THE CITY OF KINGSVILLE LANDFILL
TCEQ PERMIT MSW 235-C

PERMIT AMENDMENT APPLICATION
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CITY OF KINGSVILLE LANDFILL

PART III

ATTACHMENT 15

LEACHATE AND CONTAMINATED

WATER MANAGEMENT PLAN

ATTACHMENT 15
LEACHATE AND CONTAMINATED WATER MANAGEMENT PLAN

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1 GENERAL

1.1 Purpose and Scope

This document presents the Leachate and Contaminated Water Plan for the City of Kingsville Municipal Solid Waste Landfill in accordance with the Texas Commission on Environmental Quality's (TCEQs) requirements for Municipal Solid Waste Landfills as outlined in Title 30, Texas Administrative Code (TAC) Chapter 330 [30 TAC §330]. This plan provides methods to minimize the volume of contaminated water generated, and details of the collection, sampling, storage, treatment, and disposal of the leachate and contaminated water.

1.2 Facility Description

The City of Kingsville Landfill is comprised of approximately 200 acres located about one and one-half (1.5) miles southeast of the city of Kingsville, Texas. A detailed description of the facility is provided in the Site Development Plan (SDP).

1.3 Definitions

The following definitions apply throughout this plan:

1.3.1 First Degree Contaminated Water

This includes leachate from the facility and storm water which has come into contact with waste or with a daily cover. This material cannot be directly discharged offsite, but must be controlled and properly managed prior to discharge. Under Subtitle D there can be no disposal of bulk liquid wastes within the landfill facility.

1.3.2 Second Degree Contaminate Water

This includes storm water which has come into contact with the excavated areas of the facility. This is generally the storm water which is controlled through the Storm Water Pollution Prevention Plan of the Texas Pollutant Discharge Elimination System (TPDES) permit. It is usually contaminated with suspended solids only. Run-off from intermediate cover which has not yet had vegetation established is generally considered to be second degree contaminated water. Management for this water can include retention, filtration, and possibly detention. In addition, the proper use of erosion/sedimentation controls also help address this condition.

2 MINIMIZATION OF CONTAMINATED WASTE WATER

2.1 General

On-site management of landfill leachate and contaminated water is regulated by the TCEQ. Leachate, gas condensate, contaminated surface water, and contaminated ground water will not be discharged into waters of the state or nation, including wetlands, in violation of any state or federal requirements.

TCEQ regulations state that leachate and gas condensate may be disposed in a municipal solid waste landfill unit that is designed and constructed with a composite liner system and a leachate collection system meeting minimum requirements. Contaminated surface water and ground water will not be placed in or on the MSWLF unit.

2.2 Minimization Practices

Several factors have been incorporated into the design of the facility to minimize the quantity of leachate and contaminated water produced. These factors include landfill construction, cover practices, surface water management, and waste acceptance. The primary sources of contaminated water are rainfall and storm water run-off. Rain falling directly on the waste will be absorbed and retained in the cell. Storm water will be managed carefully in open and closed portions of the landfill to limit the quantity which may come into contact with the waste.

To minimize generation of waste waters during landfill operations, the active working face will be limited to an approximately seventy five (75) feet square area enclosed by a berm. This berm will have sufficient height to contain all the storm water that falls on the working face. The working face will be covered at the end of each day's operations. This first degree contaminated water will be managed as outlined below. Run-on and run-off diversion berms will be placed adjacent to the working face and will direct run-on away from the waste. If necessary, this second degree contaminated water will be pumped from the cell into the surface drainage system in a manner to control soil erosion. Surfaces will be properly graded to prevent ponding or erosion of cover.

3 LEACHATE COLLECTION SYSTEM DESIGN

3.1 Run-on/Runoff Control

Storm water run-on/runoff will be controlled around each section. A perimeter levee will be constructed around each waste disposal section. In addition, divider levees will be constructed between the individual sections. The cross section drawings indicate a divider levee separating lined sections from unlined sections. This levee will be used as the tie-in location for construction of the subsequent cell. While waste is being placed in the lined section, the working face will be maintained a minimum of twenty-five (25) feet away from the levee. Following completion of the new section, waste will be placed over this divider levee from the active section into the new section. These levees will prevent run-on into and runoff from the active section. The natural drainage patterns will not be significantly altered. This is discussed in more detail in Attachment 6.

3.2 Leachate Collection System Description

TCEQ regulations do not stipulate a specific design for the leachate collection system. However, the TCEQ does recommend a leachate collection system design in their "Leachate Collection System Handbook", (LCS Handbook). The recommendations outlined in this handbook have been addressed in the design of the City's system. The leachate collection system used on the floor

of all Sectors will consists of geosynthetic clay liner (GCL), a 60-mil HDPE geomembrane liner (FML), high permeability drainage layer (geocomposite), geotextile fabrics for liner protection and fines filtration, perforated collection pipes installed in gravel filled trenches, and leachate collection sumps. The liners are constructed on slopes designed to promote positive drainage along herring-bone contoured sectors. Leachate flows across the graded sector floor to a perforated pipe which directs leachate to sumps or cleanout pipes.

The leachate collection systems will be sloped to drain to a collector pipe running through the center of each section. The leachate collection system used on the sidewalls will consist of a double-sided geocomposite (synthetic drainage net between two layers of geotextile fabric). This will act as a filter to minimize the potential for clogging the drainage net, provide a high friction angle, and maintain the stability of the slope. The leachate collection system used on the bottom or floor will be a single-sided geocomposite (synthetic drainage net with one layer of geotextile fabric on top). The underlying lining system will be sloped at a minimum two percent (2%) slope to the collector pipe. The collector pipe will have a minimum slope of one percent (1%) toward the sump. The sump will have an additional riser pipe for the removal of leachate. Each sump will have nominal dimensions of thirty-four (34) feet square at the floor level and twenty-two (22) feet square at the sump base and will be two (2) feet deep. The sumps will have a gross volume of approximately 1,592 ft^3 and a net or available volume of 478 ft^3.

The entire leachate collection system will be protected by a two (2) foot thick soil cover layer.

The location of the leachate collection system for each section has been shown on Attachment 1, Site Layout Plan. Detail drawings of the leachate collection system have been included in Appendix H.

3.3 Leachate Generation

A computer program was used to estimate the amount of leachate generated from each landfill section. The particular program used was the "Hydrologic Evaluation of Landfill Performance (HELP) Model- Version 3.07". [Ref. 3] This model was developed by the U.S. Army Corps of Engineers Waterways Experiment Station under contract to the U.S. Environmental Protection Agency (EPA) Hazardous Waste Engineering Research Laboratory. The HELP model is an unsaturated flow, water balance model that uses site specific climate, soil, and design data to simulate landfill conditions over a specified time period. This program was used to predict the amount of runoff, evapotranspiration, drainage, leachate collection, and percolation through the liner.

The active stage was modeled for 1 year. 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 following cases were modeled for the proposed conditions:

- Open (Daily Cover) Conditions-modeled a drainage layer with 10 feet of waste material (1-year); and
- Intermediate Conditions-modeled a drainage layer with 25 feet of waste material (5-years); and

- Intermediate Conditions-modeled a drainage layer with 80 feet of waste material (10-years); and
- Intermediate Conditions-modeled a drainage layer with 168 feet, 141.5 feet, and 120 feet of waste, respectively (5-years); and
- Closed Conditions-modeled a landfill that had achieved final grades (approximately 200 feet) with 2 feet of cover soil (30-years).

3.3.1 Model Input

The HELP program provides a default of five (5) years of rainfall records for most major cities in the U.S. The rainfall records for Kingsville, Texas were used since it is located more than three (3) miles southwest of Corpus Christi, Texas, the closest city with available rainfall data. This rainfall data was used to synthetically generate rainfall data for the City of Kingsville.

Default average monthly temperature data for Corpus Christi was used since the Kingsville site is not more than 100 miles and difference in elevation is less than 500 feet. Default Solar Radiation Data for Corpus Christi was used since the latitude of the Kingsville site is less than 50 miles. See table below:

HELP Model Weather Input Parameters		
Month	Avg. Precip. (in.)	Avg. Temp (°F)
January	1.63	56.30
February	1.69	59.30
March	1.20	65.90
April	1.57	73.00
May	3.29	78.10
June	3.12	82.70
July	2.26	84.90
August	2.78	85.00
September	5.31	81.50
October	2.92	74.00
November	1.61	65.00
December	1.17	59.10

Default evapotranspiration data for Corpus Christi, Texas was used in the model. The default evaporative zone depth of 12 inches and maximum leaf area index value of 0 for bare ground was selected for the active cases (Case A-1 (1 YR), Case B-1 (1 YR), and Case C-1 (1 YR)). The default evaporative zone depth of 12 inches and maximum leaf area index value of 2 for fair ground was selected for the intermediate cases (Case A-2 (5 YR), Case A-3 (10 YR), Case A-4 (5 YR), Case B-2 (5 YR), Case B-3 (10 YR), Case B-4 (5 YR), Case C-2 (5 YR), Case C-3 (10 YR), and Case C-4 (5 YR)). The default evaporative zone depth of 12 inches and maximum leaf area index of 3.5 for good cover was selected for final cases (Case A-5 (30 YR), Case B-5 (30 YR), and Case C-5 (30 YR)).

For demonstration purposes, the following cases were selected as representative of the worst case leachate collection system and evaluated using the HELP model:

SECTOR 5
Case A-1 (1 YR)-Daily Cover, 10 feet of waste
Case A-2 (5 YR)-Intermediate cover, 25 feet of waste
Case A-3 (10 YR)-Intermediate cover, 80 feet of waste
Case A-4 (5 YR)-Intermediate cover, 168 feet of waste
Case A-5 (30 YR)-Final cover, 168 feet of waste
SECTOR 4C
Case B-1 (1 YR)-Daily Cover, 10 feet of waste
Case B-2 (5 YR)-Intermediate cover, 25 feet of waste
Case B-3 (10 YR)-Intermediate cover, 80 feet of waste
Case B-4 (5 YR)-Intermediate cover, 141.5 feet of waste
Case B-5 (30 YR)-Final cover, 141.5 feet of waste
SECTOR 8 OVERLINER
Case C-1 (1 YR)-Daily Cover, 10 feet of waste
Case C-2 (5 YR)-Intermediate cover, 25 feet of waste
Case C-3 (10 YR)-Intermediate cover, 80 feet of waste
Case C-4 (5 YR)-Intermediate cover, 120 feet of waste
Case C-5 (30 YR)-Final cover, 120 feet of waste

Default properties from the model were used to describe the waste layer and the composite liner. For the protective soil layer and the leachate collection system, parameters from the model were supplemented with data from the geotechnical report and design assumptions. All active scenarios were modeled with a 0% recirculation rate as shown in Appendix A.

CASE SECTION: A	LAYER NO.	LAYER TYPE	LAYER TYPE	THICKNESS (IN)
1. Modeled a geonet drainage layer, with 10 FT of refuse. **(1 Year)**	1	1	Vertical Percolation Layer (Daily Cover) – 13	6
	2	1	Vertical Percolation Layer (Waste) – 18	120
	3	1	Vertical Percolation Layer (Protective Soil Cover) – 13	24
	4	2	Lateral Drainage Layer (Geonet) – 20	0.30
	5	4	Flexible Membrane Liner (60-mil HDPE) – 35	0.06
	6	3	Barrier Liner (GCL) – 17	0.24
2. Modeled a geonet drainage layer, with 25 FT of refuse. **(5 Year)**	1	1	Vertical Percolation Layer (Intermediate) – 13	12
	2	1	Vertical Percolation Layer (Waste) – 18	300
	3	1	Vertical Percolation Layer (Protective Soil Cover) – 13	24
	4	2	Lateral Drainage Layer (Geonet) – 20	0.30
	5	4	Flexible Membrane Liner (60-mil HDPE) – 35	0.06
	6	3	Barrier Liner (GCL) – 17	0.24
3. Modeled a geonet drainage layer, with 80 FT of refuse. **(10 Year)**	1	1	Vertical Percolation Layer (Intermediate) – 13	12
	2	1	Vertical Percolation Layer (Waste) – 18	960
	3	1	Vertical Percolation Layer (Protective Soil Cover) – 13	24
	4	2	Lateral Drainage Layer (Geonet) – 20	0.30
	5	4	Flexible Membrane Liner (60-mil HDPE) – 35	0.06
	6	3	Barrier Liner (GCL) – 17	0.24
4. Modeled a landfill that had achieved final grades (200FT) with 1 FT of cover. **(5 Year)**	1	1	Vertical Percolation Layer (Intermediate Cover) – 13	12
	2	1	Vertical Percolation Layer (Waste) – 18	2,016
	3	1	Vertical Percolation Layer (Protective Soil Cover) – 13	24
	4	2	Lateral Drainage Layer (Geonet) – 20	0.30
	5	4	Flexible Membrane Liner (60-mil HDPE) – 35	0.06
	6	3	Barrier Liner (GCL) – 17	0.24
5. Modeled a landfill that had achieved final grades (200FT) with 2 FT of cover. **(30 Year)**	1	1	Vertical Percolation Layer (Erosion Cover) – 13	24
	2	2	Lateral Drainage Layer (Geonet) – 20	0.20
	3	4	Flexible Membrane Liner (40-mil LLDPE) – 36	0.04
	4	3	Barrier Liner (GCL) – 17	0.24
	5	1	Vertical Percolation Layer (Intermediate Cover) – 13	12
	6	1	Vertical Percolation Layer (Waste) – 18	2,016
	7	1	Vertical Percolation Layer (Protective Soil Cover) – 13	24
	8	2	Lateral Drainage Layer (Geonet) – 20	0.30
	9	4	Flexible Membrane Liner (60-mil HDPE) – 35	0.06
	10	3	Barrier Liner (GCL) – 17	0.24

CASE SECTION: B	LAYER NO.	LAYER TYPE	LAYER TYPE	THICKNESS (IN)
1. Modeled a geonet drainage layer, with 10 FT of refuse. **(1 Year)**	1	1	Vertical Percolation Layer (Daily Cover) – 13	6
	2	1	Vertical Percolation Layer (Waste) – 18	120
	3	1	Vertical Percolation Layer (Protective Soil Cover) – 13	24
	4	2	Lateral Drainage Layer (Geonet) – 20	0.30
	5	4	Flexible Membrane Liner (60-mil HDPE) – 35	0.06
	6	3	Barrier Liner (GCL) – 17	0.24
2. Modeled a geonet drainage layer, with 25 FT of refuse. **(5 Year)**	1	1	Vertical Percolation Layer (Intermediate) – 13	12
	2	1	Vertical Percolation Layer (Waste) – 18	300
	3	1	Vertical Percolation Layer (Protective Soil Cover) – 13	24
	4	2	Lateral Drainage Layer (Geonet) – 20	0.30
	5	4	Flexible Membrane Liner (60-mil HDPE) – 35	0.06
	6	3	Barrier Liner (GCL) – 17	0.24
3. Modeled a geonet drainage layer, with 80 FT of refuse. **(10 Year)**	1	1	Vertical Percolation Layer (Intermediate) – 13	12
	2	1	Vertical Percolation Layer (Waste) – 18	960
	3	1	Vertical Percolation Layer (Protective Soil Cover) – 13	24
	4	2	Lateral Drainage Layer (Geonet) – 20	0.30
	5	4	Flexible Membrane Liner (60-mil HDPE) – 35	0.06
	6	3	Barrier Liner (GCL) – 17	0.24
4. Modeled a landfill that had achieved final grades (200FT) with 1 FT of cover. **(5 Year)**	1	1	Vertical Percolation Layer (Intermediate Cover) – 13	12
	2	1	Vertical Percolation Layer (Waste) – 18	1698
	3	1	Vertical Percolation Layer (Protective Soil Cover) – 13	24
	4	2	Lateral Drainage Layer (Geonet) – 20	0.30
	5	4	Flexible Membrane Liner (60-mil HDPE) – 35	0.06
	6	3	Barrier Liner (GCL) – 17	0.24
5. Modeled a landfill that had achieved final grades (200FT) with 2 FT of cover. **(30 Year)**	1	1	Vertical Percolation Layer (Erosion Cover) – 13	24
	2	2	Lateral Drainage Layer (Geonet) – 20	0.20
	3	4	Flexible Membrane Liner (40-mil LLDPE) – 36	0.04
	4	3	Barrier Liner (GCL) – 17	0.24
	5	1	Vertical Percolation Layer (Intermediate Cover) – 13	12
	6	1	Vertical Percolation Layer (Waste) – 18	1698
	7	1	Vertical Percolation Layer (Protective Soil Cover) – 13	24
	8	2	Lateral Drainage Layer (Geonet) – 20	0.30
	9	4	Flexible Membrane Liner (60-mil HDPE) – 35	0.06
	10	3	Barrier Liner (GCL) – 17	0.24

OVERLINER

CASE SECTION C	LAYER NO.	LAYER TYPE	LAYER TYPE	THICKNESS (IN)
1. Modeled a geonet drainage layer, with 10 FT of refuse. **(1 Year)**	1	1	Vertical Percolation Layer (Daily Cover) – 13	6
	2	1	Vertical Percolation Layer (Waste) – 18	120
	3	1	Vertical Percolation Layer (Protective Soil Cover) – 13	24
	4	2	Lateral Drainage Layer (Geonet) – 20	0.30
	5	4	Flexible Membrane Liner (60-mil HDPE) – 35	0.06
	6	3	Barrier Liner (GCL) – 17	0.24
2. Modeled a geonet drainage layer, with 25 FT of refuse. **(5 Year)**	1	1	Vertical Percolation Layer (Intermediate Cover) – 13	12
	2	1	Vertical Percolation Layer (Waste) – 18	300
	3	1	Vertical Percolation Layer (Protective Soil Cover) – 13	24
	4	2	Lateral Drainage Layer (Geonet) – 20	0.30
	5	4	Flexible Membrane Liner (60-mil HDPE) – 35	0.06
	6	3	Barrier Liner (GCL) – 17	0.24
3. Modeled a geonet drainage layer, with 80 FT of refuse. **(10 Year)**	1	1	Vertical Percolation Layer (Intermediate Cover) – 13	12
	2	1	Vertical Percolation Layer (Waste) – 18	960
	3	1	Vertical Percolation Layer (Protective Soil Cover) – 13	24
	4	2	Lateral Drainage Layer (Geonet) – 20	0.30
	5	4	Flexible Membrane Liner (60-mil HDPE) – 35	0.06
	6	3	Barrier Liner (GCL) – 17	0.24
4. Modeled a landfill that had achieved final grades (200FT) with 1 FT of cover. **(5 Year)**	1	1	Vertical Percolation Layer (Intermediate Cover) – 13	12
	2	1	Vertical Percolation Layer (Waste) – 18	1,440
	3	1	Vertical Percolation Layer (Protective Soil Cover) – 13	24
	4	2	Lateral Drainage Layer (Geonet) – 20	0.30
	5	4	Flexible Membrane Liner (60-mil HDPE) – 35	0.06
	6	3	Barrier Liner (GCL) – 17	0.24
5. Modeled a landfill that had achieved final grades (200FT) with 2FT of cover. **(30 Year)**	1	1	Vertical Percolation Layer (Erosion Cover) – 13	24
	2	2	Lateral Drainage Layer (Geonet) – 20	0.20
	3	4	Flexible Membrane Liner (40-mil LLDPE) – 36	0.04
	4	3	Barrier Liner (GCL) – 17	0.24
	5	1	Vertical Percolation Layer (Intermediate Cover) – 13	12
	6	1	Vertical Percolation Layer (Waste) – 18	1,440
	7	1	Vertical Percolation Layer (Protective Soil Cover) – 13	24
	8	2	Lateral Drainage Layer (Geonet) – 20	0.30
	9	4	Flexible Membrane Liner (60-mil HDPE) – 35	0.06
	10	3	Barrier Liner (GCL) – 17	0.24

A summary of surface area and maximum travel distance to a collector pipe for each section of the landfill is shown below:

Section	Surface Area (AC.)	Model Surface Area (AC.)	Drain Length (FT.)	Depth of MSW at Closure (IN.)
A	19.2	1	500	2,016
B	4.7	1	150	1,698
C	26.9	1	400	1,440

Groundwater Inflow – It is assumed that there will be no groundwater inflow into the landfill.

Runoff Potential – Runoff potential for the open condition was conservatively assumed to be zero, although operational daily cover will allow runoff on graded portions of the operational areas. Runoff potential for operational conditions was assumed to be 80%, as cover will be rough graded to drain. The closed conditions model assumes a runoff potential for 100% of the surface area, since the vegetative cover and final grading will be constructed and maintained to effectively control stormwater runoff and minimize ponding on top of the final cover.

Runoff Curve Number – Default curve numbers were chosen based on the soil data, ground cover, surface slope, and slope length of the selected case. SCS runoff curve numbers ranged from approximately 84 to 95 for the HELP modeling.

Daily and Intermediate Cover Soil Layers – The open conditions model assumes that 6 inches of daily cover is in place and the intermediate conditions model assumes that 12 inches of intermediate soil cover is in place. Geotechnical information provided indicates that sandy clay soils will be available onsite for use as daily and intermediate cover soil layers and therefore default values for soil texture 13 were used in the model.

Final Cover Soil Layers – The closed conditions were modeled with a 24-inch erosion layer of onsite soil with the top 6 inches that is capable of sustaining growth of vegetation. Geotechnical information provided indicates that sandy clay soils will be available for use as erosion layer and therefore default values for soil texture 13 were used in the model.

Leachate Collection Layer – The leachate collection layer will consist of a drainage geocomposite. It will be comprised of a 300-mil geonet with an 8-ounce non-woven geotextile heat-bonded to top (at bottom of cell) or the top and bottom of the geonet (at sideslopes). Soil texture 20 was used in the model.

Flexible Membrane Cover – The flexible membrane cover consists of a 40-mil LLDPE geomembrane. Default values for soil texture 36 were used to model the flexible membrane cover. The cover will be installed and tested in accordance with the requirements of *Final Cover Quality Control Plan* and therefore was modeled for good installation quality, two defects per acre, and a pinhole density of one hole per acre.

Barrier Liner – The barrier liner consists of a geosynthetic clay liner (GCL). Default values for soil texture 17 were used to model the GCL.

Waste Layers – Waste layers of 10, 25, 80, and 168 feet were used to represent the stages of landfill development for Case Sections A&B. Waste layers of 10, 25, 80, and 120 feet were used to represent the stages of landfill development for Case Section C. Default characteristics for soil texture 18 were selected to represent municipal solid waste.

Protective Cover – The protective cover will consist of a 24 inch layer of onsite soils. Geotechnical information provided indicates that sandy clay soils will be available onsite for use as protective cover and therefore default values for soil texture 13 were used in the model.

Geomembrane – The geomembrane liner will consist of a 60-mil HDPE geomembrane. Default values for soil texture 35 were used to model the flexible membrane line. The liner will installed and tested in accordance with the requirements of *Liner Quality Control Plan* and therefore was modeled for good installation quality, two defects per acre, and a pinhole density of one hole per acre.

3.3.2 Model Output

Based on the items outlined above, the program indicated the following leachate generation rates and maximum head on the liner. For all sections, Case 1 (10 foot of MSW with six (6) inches of daily cover) generated the largest leachate volumes:

Section	Peak Daily (CF.)	Average Annual (CF.)	Max Head (IN.)
A	622	16,880	0.150
B	613	16,586	0.045
C	629	16,880	0.121

Detailed output from the HELP model has been included in Appendix A. The leachate generation rates outlined above were used to develop design flow rates, in accordance with TCEQ criteria. In addition, calculations were performed to verify the maximum depth of leachate in the leachate collection system. These independent checks indicate that this leachate system design will meet the TCEQ criteria for maintaining the leachate depth below twelve (12) inches. Since a thin synthetic media has been used, the system was designed to contain the entire flow within the thickness of the lateral drainage layer or geonet. Supporting calculations have been included in Appendix B.

3.4 Hydraulic Design of the Leachate Collection System

The hydraulic design of the various components of the leachate collection system was verified using the following procedures:

3.4.1 Leachate Aggregate

Leachate aggregate will be placed in the collection trenches and in the sumps. Granular drainage material in the pre-subtitle D and Subtitle D areas will consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials. 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 modified to use a solution of hydrochloric acid having a pH of 5). The leachate aggregate will meet the following gradation in accordance with ASTM D448, size number 467.

In addition, aggregates must meet the following criteria:

- Max 3" aggregate and minimum ¾" aggregate
- For circular pipe perforations, the ratio:

  $$\frac{\text{85 Percent Size of Aggregate}}{\text{Perforation Hole Diameter}} > 1.7$$

- For slotted pipe perforations, the ratio:

  $$\frac{\text{85 Percent of Aggregate Material}}{\text{Perforation Slot Width}} > 1.7$$

The leachate aggregate will be covered by a geotextile to maintain separation from the overlying layers. The geotextile will be resistant to commonly encountered chemicals, hydrocarbons, mildew, and will be rot resistant. Drains will be installed that extend through the protective cover into the leachate collection system if the permeability of the protective cover is less than 1×10^{-4} cm/sec.

3.4.2 Synthetic Drainage Media

A High Density Polyethylene (HDPE) drainage geonet was selected for the leachate collection system. Manufacturer's literature indicates a nominal thickness of approximately 300 mils is average for this material and 200 mils for areas five (5) acres or less. The literature indicates a transmissivity of $8.0 \times 10^{-3} m^2$/sec. for 300 mils and $2.0 \times 10^{-3} m^2$/sec for 200 mils. Structural calculations shown in Appendix C indicate the maximum expected load on the leachate collection system to be 10,628 lb/ft^2. Under this compressive load, the drainage net material is expected to compress 13 mils according to manufacturer's data. Calculations to determine the adequacy of the drainage material assumed a minimum thickness of 287 mils and 187 mils. These calculations, included in Appendix B, indicate that the HDPE drainage net is capable of conveying the expected volume of generated leachate and maintain less than 12 inches of head on the liner system.

3.4.3 Leachate Collector Pipe

The leachate collection layer will slope toward the leachate collection trenches. The leachate piping includes perforated collection trench pipes and solid sidewall riser pipes. As required by TCEQ regulations, the leachate generation rate predicted by the HELP model was increased by fifty percent (50%) (Appendix D). Since the geomembrane in the lining system was fabricated from high density polyethylene (HDPE), HDPE pipe was

specified for the leachate collection system to provide similar chemical resistance characteristics.

Manning's equation was used to model the flow in the pipe:

$$Q = \frac{1.486AR^{2/3}S^{1/2}}{n}$$

Where: Q is flow, in cubic feet per second;
A is cross sectional area, in square feet;
R is the hydraulic radius, in feet;
S is the slope, in feet per foot; and,
n is the Manning's friction coefficient.

For HDPE pipe, a Manning's friction coefficient of 0.009 was used. Six (6), eight (8), ten (10), and eighteen (18) inch diameter HDPE pipes were analyzed. The results indicated that either pipe would have adequate capacity. The six (6) inch diameter pipe was selected, since it was adequate. The output data has been included in Appendix D.

3.4.4 Sump Riser Pipe

The sump riser will be smooth walled, eighteen (18) inch diameter HDPE pipe, perforated in the sump. It will be used as a wet well into which a pump is placed for extracting leachate. Since the pipe will not convey liquids, hydraulic calculations are not necessary.

3.4.5 Perforated Piping

Where perforations are required in the piping, the perforations will be sized to allow entry of the liquids, but to prevent entry of the gravel pack around the piping. Using a maximum perforation size equal to or smaller than the effective size of the gravel should preclude entry of the gravel pack into the piping. The maximum leachate aggregate size will be (3/4) inch and the maximum perforation size will be (3/8) inch. Based on the maximum leachate generation rate shown in the hydrologic calculations in Appendix D, the impingement rate for the leachate collection system would be approximately .2052 cfs for Case A-1. With a maximum slope length of 1,100 feet as shown in Appendix D, the leachate flow rate to the collector piping would be approximately 1.87×10^{-4} cfs/ft. As shown in Appendix D, utilizing a standard orifice equation, the flow rate into a 3/8 inch diameter hole given a 1 inch (or 0.0833 foot) head would be approximately 1.1×10^{-3} cfs. This indicates that the capacity of one orifice (1.1×10^{-3} cfs) is greater than the requirement for one linear foot of perforated pipe of 1.87×10^{-4} cfs/ft. The impingement rate for the leachate collection system would be approximately .1474 cfs for Case C-1. With a maximum slope length of 400 feet as shown in Appendix D, the leachate flow rate to the collector piping would be approximately 3.69×10^{-4} cfs/ft. As described previously and shown in Appendix D, utilizing a standard orifice equation, the flow rate into a 3/8 inch diameter hole given a 1 inch (or 0.0833 foot) head would be approximately 1.1 x

10^{-3} cfs. This indicates that the capacity of one orifice (1.1×10^{-3} cfs) is greater than the requirement for one linear foot of perforated pipe of 3.69×10^{-4} cfs/ft. Therefore, one hole per linear foot would be sufficient to allow the accumulated leachate flow to enter the leachate collection pipe. However, to provide an additional factor of safety, the proposed perforated design has two holes per row around the circumference of the pipe at 120 degrees from the top center (bottom) and one per row at the top of the pipe (staggered). The bottom perforations will be spaced 6" apart and the top perforations will be spaced 6" apart aligned between the bottom perforations. There will be eight perforations per linear foot of pipe and an approximately factor of safety of 46 for Case A-1 and an approximate factor of safety of 23 for Case C-1.

3.5 Structural Design of Leachate Pipes

Once the hydraulic characteristics of the leachate piping had been established, the pipe was sized to avoid structural failure. Ultimate site development calls for approximately sixty (168) feet of fill to be placed over the top of the leachate collection system in Section B. Since the vast majority of this material will be solid waste or waste fill, a unit weight of eighty (60) pounds per cubic foot was used in the calculations. Three cases were evaluated to determine the worst case loading condition. The first case (Case 1) involved evaluating the pipe with the entire sixty (168) feet of overburden (waste fill in-place), combined with a 31,857 pound point load (compactor) superimposed. The second case (Case 2) involved evaluating the pipe with five (5) feet of overburden (waste fill in-place), combined with a 31,857 pound point load (compactor) superimposed. The third case (Case 3) involved evaluating the pipe with (2) feet of overburden (protective cover), combined with a 16,000 pound point load (HS20 wheel) superimposed. The structural calculations were performed in accordance with the American Society of Civil Engineers Manual No. 37, [Ref. 4] and the Leachate Collection System Handbook (LCS Handbook) with pipe material data supplied from the ISCO Pipe. Calculations were performed to evaluate three (3) modes of failure. These were wall crushing, wall buckling, and excessive ring deflection. A minimum factor of safety (FS) of 2.0 was assumed. The pipe design was dependent on adequate wall thickness. A Standard Dimension Ratio (SDR, ratio of outside diameter to wall thickness) of 17 was used in the calculations. The calculations indicated that the controlling condition was the excessive ring deflection, with calculated factors of safety of 2.03 for six (6) inch pipe, 2.06 for eight (8) inch pipe, 2.07 for (10) inch pipe, and 2.10 for eighteen (18) inch pipe. Six (6) inch and eighteen (18) inch pipe were selected for use, since they provided acceptable factors of safety. The pipe structural calculations have been included in Appendix C.

3.6 Filter Design

To prevent clogging of the leachate collection system, a geotextile barrier will be required between the protective soil layer and the leachate collection system layer. This filter layer must prevent an excessive quantity of fine particles from entering the leachate collection system, while maintaining adequate flow from the protective soil layer. The approach is to determine the Apparent Opening Size (AOS), based on soil characteristics, determine the minimum permeability of the geotextile fabric, and compute the Factor of Safety (FOS) for the design. The

minimum parameters were determined using information from the on-site soil proposed for use (SC-clayey sands, sand clay mixture). The soil is approximately twenty-five (25) to thirty (30) feet deep. Information on the soil was obtained from the geotechnical investigations performed in 1997 [Ref. 2]. The calculations (included in Appendix E) indicated that an AOS of 0.27 millimeters (mm) and a fabric permeability of 5.4×10^{-4} cm/sec was required. The geotextile material placed on the floor over the drainage net and on the side walls and around gravel packs shall have the following minimum properties:

- Mass per unit area: 8 oz./square yard
- Grab tensile strength: 210 lbs.
- Grab elongation: 50 %
- Thickness: 95 mils
- CBR Puncture Strength: 600 lbs
- Permeability: 0.30 cm/sec
- Apparent Opening Size: 0.27 mm

3.7 Minimum Design Criteria

The preceding sections describe the design of the leachate collection system. See Appendix H for leachate collection system details. Where necessary, the design values needed to comply with applicable regulatory requirements shall be considered minimum performance specifications and shall be incorporated into the other applicable implementing portions of the SDP and the Site Operating Plan (SOP). Typical values are not meant to be minimum or maximum values, as construction materials and specifications may vary between manufacturers and over the life of the site.

4 CONTROL OF LEACHATE

4.1 Operation of the Leachate Collection System

The leachate collection system will be operated as outlines below:

4.1.1 Leachate Monitoring and Removal

The sump in each landfill section will be constructed with a leachate collector pipe and a sump riser pipe. The collector pipe (6") riser which will allow access to the collection header for clean-out. The sump riser (18") will be used for monitoring the presence of leachate. Leachate liquid levels will be monitored at least monthly and recorded in the Site Operating Record (SOR). The 18" riser will also contain a submersible pump used to evacuate the leachate from the sump. An automatic liquid level sensing device will control the operation of the submersible pump. Control levels for the submersible pump will be set to maintain a maximum liquid level of thirty centimeters (cm) above the liner. The pump will be provided with a manual over-ride to allow them to be operated independent of the liquid level control settings.

The capacity of the leachate collection pump was selected to both comply with the maximum allowable liquid level and provide a reasonable pump cycle time. Minimum pump capacities for the individual landfill sections are shown in the following table.

Section	Design Flow (gpm)	Design Volume (gal/week)	Leachate Collector Line Size (inches)
A	92.0	46,000	6
B	22.5	45,210	6
C	66.2	32,700	6

Piping used to convey leachate will be smooth walled high density polyethylene (HDPE) piping. This piping will be run above ground, where it can be inspected for leakage. If it is necessary to provide a crossing for equipment, the line will be buried and/or cased, and an earthen ramp constructed over the casing. A high level shut-off switch will be provided at the Contaminated Water Storage Area to prevent over-filling of the leachate storage unit.

4.1.2 Collector Pipe Cleaning

The City of Kingsville currently has sewer cleaning capabilities which can be used to clean the leachate lines if necessary. The maximum pipe length will not exceed approximately 1,100 feet. This should be adequate to hydroflush lines in each Sector with no obstructions in the event the pipes become clogged.

4.2 Management and Disposal of Leachate

Leachate may be managed in several ways. Leachate may be pumped to and stored onsite in a lined evaporation pond, as discussed in Section 5.3. It may also be collected and transported or pumped and disposed of directly at the Kingsville Wastewater Treatment Plant in accordance with the City of Kingsville, TX Code of Ordinances. A copy of the Kingsville, TX Code of Ordinances is attached in Appendix F. A copy of the Kingsville, TX Code of Ordinances will be placed in the Site Operating Record (SOR). The City of Kingsville may also elect to transport the leachate to an alternate disposal facility, authorized by the TCEQ to accept MSW landfill leachate. Leachate will be pumped to the lined evaporation pond during active waste filling operations up until Sector 7 is completely developed. At which time, due to space limitations, the leachate will be pumped to an onsite Contaminated Water Storage Area (leachate tanks) as described in Section 7. The leachate will either be collected and transported or pumped directly to the Kingsville Wastewater Treatment Plant and/or transported to an alternate TCEQ authorized disposal facility.

4.3 Storage of Leachate

Leachate may be stored in the Contaminated Water Storage Area, described in Section 7, Design of Contaminated Water Storage Area. The Contaminated Water Storage Area will provide for proper storage and containment for contaminated water. If necessary, gas condensate may also be stored in the contaminated water storage area.

5 LEACHATE MANAGEMENT DURING POST-CLOSURE

During the post-closure care period, the City will monitor the leachate removal risers for the presence of leachate at least weekly. The computer modeling described below indicates that the leachate will be maintained at a depth of less than thirty (30) centimeters (cm) if it is removed weekly.

5.1 Post-Closure Leachate Generation

The HELP Program was used to estimate leachate generation during the thirty (30) year post-closure period. Program input was the same as described previously, except that the MSW layer was increased to reflect depth at closure, and four (4) layers were added to simulate the final cover of the landfill. The final depth of MSW used as input is shown in Appendix A. The following is a summary of leachate generation rates output by the HELP model:

Section	Peak Daily (CF.)	Annual Average (CF.)
A	0.1701	0.078
B	0.00021	0.008
C	0.151	0.062

5.2 Leachate Monitoring and Removal

As mentioned previously, leachate risers will initially be monitored weekly for the presence of leachate. Any section which has been monitored for eight (8) consecutive weeks, and has produced no leachate, will have the monitoring frequency reduced to monthly after final cap placement. Any section which has been monitored for six (6) consecutive months, and has produced no leachate, will have the monitoring frequency reduced to quarterly. Quarterly monitoring shall continue for all sections after closure. Leachate removal pumps will be maintained in those sections of the landfill which are still producing leachate on a weekly basis.

5.3 Management and Disposal of Leachate

Leachate generated during the post-closure period may be managed in several ways. During the active period the leachate will pumped into a lined evaporation pond. The leachate generation modeling performed indicates that this is a cost effective way of handing the leachate. The pond will be constructed in an unused portion of the west side of the landfill located in future Sector 7. This pond will be sized to contain the combined leachate volumes from Sectors 1-6, plus the rainfall from a 25 year, 24 hour storm and one foot of freeboard. The pond will be lined with a 60 mil flexible membrane liner (HDPE geomembrane) and geosynthetic clay liner (GCL). A typical cross section of the evaporation pond is shown in Appendix G.

The pond will require a surface area of approximately one acre. Calculations and design details demonstrating the adequacy of the evaporation pond have been in included in Appendix G. The pond will be monitored during the periodic leachate monitoring activities. If the leachate generation rates exceed the capacity of the pond, the excess leachate will be disposed of at an authorized offsite facility.

Once Sector 7 is fully developed, the leachate may be pumped to an onsite Contaminated Water Storage Area (leachate tanks). The leachate storage facility design is shown in Appendix G. The leachate may be disposed of at the City of Kingsville Wastewater Treatment Plant by either pumping or transporting it in accordance with the City of City of Kingsville, TX Code of Ordinances (Appendix F). The City of Kingsville may also elect to transport the leachate to an alternate disposal facility, authorized by the TCEQ to accept MSW landfill leachate.

6 CONTROL OF CONTAMINATED STORM WATER

6.1 First Degree Contaminated Storm Water

First degree contaminated storm water will be evacuated utilizing a portable pump which will be moved about the cell depending on where the working face and ponded water are located. A twenty five (25) year, twenty four (24) hour storm event of eight and one-half (8 ½) inches can be expected to generate approximately 30,000 gallons of contaminated storm water on a seventy five (75) feet square working face. This contaminated storm water will either be pumped to the Contaminated Water Storage Area or removed and transported off- site. Piping used to convey first degree contaminated water will be smooth walled high density polyethylene piping. This piping will be run above ground, where it can be inspected for leakage. If it is necessary to provide a crossing for equipment, the line will be cased, and an earthen ramp constructed over the casing. This storm water will be disposed of at either the Kingsville Wastewater Treatment Plant (in accordance with the City of Kingsville, TX Code of Ordinances) or at an authorized off-site facility.

6.2 Second Degree Contaminated Storm Water

The City of Kingsville has a current Stormwater Pollution Prevention Plan (SWPPP) prepared according to the requirements of the *Texas Commission on Environmental Quality (TCEQ) Permit Number TXR050000-General Permit to Discharge Under the Texas Pollutant Discharge Elimination System (TPDES)-Multi-Sector General Permit (MSGP)*, effective on August 14, 2016. Prior to being discharged, second degree contaminated storm water will be inspected for the presence of excessive suspended solids and/or an oil sheen. Contaminated storm water which exhibits excessive suspended solid will be discharged through a sediment control structure. Acceptable sediment control structures include silt fences, hay bales, wattles, and similar technologies. All discharges will be made in a manner that minimizes erosion at the discharge point. Second degree contaminated storm water which exhibits an oil sheen will be managed as first degree contaminated storm water.

7 DESIGN OF CONTAMINATED WATER STORAGE AREA

The Contaminated Water Storage Area will provide tanks to contain leachate, contaminated water, and gas condensate, if produced. These tanks will be placed inside a secondary concrete containment unit. Secondary containment will be designed to hold a spill of the largest tank plus the rainfall volume of the twenty-five (25) year, twenty-four (24) hour storm. Approximately

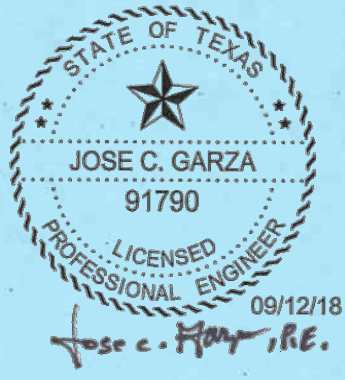
30,000 gallons of tankage will be maintained on-site with the option of adding a future 30,000 gallon tank; and based on actual leachate volumes and characteristics, the storage capacities of the tanks and disposal frequencies may be revised. Details for the contaminated water storage area have been included in Appendix G.

8 REFERENCES

1. Texas Natural Resource Conservation Commission Municipal Solid Waste Division, Leachate Collection System Handbook, October 1993.
2. City of Kingsville Municipal Solid Waste Disposal Facility Permit Amendment Application MSW 235-5 (Attachment 4-Geology Report), September 1998.
3. The Hydrologic Evaluation of Landfill Performance (HELP) Model, User's Guide Version 3, Paul R. Schroeder, Cheryl M. Lloyd, Paul A. Zappi, and Nadim M. Aziz, September 1994.
4. ASCE, "Design and Construction of Sanitary and Storm Sewers", Manual and Report on Engineering Practice No. 37, American Society of Civil Engineers, New York, NY, Printed 1969, Reprinted 1979, 332 p.
5. Koerner, Robert M., (1994). "Designing with Geosynthetics"; 3rd Edition; Prentice Hall; Englewood-Cliffs, New Jersey 07632.
6. Uni-Bell PVC Pipe Association (1993), "Handbook of PVC Pipe Design and Construction"; 3rd Edition; Uni-Bell PVC Pipe Association; Dallas, Texas 75234
7. "TNRCC Municipal Solid Waste Permits Section Subtitle D Training Manual"; May 10, 1994.

APPENDIX A

HELP MODEL DATA



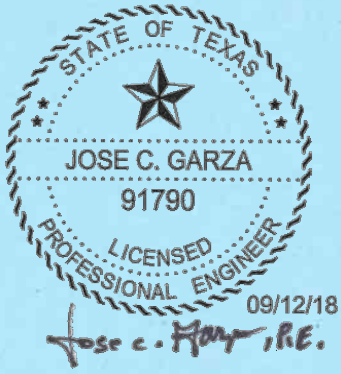
CITY OF KINGSVILLE MUNICIPAL SOLID WASTE LANDFILL
HELP MODEL INPUT

CASE	SURFACE AREA (AC.)	DRAIN LENGTH (FT.)	DEPTH OF MSW (IN)
1. CASE A-1 (1 YR)	1	500	120
2. CASE A-2 (5 YR)	1	500	300
3. CASE A-3 (10 YR)	1	500	960
4. CASE A-4 (5 YR)	1	500	2,016
5. CASE A-5 (30 YR)	1	500	2,016
6. CASE B-1 (1 YR)	1	150	120
7. CASE B-2 (5 YR)	1	150	300
8. CASE B-3 (10 YR)	1	150	960
9. CASE B-4 (5 YR)	1	150	1,698
10. CASE B-5 (30 YR)	1	150	1,698
11. CASE C-1 (1 YR)	1	400	120
12. CASE C-2 (5 YR)	1	400	300
13. CASE C-3 (10 YR)	1	400	960
14. CASE C-4 (5 YR)	1	400	1,440
15. CASE C-5 (30 YR)	1	400	1,440

CITY OF KINGSVILLE MUNICIPAL SOLID WASTE LANDFILL
HELP MODEL RESULTS

CASE	AVERAGE ANNUAL (C.F.)	PEAK DAILY (IN.)	PEAK DAILY (C.F.)	MAX HEAD ON LAYER (IN.)
1. CASE A-1 (1 YR)	16,880	0.171	622	0.150
2. CASE A-2 (5 YR)	11,818	0.162	590	0.143
3. CASE A-3 (10 YR)	15,040	0.160	580	0.139
4. CASE A-4 (5 YR)	11,825	0.154	560	0.135
5. CASE A-5 (30 YR)	0.078	0.000	0.1701	0.013
6. CASE B-1 (1 YR)	16,586	0.169	613	0.045
7. CASE B-2 (5 YR)	9,704	0.163	593	0.043
8. CASE B-3 (10 YR)	12,031	0.165	598	0.043
9. CASE B-4 (5 YR)	9,708	0.156	568	0.041
10. CASE B-5 (30 YR)	0.008	0.000	0.00021	0.005
11. CASE C-1 (1 YR)	16,880	0.173	629	0.121
12. CASE C-2 (5 YR)	11,817	0.166	603	0.116
13. CASE C-3 (10 YR)	15,040	0.163	592	0.115
14. CASE C-4 (5 YR)	11,824	0.163	592	0.115
15. CASE C-5 (30 YR)	0.062	0.000	0.151	0.000

CASE A-1 (1 YR)


STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18
Jose C. Garza, P.E.

CASEA-1.OUT

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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:\HELP3\JDATA\KGVPR1Y.D4
TEMPERATURE DATA FILE:      C:\HELP3\JDATA\KGVTE1Y.D7
SOLAR RADIATION DATA FILE:  C:\HELP3\JDATA\KGVSOL1Y.D13
EVAPOTRANSPIRATION DATA:    C:\HELP3\JDATA\KGVEVA1Y.D11
SOIL AND DESIGN DATA FILE:  C:\HELP3\JDATA\CASEA-1.D10
OUTPUT DATA FILE:           C:\HELP3\JDATA\CASEA-1.OUT


TIME:  15:30     DATE:   3/28/2017


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

     TITLE:  CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE A-1

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


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


                            LAYER  1
                            --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER  13
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.4300 VOL/VOL
          FIELD CAPACITY               =      0.3210 VOL/VOL
          WILTING POINT                =      0.2210 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2491 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.330000003000E-04 CM/SEC



                            LAYER  2
                            --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER  18
          THICKNESS                    =    120.00   INCHES
          POROSITY                     =      0.6710 VOL/VOL
          FIELD CAPACITY               =      0.2920 VOL/VOL
                                                        Page 1
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WILTING POINT               =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2861 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                      LAYER  3
                      --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  13
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4300 VOL/VOL
FIELD CAPACITY              =      0.3210 VOL/VOL
WILTING POINT               =      0.2210 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3288 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.330000003000E-04 CM/SEC


                      LAYER  4
                      --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER  20
THICKNESS                   =      0.30   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0182 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    500.0    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         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      2.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD


                      LAYER  6
                      --------

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  17
THICKNESS                   =      0.24   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
```

EFFECTIVE SAT. HYD. COND. = 0.300000003000E-08 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	95.40	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.542	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6.606	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.788	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	43.907	INCHES
TOTAL INITIAL WATER	=	43.907	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

STATION LATITUDE	=	27.77 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	12.00 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	78.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.63	1.69	1.20	1.57	3.29	3.12
2.26	2.78	5.31	2.92	1.61	1.17

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

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

CASEA-1.OUT

56.30	59.30	65.90	73.00	78.10	82.70
84.90	85.00	81.50	74.00	65.00	59.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CORPUS CHRISTI TEXAS
AND STATION LATITUDE = 27.77 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	0.50	0.93	1.47	0.15	0.77	0.41
	0.05	6.18	7.59	4.30	1.12	1.62
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	0.454	0.373	2.218	0.432	0.320	0.467
	0.220	4.382	4.715	4.214	0.727	1.921
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 4						
TOTALS	0.1805	0.0101	0.0071	0.0000	0.0039	0.0000
	0.0000	0.0002	0.4494	1.8415	1.8610	0.2958
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 6						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

CASEA-1.OUT

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0026	0.0002	0.0001	0.0000	0.0001	0.0000
	0.0000	0.0000	0.0066	0.0262	0.0274	0.0042
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

****

****

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

	INCHES	CU. FEET	PERCENT
PRECIPITATION	25.09 (0.000)	91076.7	100.00
RUNOFF	0.000 (0.0000)	0.00	0.000
EVAPOTRANSPIRATION	20.441 (0.0000)	74200.28	81.470
LATERAL DRAINAGE COLLECTED FROM LAYER 4	4.64938 (0.00000)	16877.266	18.53082
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.006	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.006 (0.000)		
CHANGE IN WATER STORAGE	0.000 (0.0000)	-0.86	-0.001

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	3.84	13939.199
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 4	0.17126	621.68140
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00007
AVERAGE HEAD ON TOP OF LAYER 5	0.076	
MAXIMUM HEAD ON TOP OF LAYER 5	0.150	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	2.4 FEET	
SNOW WATER	0.00	0.0000
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3870	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1529	

Page 5

CASEA-1.OUT

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

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

****

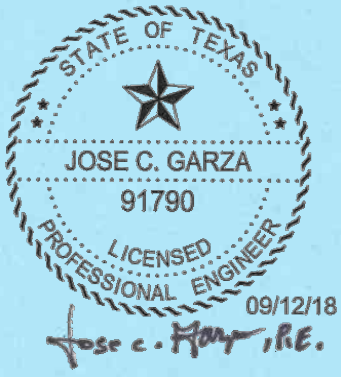
****

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	1.4947	0.2491
2	34.3324	0.2861
3	7.8940	0.3289
4	0.0055	0.0182
5	0.0000	0.0000
6	0.1800	0.7500
SNOW WATER	0.000	

****
****

CASE A-2 (5 YR)


STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18
Jose C. Garza, P.E.

CASEA-2.OUT

```
**************************************************************************
**************************************************************************
**                                                                      **
**                                                                      **
**          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:\HELP3\JDATA\KGVPRE5Y.D4
TEMPERATURE DATA FILE:      C:\HELP3\JDATA\KGVTEM5Y.D7
SOLAR RADIATION DATA FILE:  C:\HELP3\JDATA\KGVSOL5Y.D13
EVAPOTRANSPIRATION DATA:    C:\HELP3\JDATA\KGVEVA5Y.D11
SOIL AND DESIGN DATA FILE:  C:\HELP3\JDATA\CASEA-2.D10
OUTPUT DATA FILE:           C:\HELP3\JDATA\CASEA-2.OUT


TIME:  15:36     DATE:   3/28/2017


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

     TITLE:  CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE A-2

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


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


                              LAYER  1
                              --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER  13
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4300 VOL/VOL
          FIELD CAPACITY               =      0.3210 VOL/VOL
          WILTING POINT                =      0.2210 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2288 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.330000003000E-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  18
          THICKNESS                    =    300.00   INCHES
```

```
POROSITY                    =      0.6710 VOL/VOL
FIELD CAPACITY              =      0.2920 VOL/VOL
WILTING POINT               =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2920 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

```
                        LAYER  3
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  13
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4300 VOL/VOL
FIELD CAPACITY              =      0.3210 VOL/VOL
WILTING POINT               =      0.2210 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3261 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.330000003000E-04 CM/SEC
```

```
                        LAYER  4
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER  20
THICKNESS                   =      0.30   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0188 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    500.0    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         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      2.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

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

             TYPE 3 - BARRIER SOIL LINER
             MATERIAL TEXTURE NUMBER  17
THICKNESS                   =      0.24   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
```

CASEA-2.OUT

WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	88.40	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.745	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.160	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.652	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	98.358	INCHES
TOTAL INITIAL WATER	=	98.358	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

STATION LATITUDE	=	27.77 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	12.00 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	78.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.63	1.69	1.20	1.57	3.29	3.12
2.26	2.78	5.31	2.92	1.61	1.17

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

CASEA-2.OUT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
56.30	59.30	65.90	73.00	78.10	82.70
84.90	85.00	81.50	74.00	65.00	59.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CORPUS CHRISTI TEXAS
AND STATION LATITUDE = 27.77 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	0.95	2.68	1.37	1.91	0.88	2.95
	1.12	3.27	5.24	3.31	0.66	1.38
STD. DEVIATIONS	0.67	1.67	0.39	1.21	0.54	3.03
	0.86	1.72	2.95	2.46	0.35	0.68
RUNOFF						
TOTALS	0.000	0.067	0.006	0.059	0.007	0.320
	0.016	0.162	0.904	0.295	0.000	0.009
STD. DEVIATIONS	0.000	0.074	0.006	0.092	0.011	0.501
	0.025	0.107	1.227	0.351	0.000	0.020
EVAPOTRANSPIRATION						
TOTALS	0.796	2.050	1.690	1.514	1.066	1.962
	1.227	2.222	3.837	2.265	0.678	1.352
STD. DEVIATIONS	0.808	1.153	0.323	0.898	0.820	1.208
	0.918	1.206	1.049	1.361	0.460	0.649
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	0.1086	0.0134	0.3317	0.1833	0.1009	0.0525
	0.4264	0.1112	0.1623	0.8786	0.7065	0.1800
STD. DEVIATIONS	0.0444	0.0135	0.3409	0.1676	0.0925	0.0969
	0.7938	0.1623	0.2083	1.0218	0.7362	0.1352
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)

CASEA-2.OUT

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0015	0.0002	0.0047	0.0027	0.0014	0.0008
	0.0061	0.0016	0.0024	0.0125	0.0104	0.0026
STD. DEVIATIONS	0.0006	0.0002	0.0049	0.0025	0.0013	0.0014
	0.0113	0.0023	0.0031	0.0145	0.0108	0.0019

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 5

	INCHES		CU. FEET	PERCENT
PRECIPITATION	25.71	(6.634)	93341.8	100.00
RUNOFF	1.844	(1.6270)	6694.63	7.172
EVAPOTRANSPIRATION	20.658	(3.2310)	74988.53	80.338
LATERAL DRAINAGE COLLECTED FROM LAYER 4	3.25556	(2.41040)	11817.680	12.66065
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.007	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.004	(0.003)		
CHANGE IN WATER STORAGE	-0.044	(0.3478)	-159.04	-0.170

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****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 5

	(INCHES)	(CU. FT.)
PRECIPITATION	3.84	13939.199
RUNOFF	1.387	5034.9873
DRAINAGE COLLECTED FROM LAYER 4	0.16248	589.81421
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00007
AVERAGE HEAD ON TOP OF LAYER 5	0.072	
MAXIMUM HEAD ON TOP OF LAYER 5	0.143	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	1.2 FEET	
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4071

Page 5

CASEA-2.OUT

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.2210

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

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

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FINAL WATER STORAGE AT END OF YEAR 5

LAYER	(INCHES)	(VOL/VOL)
1	2.6520	0.2210
2	87.5999	0.2920
3	7.7040	0.3210
4	0.0030	0.0100
5	0.0000	0.0000
6	0.1800	0.7500
SNOW WATER	0.000	

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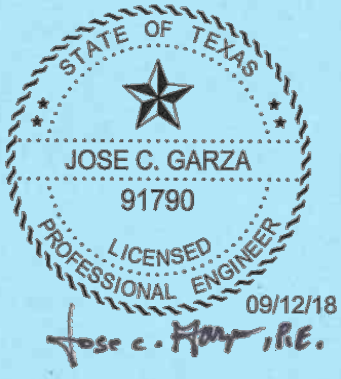
CASE A-3 (10 YR)


STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18
Jose C. Garza, P.E.

CASEA-3.OUT

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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:\HELP3\JDATA\KGVPR10Y.D4
TEMPERATURE DATA FILE:      C:\HELP3\JDATA\KGVTE10Y.D7
SOLAR RADIATION DATA FILE:  C:\HELP3\JDATA\KGVSO10Y.D13
EVAPOTRANSPIRATION DATA:    C:\HELP3\JDATA\KGVEV10Y.D11
SOIL AND DESIGN DATA FILE:  C:\HELP3\JDATA\CASEA-3.D10
OUTPUT DATA FILE:           C:\HELP3\JDATA\CASEA-3.OUT


TIME:  15:40     DATE:   3/28/2017


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

     TITLE:  CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE A-3

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


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


                              LAYER  1
                              --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER  13
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4300 VOL/VOL
          FIELD CAPACITY               =      0.3210 VOL/VOL
          WILTING POINT                =      0.2210 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2288 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.330000003000E-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  18
          THICKNESS                    =    960.00   INCHES
```

CASEA-3.OUT

POROSITY	=	0.6710 VOL/VOL
FIELD CAPACITY	=	0.2920 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2920 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 13

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4300 VOL/VOL
FIELD CAPACITY	=	0.3210 VOL/VOL
WILTING POINT	=	0.2210 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3264 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.330000003000E-04 CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20

THICKNESS	=	0.30 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0192 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000 CM/SEC
SLOPE	=	2.00 PERCENT
DRAINAGE LENGTH	=	500.0 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	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.24 INCHES
POROSITY	=	0.7500 VOL/VOL
FIELD CAPACITY	=	0.7470 VOL/VOL

CASEA-3.OUT

WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	88.40	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.745	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.160	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.652	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	291.086	INCHES
TOTAL INITIAL WATER	=	291.086	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

STATION LATITUDE	=	27.77 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	12.00 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	78.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.63	1.69	1.20	1.57	3.29	3.12
2.26	2.78	5.31	2.92	1.61	1.17

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

CASEA-3.OUT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
56.30	59.30	65.90	73.00	78.10	82.70
84.90	85.00	81.50	74.00	65.00	59.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CORPUS CHRISTI TEXAS
AND STATION LATITUDE = 27.77 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.06	2.35	1.01	1.50	1.80	3.09
	2.20	2.82	5.84	2.94	1.59	1.30
STD. DEVIATIONS	0.59	1.23	0.57	1.13	1.89	2.37
	2.21	1.84	2.64	1.94	1.41	0.78
RUNOFF						
TOTALS	0.004	0.077	0.003	0.077	0.093	0.379
	0.420	0.200	0.838	0.189	0.131	0.005
STD. DEVIATIONS	0.012	0.085	0.005	0.147	0.142	0.379
	0.881	0.181	0.865	0.263	0.328	0.014
EVAPOTRANSPIRATION						
TOTALS	0.837	2.069	1.231	1.216	1.552	1.840
	1.576	1.972	3.815	2.349	1.158	1.220
STD. DEVIATIONS	0.545	0.838	0.630	0.808	1.406	1.199
	1.136	1.234	1.009	1.143	0.939	0.656
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	0.1344	0.0542	0.2211	0.1295	0.0832	0.1818
	0.5063	0.4858	0.4108	0.8877	0.6735	0.3751
STD. DEVIATIONS	0.1049	0.0659	0.2794	0.1440	0.1042	0.2527
	0.5801	0.7163	0.6354	0.7006	0.6542	0.5287
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)

CASEA-3.OUT

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0019	0.0009	0.0031	0.0019	0.0012	0.0027
	0.0072	0.0069	0.0060	0.0126	0.0099	0.0053
STD. DEVIATIONS	0.0015	0.0010	0.0040	0.0021	0.0015	0.0037
	0.0083	0.0102	0.0093	0.0100	0.0096	0.0075

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	27.50 (5.539)	99843.1	100.00
RUNOFF	2.416 (1.3408)	8769.43	8.783
EVAPOTRANSPIRATION	20.836 (3.1022)	75634.62	75.753
LATERAL DRAINAGE COLLECTED FROM LAYER 4	4.14326 (2.03305)	15040.019	15.06365
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.007	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.005 (0.002)		
CHANGE IN WATER STORAGE	0.110 (0.4589)	399.07	0.400

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 10

	(INCHES)	(CU. FT.)
PRECIPITATION	4.96	18004.801
RUNOFF	2.477	8990.2607
DRAINAGE COLLECTED FROM LAYER 4	0.15989	580.41718
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00007
AVERAGE HEAD ON TOP OF LAYER 5	0.071	
MAXIMUM HEAD ON TOP OF LAYER 5	0.139	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	5.4 FEET	
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4122

Page 5

CASEA-3.OUT

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.2210

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

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

****

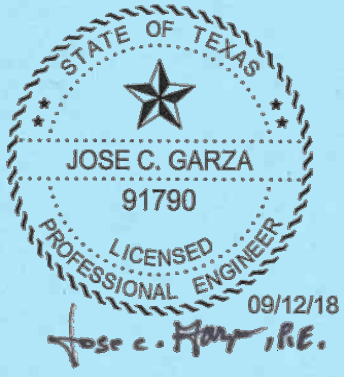
****

FINAL WATER STORAGE AT END OF YEAR 10

LAYER	(INCHES)	(VOL/VOL)
1	2.9749	0.2479
2	280.3199	0.2920
3	8.7003	0.3625
4	0.0098	0.0326
5	0.0000	0.0000
6	0.1800	0.7500
SNOW WATER	0.000	

****
****

CASE A-4 (5 YR)


STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18
Jose C. Garza, P.E.

CASEA-4.OUT

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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:\HELP3\JDATA\KGVPRE5Y.D4
TEMPERATURE DATA FILE:      C:\HELP3\JDATA\KGVTEM5Y.D7
SOLAR RADIATION DATA FILE:  C:\HELP3\JDATA\KGVSOL5Y.D13
EVAPOTRANSPIRATION DATA:    C:\HELP3\JDATA\KGVEVA5Y.D11
SOIL AND DESIGN DATA FILE:  C:\HELP3\JDATA\CASEA-4.D10
OUTPUT DATA FILE:           C:\HELP3\JDATA\CASEA-4.OUT


TIME:  15:45     DATE:   3/28/2017


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

     TITLE:  CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE A-4

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


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


                              LAYER  1
                              --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER  13
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4300 VOL/VOL
          FIELD CAPACITY               =      0.3210 VOL/VOL
          WILTING POINT                =      0.2210 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2288 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.330000003000E-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  18
          THICKNESS                    =   2016.00   INCHES
                                                  Page 1
```

```
POROSITY                    =      0.6710 VOL/VOL
FIELD CAPACITY              =      0.2920 VOL/VOL
WILTING POINT               =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2920 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

```
                        LAYER  3
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  13
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4300 VOL/VOL
FIELD CAPACITY              =      0.3210 VOL/VOL
WILTING POINT               =      0.2210 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3265 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.330000003000E-04 CM/SEC
```

```
                        LAYER  4
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER  20
THICKNESS                   =      0.30   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0193 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    500.0    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         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      2.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

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

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  17
THICKNESS                   =      0.24   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
```

CASEA-4.OUT

WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	88.40	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.745	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.160	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.652	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	599.440	INCHES
TOTAL INITIAL WATER	=	599.440	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

STATION LATITUDE	=	27.77 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	12.00 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	78.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.63	1.69	1.20	1.57	3.29	3.12
2.26	2.78	5.31	2.92	1.61	1.17

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

CASEA-4.OUT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
56.30	59.30	65.90	73.00	78.10	82.70
84.90	85.00	81.50	74.00	65.00	59.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CORPUS CHRISTI TEXAS
AND STATION LATITUDE = 27.77 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	0.95	2.68	1.37	1.91	0.88	2.95
	1.12	3.27	5.24	3.31	0.66	1.38
STD. DEVIATIONS	0.67	1.67	0.39	1.21	0.54	3.03
	0.86	1.72	2.95	2.46	0.35	0.68
RUNOFF						
TOTALS	0.000	0.067	0.006	0.059	0.007	0.320
	0.016	0.162	0.904	0.295	0.000	0.009
STD. DEVIATIONS	0.000	0.074	0.006	0.092	0.011	0.501
	0.025	0.107	1.227	0.351	0.000	0.020
EVAPOTRANSPIRATION						
TOTALS	0.796	2.050	1.690	1.514	1.066	1.962
	1.227	2.222	3.837	2.265	0.678	1.352
STD. DEVIATIONS	0.808	1.153	0.323	0.898	0.820	1.208
	0.918	1.206	1.049	1.361	0.460	0.649
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	0.1191	0.0183	0.3275	0.1852	0.1024	0.0524
	0.4164	0.1182	0.1630	0.7276	0.8315	0.1958
STD. DEVIATIONS	0.0563	0.0171	0.3363	0.1695	0.0938	0.0970
	0.7717	0.1764	0.2055	0.7746	0.9282	0.1566
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)

CASEA-4.OUT

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0017	0.0003	0.0047	0.0027	0.0015	0.0008
	0.0059	0.0017	0.0024	0.0104	0.0122	0.0028
STD. DEVIATIONS	0.0008	0.0003	0.0048	0.0025	0.0013	0.0014
	0.0110	0.0025	0.0030	0.0110	0.0136	0.0022

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	25.71 (6.634)	93341.8	100.00
RUNOFF	1.844 (1.6270)	6694.63	7.172
EVAPOTRANSPIRATION	20.658 (3.2310)	74988.53	80.338
LATERAL DRAINAGE COLLECTED FROM LAYER 4	3.25746 (2.39845)	11824.574	12.66803
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.007	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.004 (0.003)		
CHANGE IN WATER STORAGE	-0.046 (0.3323)	-165.95	-0.178

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****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 5

	(INCHES)	(CU. FT.)
PRECIPITATION	3.84	13939.199
RUNOFF	1.387	5034.9873
DRAINAGE COLLECTED FROM LAYER 4	0.15416	559.61389
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00007
AVERAGE HEAD ON TOP OF LAYER 5	0.068	
MAXIMUM HEAD ON TOP OF LAYER 5	0.135	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	4.5 FEET	
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4071

Page 5

CASEA-4.OUT

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.2210

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

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

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FINAL WATER STORAGE AT END OF YEAR 5

LAYER	(INCHES)	(VOL/VOL)
1	2.6520	0.2210
2	588.6719	0.2920
3	7.7040	0.3210
4	0.0030	0.0100
5	0.0000	0.0000
6	0.1800	0.7500
SNOW WATER	0.000	

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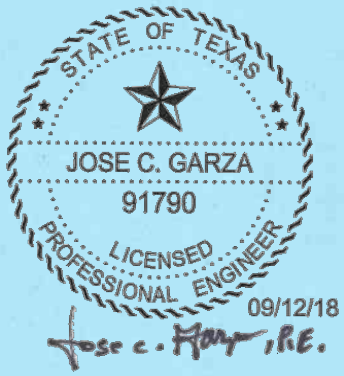
CASE A-5 (30 YR)


STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18
Jose C. Garza, P.E.

CASEA-5.OUT

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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:\HELP3\JDATA\KGVPR30Y.D4
TEMPERATURE DATA FILE:      C:\HELP3\JDATA\KGVTE30Y.D7
SOLAR RADIATION DATA FILE:  C:\HELP3\JDATA\KGVSO30Y.D13
EVAPOTRANSPIRATION DATA:    C:\HELP3\JDATA\KGVEV30Y.D11
SOIL AND DESIGN DATA FILE:  C:\HELP3\JDATA\CASEA-5.D10
OUTPUT DATA FILE:           C:\HELP3\JDATA\CASEA-5.OUT


TIME:  15:50     DATE:   3/28/2017


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

     TITLE:  CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE A-5

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


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


                              LAYER  1
                              --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  13
          THICKNESS                    =     24.00   INCHES
          POROSITY                     =      0.4300 VOL/VOL
          FIELD CAPACITY               =      0.3210 VOL/VOL
          WILTING POINT                =      0.2210 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2734 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.330000003000E-04 CM/SEC
        NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.63
                FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.



                              LAYER  2
                              --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                      MATERIAL TEXTURE NUMBER  20
          THICKNESS                    =      0.20   INCHES
                                                          Page 1
```

POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	500.0	FEET

LAYER 3

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	=	2.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.24	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 13

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4300	VOL/VOL
FIELD CAPACITY	=	0.3210	VOL/VOL
WILTING POINT	=	0.2210	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3210	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.330000003000E-04	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	2016.00	INCHES
POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.2920	VOL/VOL

```
WILTING POINT               =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2920 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                      LAYER  7
                      --------

         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  13
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4300 VOL/VOL
FIELD CAPACITY              =      0.3210 VOL/VOL
WILTING POINT               =      0.2210 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3210 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.330000003000E-04 CM/SEC


                      LAYER  8
                      --------

           TYPE 2 - LATERAL DRAINAGE LAYER
             MATERIAL TEXTURE NUMBER  20
THICKNESS                   =      0.30   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    500.0    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         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      2.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD


                      LAYER 10
                      --------

             TYPE 3 - BARRIER SOIL LINER
             MATERIAL TEXTURE NUMBER  17
THICKNESS                   =      0.24   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
```

EFFECTIVE SAT. HYD. COND. = 0.300000003000E-08 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	84.10	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.709	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.160	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.652	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	607.154	INCHES
TOTAL INITIAL WATER	=	607.154	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

STATION LATITUDE	=	27.77 DEGREES
MAXIMUM LEAF AREA INDEX	=	3.50
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	12.00 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	78.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.63	1.69	1.20	1.57	3.29	3.12
2.26	2.78	5.31	2.92	1.61	1.17

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

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

CASEA-5.OUT

56.30	59.30	65.90	73.00	78.10	82.70
84.90	85.00	81.50	74.00	65.00	59.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CORPUS CHRISTI TEXAS
AND STATION LATITUDE = 27.77 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.37	1.81	1.19	1.40	2.51	2.59
	2.36	2.86	5.39	2.99	1.49	1.25
STD. DEVIATIONS	0.81	1.21	0.57	1.05	1.80	1.82
	2.23	2.36	2.96	1.90	1.16	0.84
RUNOFF						
TOTALS	0.004	0.013	0.003	0.045	0.163	0.132
	0.327	0.178	0.552	0.151	0.042	0.003
STD. DEVIATIONS	0.015	0.028	0.018	0.170	0.495	0.186
	0.773	0.317	0.844	0.290	0.172	0.015
EVAPOTRANSPIRATION						
TOTALS	1.076	1.761	1.316	1.248	1.932	2.041
	1.736	2.152	3.438	2.385	1.304	1.112
STD. DEVIATIONS	0.679	0.898	0.617	0.799	1.174	1.206
	1.224	1.479	1.214	1.104	0.892	0.694
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.0842	0.2413	0.1093	0.0584	0.2319	0.4061
	0.3681	0.4333	0.9635	0.8010	0.2928	0.0867
STD. DEVIATIONS	0.1571	0.3033	0.1178	0.1582	0.3366	0.5716
	0.5942	0.6737	0.9803	0.8560	0.4096	0.1208
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 10

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

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0012	0.0038	0.0016	0.0009	0.0129	0.0680
	0.0654	0.0894	0.3723	0.1907	0.0250	0.0012
STD. DEVIATIONS	0.0022	0.0048	0.0017	0.0023	0.0350	0.2170
	0.2711	0.2468	0.7672	0.4791	0.1058	0.0017

DAILY AVERAGE HEAD ON TOP OF LAYER 9

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

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	27.20	(5.704)	98722.7	100.00
RUNOFF	1.614	(1.1884)	5857.79	5.934
EVAPOTRANSPIRATION	21.499	(3.7310)	78042.02	79.052
LATERAL DRAINAGE COLLECTED FROM LAYER 2	4.07648	(2.08837)	14797.638	14.98909
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00002	(0.00003)	0.081	0.00008
AVERAGE HEAD ON TOP OF LAYER 3	0.069	(0.102)		
LATERAL DRAINAGE COLLECTED FROM LAYER 8	0.00002	(0.00003)	0.078	0.00008
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.004	0.00000
AVERAGE HEAD ON TOP OF LAYER 9	0.000	(0.000)		
CHANGE IN WATER STORAGE	0.007	(0.4332)	25.15	0.025

CASEA-5.OUT

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.07	18404.102
RUNOFF	2.585	9382.0947
DRAINAGE COLLECTED FROM LAYER 2	0.45365	1646.74841
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000023	0.08297
AVERAGE HEAD ON TOP OF LAYER 3	22.797	
MAXIMUM HEAD ON TOP OF LAYER 3	31.103	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	158.8 FEET	
DRAINAGE COLLECTED FROM LAYER 8	0.00005	0.17010
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	0.013	
LOCATION OF MAXIMUM HEAD IN LAYER 8 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.02	73.7433

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4300
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.2210

*** 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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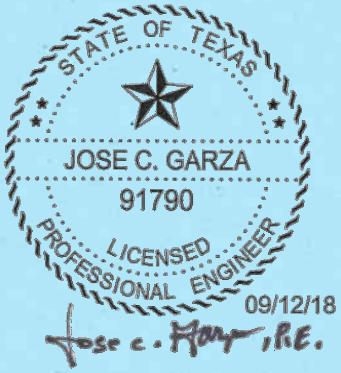
FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	6.7692	0.2821

2	0.0020	0.0100
3	0.0000	0.0000
4	0.1800	0.7500
5	3.8520	0.3210
6	588.6720	0.2920
7	7.7040	0.3210
8	0.0030	0.0100
9	0.0000	0.0000
10	0.1800	0.7500
SNOW WATER	0.000	

****
****

CASE B-1 (1 YR)


STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18
Jose C. Garza P.E.

CASEB-1.OUT

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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:\HELP3\JDATA\KGVPR1Y.D4
TEMPERATURE DATA FILE:      C:\HELP3\JDATA\KGVTE1Y.D7
SOLAR RADIATION DATA FILE:  C:\HELP3\JDATA\KGVSOL1Y.D13
EVAPOTRANSPIRATION DATA:    C:\HELP3\JDATA\KGVEVA1Y.D11
SOIL AND DESIGN DATA FILE:  C:\HELP3\JDATA\CASEB-1.D10
OUTPUT DATA FILE:           C:\HELP3\JDATA\CASEB-1.OUT


TIME:  16: 4     DATE:   3/28/2017


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

     TITLE:  CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE B-1

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


                              LAYER  1
                              --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                   MATERIAL TEXTURE NUMBER  13
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.4300 VOL/VOL
          FIELD CAPACITY               =      0.3210 VOL/VOL
          WILTING POINT                =      0.2210 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2511 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.330000003000E-04 CM/SEC



                              LAYER  2
                              --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                   MATERIAL TEXTURE NUMBER  18
          THICKNESS                    =    120.00   INCHES
          POROSITY                     =      0.6710 VOL/VOL
          FIELD CAPACITY               =      0.2920 VOL/VOL
                                                 Page 1
```

WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2868 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 13

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4300 VOL/VOL
FIELD CAPACITY	=	0.3210 VOL/VOL
WILTING POINT	=	0.2210 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3287 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.330000003000E-04 CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20

THICKNESS	=	0.30 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0137 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000 CM/SEC
SLOPE	=	2.00 PERCENT
DRAINAGE LENGTH	=	150.0 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	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.24 INCHES
POROSITY	=	0.7500 VOL/VOL
FIELD CAPACITY	=	0.7470 VOL/VOL
WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL

CASEB-1.OUT

EFFECTIVE SAT. HYD. COND. = 0.300000003000E-08 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	95.40	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.635	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6.606	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.788	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	43.997	INCHES
TOTAL INITIAL WATER	=	43.997	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

STATION LATITUDE	=	27.77 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	12.00 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	78.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.63	1.69	1.20	1.57	3.29	3.12
2.26	2.78	5.31	2.92	1.61	1.17

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

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

CASEB-1.OUT

56.30	59.30	65.90	73.00	78.10	82.70
84.90	85.00	81.50	74.00	65.00	59.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CORPUS CHRISTI TEXAS
AND STATION LATITUDE = 27.77 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	0.50	0.93	1.47	0.15	0.77	0.41
	0.05	6.18	7.59	4.30	1.12	1.62
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	0.453	0.373	2.219	0.431	0.319	0.469
	0.226	4.415	4.760	4.207	0.732	1.925
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 4						
TOTALS	0.1791	0.0100	0.0177	0.0000	0.0023	0.0000
	0.0000	0.0018	0.3826	1.5904	2.0717	0.3136
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 6						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

CASEB-1.OUT

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0008	0.0000	0.0001	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0017	0.0068	0.0091	0.0013
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 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	25.09	(0.000)	91076.7	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	20.529	(0.0000)	74519.87	81.821
LATERAL DRAINAGE COLLECTED FROM LAYER 4	4.56919	(0.00000)	16586.178	18.21121
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.005	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.002	(0.000)		
CHANGE IN WATER STORAGE	-0.008	(0.0000)	-29.34	-0.032

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****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	3.84	13939.199
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 4	0.16888	613.03558
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 5	0.022	
MAXIMUM HEAD ON TOP OF LAYER 5	0.045	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	0.6 FEET	
SNOW WATER	0.00	0.0000
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4139	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1599	

Page 5

CASEB-1.OUT

*** 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 1

LAYER	(INCHES)	(VOL/VOL)
1	1.5065	0.2511
2	34.4044	0.2867
3	7.8939	0.3289
4	0.0038	0.0125
5	0.0000	0.0000
6	0.1800	0.7500
SNOW WATER	0.000	

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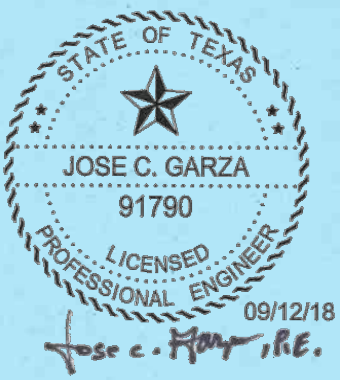
****

CASE B-2 (5 YR)


STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18
Jose C. Garza, P.E.

CASEB-2.OUT

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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:\HELP3\JDATA\KGVPRE5Y.D4
TEMPERATURE DATA FILE:      C:\HELP3\JDATA\KGVTEM5Y.D7
SOLAR RADIATION DATA FILE:  C:\HELP3\JDATA\KGVSOL5Y.D13
EVAPOTRANSPIRATION DATA:    C:\HELP3\JDATA\KGVEVA5Y.D11
SOIL AND DESIGN DATA FILE:  C:\HELP3\JDATA\CASEB-2.D10
OUTPUT DATA FILE:           C:\HELP3\JDATA\CASEB-2.OUT

TIME:  16:12     DATE:   3/28/2017

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

     TITLE:  CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE B-2

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

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

                              LAYER  1
                              --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER  13
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4300 VOL/VOL
          FIELD CAPACITY               =      0.3210 VOL/VOL
          WILTING POINT                =      0.2210 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2321 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.330000003000E-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  18
          THICKNESS                    =    300.00   INCHES
```

CASEB-2.OUT

POROSITY	=	0.6710 VOL/VOL
FIELD CAPACITY	=	0.2920 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2920 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 13

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4300 VOL/VOL
FIELD CAPACITY	=	0.3210 VOL/VOL
WILTING POINT	=	0.2210 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3251 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.330000003000E-04 CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20

THICKNESS	=	0.30 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0123 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000 CM/SEC
SLOPE	=	2.00 PERCENT
DRAINAGE LENGTH	=	150.0 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	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.24 INCHES
POROSITY	=	0.7500 VOL/VOL
FIELD CAPACITY	=	0.7470 VOL/VOL

Page 2

CASEB-2.OUT

WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	88.40	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.785	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.160	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.652	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	98.373	INCHES
TOTAL INITIAL WATER	=	98.373	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

STATION LATITUDE	=	27.77 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	12.00 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	78.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.63	1.69	1.20	1.57	3.29	3.12
2.26	2.78	5.31	2.92	1.61	1.17

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

CASEB-2.OUT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
56.30	59.30	65.90	73.00	78.10	82.70
84.90	85.00	81.50	74.00	65.00	59.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CORPUS CHRISTI TEXAS
AND STATION LATITUDE = 27.77 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	0.95	2.68	1.37	1.91	0.88	2.95
	1.12	3.27	5.24	3.31	0.66	1.38
STD. DEVIATIONS	0.67	1.67	0.39	1.21	0.54	3.03
	0.86	1.72	2.95	2.46	0.35	0.68
RUNOFF						
TOTALS	0.000	0.089	0.006	0.061	0.007	0.338
	0.017	0.177	0.988	0.314	0.000	0.010
STD. DEVIATIONS	0.000	0.089	0.006	0.096	0.011	0.538
	0.027	0.128	1.357	0.358	0.000	0.022
EVAPOTRANSPIRATION						
TOTALS	0.820	2.085	1.697	1.512	1.120	2.029
	1.269	2.201	3.966	2.377	0.687	1.316
STD. DEVIATIONS	0.795	1.161	0.263	0.895	0.851	1.270
	0.998	1.208	1.130	1.500	0.485	0.640
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	0.0961	0.0114	0.2799	0.1889	0.1040	0.0174
	0.3224	0.0813	0.1047	0.7290	0.5771	0.1610
STD. DEVIATIONS	0.0616	0.0103	0.2914	0.1737	0.0957	0.0242
	0.6289	0.1422	0.1067	0.8733	0.5987	0.1325
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)

CASEB-2.OUT

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0004	0.0001	0.0012	0.0008	0.0004	0.0001
	0.0014	0.0003	0.0005	0.0031	0.0025	0.0007
STD. DEVIATIONS	0.0003	0.0000	0.0012	0.0008	0.0004	0.0001
	0.0027	0.0006	0.0005	0.0037	0.0026	0.0006

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 5

	INCHES		CU. FEET	PERCENT
PRECIPITATION	25.71	(6.634)	93341.8	100.00
RUNOFF	2.007	(1.7908)	7283.72	7.803
EVAPOTRANSPIRATION	21.079	(3.3849)	76517.34	81.975
LATERAL DRAINAGE COLLECTED FROM LAYER 4	2.67326	(2.04005)	9703.923	10.39611
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.005	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.001	(0.001)		
CHANGE IN WATER STORAGE	-0.045	(0.3630)	-163.17	-0.175

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 5

	(INCHES)	(CU. FT.)
PRECIPITATION	3.84	13939.199
RUNOFF	1.544	5605.5229
DRAINAGE COLLECTED FROM LAYER 4	0.16334	592.90790
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 5	0.022	
MAXIMUM HEAD ON TOP OF LAYER 5	0.043	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	1.5 FEET	
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4226

Page 5

CASEB-2.OUT

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.2210

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

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

****

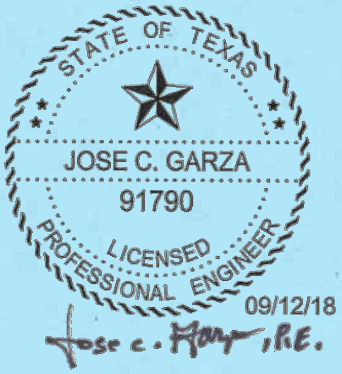
****

FINAL WATER STORAGE AT END OF YEAR 5

LAYER	(INCHES)	(VOL/VOL)
1	2.6610	0.2217
2	87.5999	0.2920
3	7.7040	0.3210
4	0.0030	0.0100
5	0.0000	0.0000
6	0.1800	0.7500
SNOW WATER	0.000	

****
****

CASE B-3 (10 YR)


STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18
Jose C. Garza, P.E.

CASEB-3.OUT

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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:\HELP3\JDATA\KGVPR10Y.D4
TEMPERATURE DATA FILE:      C:\HELP3\JDATA\KGVTE10Y.D7
SOLAR RADIATION DATA FILE:  C:\HELP3\JDATA\KGVSO10Y.D13
EVAPOTRANSPIRATION DATA:    C:\HELP3\JDATA\KGVEV10Y.D11
SOIL AND DESIGN DATA FILE:  C:\HELP3\JDATA\CASEB-3.D10
OUTPUT DATA FILE:           C:\HELP3\JDATA\CASEB-3.OUT


TIME:  16:17     DATE:   3/28/2017


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

     TITLE:  CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE B-3

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


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


                              LAYER  1
                              --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER  13
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4300 VOL/VOL
          FIELD CAPACITY               =      0.3210 VOL/VOL
          WILTING POINT                =      0.2210 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2321 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.330000003000E-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  18
          THICKNESS                    =    960.00   INCHES
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CASEB-3.OUT

POROSITY	=	0.6710 VOL/VOL
FIELD CAPACITY	=	0.2920 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2920 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 13

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4300 VOL/VOL
FIELD CAPACITY	=	0.3210 VOL/VOL
WILTING POINT	=	0.2210 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3253 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.330000003000E-04 CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20

THICKNESS	=	0.30 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0123 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000 CM/SEC
SLOPE	=	2.00 PERCENT
DRAINAGE LENGTH	=	150.0 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	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.24 INCHES
POROSITY	=	0.7500 VOL/VOL
FIELD CAPACITY	=	0.7470 VOL/VOL

CASEB-3.OUT

WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	88.40	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.785	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.160	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.652	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	291.098	INCHES
TOTAL INITIAL WATER	=	291.098	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

STATION LATITUDE	=	27.77 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	12.00 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	78.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.63	1.69	1.20	1.57	3.29	3.12
2.26	2.78	5.31	2.92	1.61	1.17

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

CASEB-3.OUT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
56.30	59.30	65.90	73.00	78.10	82.70
84.90	85.00	81.50	74.00	65.00	59.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CORPUS CHRISTI TEXAS
AND STATION LATITUDE = 27.77 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.06	2.35	1.01	1.50	1.80	3.09
	2.20	2.82	5.84	2.94	1.59	1.30
STD. DEVIATIONS	0.59	1.23	0.57	1.13	1.89	2.37
	2.21	1.84	2.64	1.94	1.41	0.78
RUNOFF						
TOTALS	0.004	0.090	0.003	0.078	0.101	0.395
	0.448	0.219	0.938	0.203	0.173	0.006
STD. DEVIATIONS	0.013	0.092	0.005	0.148	0.155	0.402
	0.923	0.217	0.963	0.271	0.463	0.015
EVAPOTRANSPIRATION						
TOTALS	0.819	2.103	1.241	1.230	1.621	1.925
	1.668	1.983	3.968	2.451	1.158	1.243
STD. DEVIATIONS	0.536	0.842	0.614	0.817	1.425	1.260
	1.284	1.263	1.038	1.248	0.928	0.597
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	0.1111	0.0418	0.1984	0.1331	0.0808	0.1196
	0.3786	0.3978	0.2864	0.7347	0.5208	0.3114
STD. DEVIATIONS	0.1017	0.0566	0.2436	0.1490	0.0930	0.1902
	0.4638	0.5807	0.4839	0.5871	0.5311	0.4169
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)

CASEB-3.OUT

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0005	0.0002	0.0008	0.0006	0.0003	0.0005
	0.0016	0.0017	0.0013	0.0031	0.0023	0.0013
STD. DEVIATIONS	0.0004	0.0003	0.0010	0.0007	0.0004	0.0008
	0.0020	0.0025	0.0021	0.0025	0.0023	0.0018

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	27.50 (5.539)	99843.1	100.00
RUNOFF	2.658 (1.4975)	9648.88	9.664
EVAPOTRANSPIRATION	21.410 (3.2139)	77719.13	77.841
LATERAL DRAINAGE COLLECTED FROM LAYER 4	3.31445 (1.67892)	12031.441	12.05034
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.006	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.001 (0.001)		
CHANGE IN WATER STORAGE	0.122 (0.4798)	443.70	0.444

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****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 10

	(INCHES)	(CU. FT.)
PRECIPITATION	4.96	18004.801
RUNOFF	2.463	8939.5000
DRAINAGE COLLECTED FROM LAYER 4	0.16481	598.25214
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 5	0.022	
MAXIMUM HEAD ON TOP OF LAYER 5	0.043	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	1.7 FEET	
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4237

Page 5

CASEB-3.OUT

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.2210

*** 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 10

LAYER	(INCHES)	(VOL/VOL)
1	3.2572	0.2714
2	280.3199	0.2920
3	8.5597	0.3567
4	0.0030	0.0100
5	0.0000	0.0000
6	0.1800	0.7500
SNOW WATER	0.000	

****
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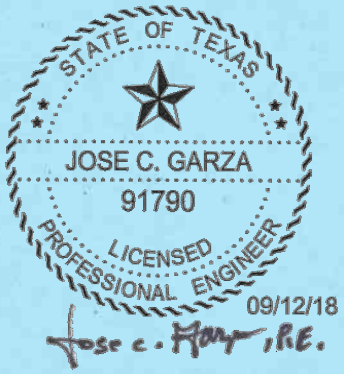
CASE B-4 (5 YR)


STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18
Jose C. Garza, P.E.

CASEB-4.OUT

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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:\HELP3\JDATA\KGVPRE5Y.D4
TEMPERATURE DATA FILE:      C:\HELP3\JDATA\KGVTEM5Y.D7
SOLAR RADIATION DATA FILE:  C:\HELP3\JDATA\KGVSOL5Y.D13
EVAPOTRANSPIRATION DATA:    C:\HELP3\JDATA\KGVEVA5Y.D11
SOIL AND DESIGN DATA FILE:  C:\HELP3\JDATA\CASEB-4.D10
OUTPUT DATA FILE:           C:\HELP3\JDATA\CASEB-4.OUT


TIME:  16:26     DATE:   3/28/2017


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

     TITLE:  CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE B-4

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


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  13
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4300 VOL/VOL
          FIELD CAPACITY               =      0.3210 VOL/VOL
          WILTING POINT                =      0.2210 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2321 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.330000003000E-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  18
          THICKNESS                    =   1698.00   INCHES
```

POROSITY	=	0.6710 VOL/VOL
FIELD CAPACITY	=	0.2920 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2920 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 13

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4300 VOL/VOL
FIELD CAPACITY	=	0.3210 VOL/VOL
WILTING POINT	=	0.2210 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3254 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.330000003000E-04 CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20

THICKNESS	=	0.30 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0124 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000 CM/SEC
SLOPE	=	2.00 PERCENT
DRAINAGE LENGTH	=	150.0 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	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.24 INCHES
POROSITY	=	0.7500 VOL/VOL
FIELD CAPACITY	=	0.7470 VOL/VOL

CASEB-4.OUT

WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	88.40	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.785	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.160	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.652	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	506.594	INCHES
TOTAL INITIAL WATER	=	506.594	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

STATION LATITUDE	=	27.77 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	12.00 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	78.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.63	1.69	1.20	1.57	3.29	3.12
2.26	2.78	5.31	2.92	1.61	1.17

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

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JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
56.30	59.30	65.90	73.00	78.10	82.70
84.90	85.00	81.50	74.00	65.00	59.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CORPUS CHRISTI TEXAS
AND STATION LATITUDE = 27.77 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	0.95	2.68	1.37	1.91	0.88	2.95
	1.12	3.27	5.24	3.31	0.66	1.38
STD. DEVIATIONS	0.67	1.67	0.39	1.21	0.54	3.03
	0.86	1.72	2.95	2.46	0.35	0.68
RUNOFF						
TOTALS	0.000	0.089	0.006	0.061	0.007	0.338
	0.017	0.177	0.988	0.314	0.000	0.010
STD. DEVIATIONS	0.000	0.089	0.006	0.096	0.011	0.538
	0.027	0.128	1.357	0.358	0.000	0.022
EVAPOTRANSPIRATION						
TOTALS	0.820	2.085	1.697	1.512	1.120	2.029
	1.269	2.201	3.966	2.377	0.687	1.316
STD. DEVIATIONS	0.795	1.161	0.263	0.895	0.851	1.270
	0.998	1.208	1.130	1.500	0.485	0.640
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	0.1049	0.0123	0.2751	0.1915	0.1057	0.0174
	0.3162	0.0846	0.1051	0.6326	0.6608	0.1682
STD. DEVIATIONS	0.0690	0.0108	0.2864	0.1763	0.0972	0.0244
	0.6146	0.1492	0.1047	0.6993	0.7427	0.1410
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)

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DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0004	0.0001	0.0012	0.0008	0.0005	0.0001
	0.0013	0.0004	0.0005	0.0027	0.0029	0.0007
STD. DEVIATIONS	0.0003	0.0001	0.0012	0.0008	0.0004	0.0001
	0.0026	0.0006	0.0005	0.0030	0.0033	0.0006

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	25.71 (6.634)	93341.8	100.00
RUNOFF	2.007 (1.7908)	7283.72	7.803
EVAPOTRANSPIRATION	21.079 (3.3849)	76517.34	81.975
LATERAL DRAINAGE COLLECTED FROM LAYER 4	2.67443 (2.03125)	9708.189	10.40069
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.005	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.001 (0.001)		
CHANGE IN WATER STORAGE	-0.046 (0.3512)	-167.48	-0.179

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 5

	(INCHES)	(CU. FT.)
PRECIPITATION	3.84	13939.199
RUNOFF	1.544	5605.5229
DRAINAGE COLLECTED FROM LAYER 4	0.15645	567.92877
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 5	0.021	
MAXIMUM HEAD ON TOP OF LAYER 5	0.041	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	0.4 FEET	
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4226

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MINIMUM VEG. SOIL WATER (VOL/VOL) 0.2210

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

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

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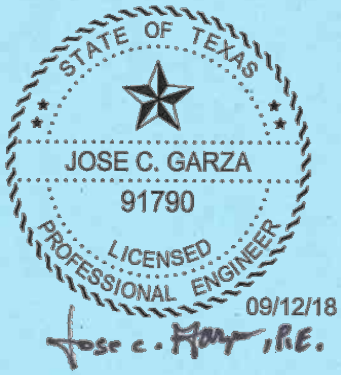
FINAL WATER STORAGE AT END OF YEAR 5

LAYER	(INCHES)	(VOL/VOL)
1	2.6610	0.2217
2	495.8159	0.2920
3	7.7040	0.3210
4	0.0030	0.0100
5	0.0000	0.0000
6	0.1800	0.7500
SNOW WATER	0.000	

****
****

CASE B-5 (30 YR)


STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18
Jose C. Garza, P.E.

CASEB-5.OUT

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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:\HELP3\JDATA\KGVPR30Y.D4
TEMPERATURE DATA FILE:      C:\HELP3\JDATA\KGVTE30Y.D7
SOLAR RADIATION DATA FILE:  C:\HELP3\JDATA\KGVSO30Y.D13
EVAPOTRANSPIRATION DATA:    C:\HELP3\JDATA\KGVEV30Y.D11
SOIL AND DESIGN DATA FILE:  C:\HELP3\JDATA\CASEB-5.D10
OUTPUT DATA FILE:           C:\HELP3\JDATA\CASEB-5.OUT


TIME:  16:31     DATE:   3/28/2017


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

     TITLE:  CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE B-5

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


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


                              LAYER  1
                              --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER  13
          THICKNESS                    =     24.00   INCHES
          POROSITY                     =      0.4300 VOL/VOL
          FIELD CAPACITY               =      0.3210 VOL/VOL
          WILTING POINT                =      0.2210 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2758 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.330000003000E-04 CM/SEC
        NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.63
                FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.



                              LAYER  2
                              --------

                  TYPE 2 - LATERAL DRAINAGE LAYER
                    MATERIAL TEXTURE NUMBER  20
          THICKNESS                    =      0.20   INCHES
```

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POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	150.0	FEET

LAYER 3

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	=	2.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.24	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 13

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4300	VOL/VOL
FIELD CAPACITY	=	0.3210	VOL/VOL
WILTING POINT	=	0.2210	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3210	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.330000003000E-04	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	2016.00	INCHES
POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.2920	VOL/VOL

```
WILTING POINT               =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2920 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                      LAYER  7
                      --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  13
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4300 VOL/VOL
FIELD CAPACITY              =      0.3210 VOL/VOL
WILTING POINT               =      0.2210 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3210 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.330000003000E-04 CM/SEC


                      LAYER  8
                      --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER  20
THICKNESS                   =      0.30   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    150.0    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         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      2.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD


                      LAYER 10
                      --------

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  17
THICKNESS                   =      0.24   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
```

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EFFECTIVE SAT. HYD. COND. = 0.300000003000E-08 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	84.10	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.768	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.160	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.652	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	607.213	INCHES
TOTAL INITIAL WATER	=	607.213	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

STATION LATITUDE	=	27.77 DEGREES
MAXIMUM LEAF AREA INDEX	=	3.50
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	12.00 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	78.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.63	1.69	1.20	1.57	3.29	3.12
2.26	2.78	5.31	2.92	1.61	1.17

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

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

Page 4

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56.30	59.30	65.90	73.00	78.10	82.70
84.90	85.00	81.50	74.00	65.00	59.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CORPUS CHRISTI TEXAS
AND STATION LATITUDE = 27.77 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.37	1.81	1.19	1.40	2.51	2.59
	2.36	2.86	5.39	2.99	1.49	1.25
STD. DEVIATIONS	0.81	1.21	0.57	1.05	1.80	1.82
	2.23	2.36	2.96	1.90	1.16	0.84
RUNOFF						
TOTALS	0.005	0.016	0.003	0.045	0.164	0.149
	0.323	0.187	0.592	0.181	0.060	0.004
STD. DEVIATIONS	0.017	0.031	0.018	0.168	0.487	0.220
	0.751	0.348	0.887	0.376	0.263	0.019
EVAPOTRANSPIRATION						
TOTALS	1.092	1.774	1.340	1.253	2.009	2.118
	1.801	2.228	3.544	2.477	1.329	1.108
STD. DEVIATIONS	0.654	0.879	0.628	0.805	1.207	1.251
	1.297	1.552	1.275	1.161	0.914	0.669
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.0723	0.2282	0.1204	0.0472	0.1634	0.3065
	0.3125	0.3167	0.8073	0.7183	0.2233	0.0711
STD. DEVIATIONS	0.1486	0.2632	0.1400	0.1255	0.2603	0.4571
	0.5455	0.5353	0.9329	0.7503	0.2983	0.0953
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 10

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

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0003	0.0011	0.0005	0.0002	0.0007	0.0014
	0.0013	0.0014	0.0036	0.0031	0.0010	0.0003
STD. DEVIATIONS	0.0006	0.0012	0.0006	0.0006	0.0011	0.0020
	0.0023	0.0023	0.0041	0.0032	0.0013	0.0004

DAILY AVERAGE HEAD ON TOP OF LAYER 9

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

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	27.20	(5.704)	98722.7	100.00
RUNOFF	1.730	(1.2349)	6279.16	6.360
EVAPOTRANSPIRATION	22.075	(3.8349)	80130.48	81.167
LATERAL DRAINAGE COLLECTED FROM LAYER 2	3.38704	(1.81757)	12294.941	12.45402
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 3	0.001	(0.001)		
LATERAL DRAINAGE COLLECTED FROM LAYER 8	0.00000	(0.00000)	0.008	0.00001
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.001	0.00000
AVERAGE HEAD ON TOP OF LAYER 9	0.000	(0.000)		
CHANGE IN WATER STORAGE	0.005	(0.4665)	18.10	0.018

CASEB-5.OUT

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.07	18404.102
RUNOFF	2.488	9029.8857
DRAINAGE COLLECTED FROM LAYER 2	1.04379	3788.95557
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000000	0.00024
AVERAGE HEAD ON TOP OF LAYER 3	0.138	
MAXIMUM HEAD ON TOP OF LAYER 3	0.268	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	4.4 FEET	
DRAINAGE COLLECTED FROM LAYER 8	0.00000	0.00021
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00001
AVERAGE HEAD ON TOP OF LAYER 9	0.000	
MAXIMUM HEAD ON TOP OF LAYER 9	0.005	
LOCATION OF MAXIMUM HEAD IN LAYER 8 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.02	73.7433

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4262
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.2210

*** 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 30

LAYER	(INCHES)	(VOL/VOL)
1	6.7695	0.2821

CASEB-5.OUT

2	0.0020	0.0100
3	0.0000	0.0000
4	0.1800	0.7500
5	3.8520	0.3210
6	588.6720	0.2920
7	7.7040	0.3210
8	0.0030	0.0100
9	0.0000	0.0000
10	0.1800	0.7500
SNOW WATER	0.000	

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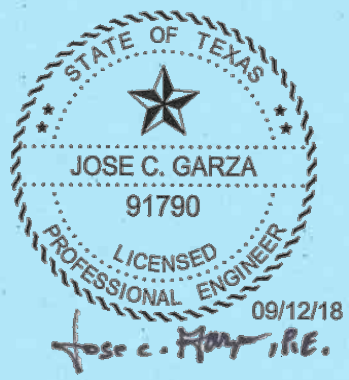
CASE C-1 (1 YR)


STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18
Jose C. Garza, P.E.

CASEC-1.OUT

```
**************************************************************************
**************************************************************************
**                                                                      **
**                                                                      **
**            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:\HELP3\JDATA\KGVPR1Y.D4
TEMPERATURE DATA FILE:      C:\HELP3\JDATA\KGVTE1Y.D7
SOLAR RADIATION DATA FILE:  C:\HELP3\JDATA\KGVSOL1Y.D13
EVAPOTRANSPIRATION DATA:    C:\HELP3\JDATA\KGVEVA1Y.D11
SOIL AND DESIGN DATA FILE:  C:\HELP3\JDATA\CASEC-1.D10
OUTPUT DATA FILE:           C:\HELP3\JDATA\CASEC-1.OUT


TIME:  15:24     DATE:   3/28/2017


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

     TITLE:  CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE C-1

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


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


                              LAYER  1
                              --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER  13
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.4300 VOL/VOL
          FIELD CAPACITY               =      0.3210 VOL/VOL
          WILTING POINT                =      0.2210 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2491 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.330000003000E-04 CM/SEC



                              LAYER  2
                              --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER  18
          THICKNESS                    =    120.00   INCHES
          POROSITY                     =      0.6710 VOL/VOL
          FIELD CAPACITY               =      0.2920 VOL/VOL
                                                  Page 1
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```
WILTING POINT               =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2861 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                      LAYER  3
                      --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  13
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4300 VOL/VOL
FIELD CAPACITY              =      0.3210 VOL/VOL
WILTING POINT               =      0.2210 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3288 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.330000003000E-04 CM/SEC


                      LAYER  4
                      --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER  20
THICKNESS                   =      0.30   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0165 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    400.0    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         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      2.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD


                      LAYER  6
                      --------

            TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  17
THICKNESS                   =      0.24   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
```

CASEC-1.OUT

EFFECTIVE SAT. HYD. COND. = 0.300000003000E-08 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	95.40	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.542	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6.606	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.788	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	43.906	INCHES
TOTAL INITIAL WATER	=	43.906	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

STATION LATITUDE	=	27.77 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	12.00 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	78.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.63	1.69	1.20	1.57	3.29	3.12
2.26	2.78	5.31	2.92	1.61	1.17

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

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

CASEC-1.OUT

56.30	59.30	65.90	73.00	78.10	82.70
84.90	85.00	81.50	74.00	65.00	59.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CORPUS CHRISTI TEXAS
AND STATION LATITUDE = 27.77 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	0.50	0.93	1.47	0.15	0.77	0.41
	0.05	6.18	7.59	4.30	1.12	1.62
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	0.454	0.373	2.218	0.432	0.320	0.467
	0.220	4.382	4.715	4.214	0.727	1.921
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 4						
TOTALS	0.1803	0.0098	0.0071	0.0000	0.0039	0.0000
	0.0000	0.0002	0.4510	1.8499	1.8520	0.2953
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 6						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

CASEC-1.OUT

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0021	0.0001	0.0001	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0053	0.0211	0.0218	0.0034
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 1 THROUGH 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	25.09 (0.000)	91076.7	100.00
RUNOFF	0.000 (0.0000)	0.00	0.000
EVAPOTRANSPIRATION	20.441 (0.0000)	74200.28	81.470
LATERAL DRAINAGE COLLECTED FROM LAYER 4	4.64938 (0.00000)	16877.260	18.53082
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.006	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.004 (0.000)		
CHANGE IN WATER STORAGE	0.000 (0.0000)	-0.84	-0.001

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****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	3.84	13939.199
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 4	0.17316	628.57318
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00006
AVERAGE HEAD ON TOP OF LAYER 5	0.061	
MAXIMUM HEAD ON TOP OF LAYER 5	0.121	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	4.1 FEET	
SNOW WATER	0.00	0.0000
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3870	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1529	

Page 5

CASEC-1.OUT

*** 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 1

LAYER	(INCHES)	(VOL/VOL)
1	1.4947	0.2491
2	34.3324	0.2861
3	7.8940	0.3289
4	0.0050	0.0165
5	0.0000	0.0000
6	0.1800	0.7500
SNOW WATER	0.000	

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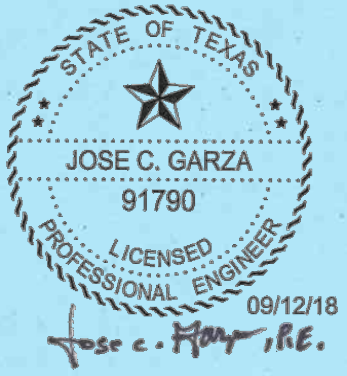
CASE C-2 (5 YR)


STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18
Jose C. Garza, P.E.

CASEC-2.OUT

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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:\HELP3\JDATA\KGVPRE5Y.D4
TEMPERATURE DATA FILE:      C:\HELP3\JDATA\KGVTEM5Y.D7
SOLAR RADIATION DATA FILE:  C:\HELP3\JDATA\KGVSOL5Y.D13
EVAPOTRANSPIRATION DATA:    C:\HELP3\JDATA\KGVEVA5Y.D11
SOIL AND DESIGN DATA FILE:  C:\HELP3\JDATA\CASEC-2.D10
OUTPUT DATA FILE:           C:\HELP3\JDATA\CASEC-2.OUT

TIME:  16:49     DATE:   3/28/2017

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

     TITLE:  CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE C-2

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

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

                              LAYER  1
                              --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER  13
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4300 VOL/VOL
          FIELD CAPACITY               =      0.3210 VOL/VOL
          WILTING POINT                =      0.2210 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2288 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.330000003000E-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  18
          THICKNESS                    =    300.00   INCHES
                                                    Page 1
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CASEC-2.OUT

POROSITY	=	0.6710 VOL/VOL
FIELD CAPACITY	=	0.2920 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2920 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 13

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4300 VOL/VOL
FIELD CAPACITY	=	0.3210 VOL/VOL
WILTING POINT	=	0.2210 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3261 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.330000003000E-04 CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20

THICKNESS	=	0.30 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0170 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000 CM/SEC
SLOPE	=	2.00 PERCENT
DRAINAGE LENGTH	=	400.0 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	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.24 INCHES
POROSITY	=	0.7500 VOL/VOL
FIELD CAPACITY	=	0.7470 VOL/VOL

CASEC-2.OUT

WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	88.40	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.745	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.160	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.652	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	98.357	INCHES
TOTAL INITIAL WATER	=	98.357	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

STATION LATITUDE	=	27.77 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	12.00 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	78.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.63	1.69	1.20	1.57	3.29	3.12
2.26	2.78	5.31	2.92	1.61	1.17

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

CASEC-2.OUT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
56.30	59.30	65.90	73.00	78.10	82.70
84.90	85.00	81.50	74.00	65.00	59.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CORPUS CHRISTI TEXAS
AND STATION LATITUDE = 27.77 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	0.95	2.68	1.37	1.91	0.88	2.95
	1.12	3.27	5.24	3.31	0.66	1.38
STD. DEVIATIONS	0.67	1.67	0.39	1.21	0.54	3.03
	0.86	1.72	2.95	2.46	0.35	0.68
RUNOFF						
TOTALS	0.000	0.067	0.006	0.059	0.007	0.320
	0.016	0.162	0.904	0.295	0.000	0.009
STD. DEVIATIONS	0.000	0.074	0.006	0.092	0.011	0.501
	0.025	0.107	1.227	0.351	0.000	0.020
EVAPOTRANSPIRATION						
TOTALS	0.796	2.050	1.690	1.514	1.066	1.962
	1.227	2.222	3.837	2.265	0.678	1.352
STD. DEVIATIONS	0.808	1.153	0.323	0.898	0.820	1.208
	0.918	1.206	1.049	1.361	0.460	0.649
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	0.1082	0.0136	0.3323	0.1830	0.1007	0.0525
	0.4267	0.1109	0.1627	0.8820	0.7032	0.1797
STD. DEVIATIONS	0.0442	0.0136	0.3414	0.1674	0.0923	0.0971
	0.7945	0.1619	0.2092	1.0257	0.7326	0.1351
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)

CASEC-2.OUT

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0012	0.0002	0.0038	0.0022	0.0011	0.0006
	0.0049	0.0013	0.0019	0.0100	0.0083	0.0020
STD. DEVIATIONS	0.0005	0.0002	0.0039	0.0020	0.0011	0.0011
	0.0090	0.0018	0.0025	0.0117	0.0086	0.0015

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	25.71 (6.634)	93341.8	100.00
RUNOFF	1.844 (1.6270)	6694.63	7.172
EVAPOTRANSPIRATION	20.658 (3.2310)	74988.53	80.338
LATERAL DRAINAGE COLLECTED FROM LAYER 4	3.25545 (2.41050)	11817.292	12.66023
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.006	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.003 (0.002)		
CHANGE IN WATER STORAGE	-0.044 (0.3480)	-158.65	-0.170

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 5

	(INCHES)	(CU. FT.)
PRECIPITATION	3.84	13939.199
RUNOFF	1.387	5034.9873
DRAINAGE COLLECTED FROM LAYER 4	0.16612	603.01666
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00006
AVERAGE HEAD ON TOP OF LAYER 5	0.059	
MAXIMUM HEAD ON TOP OF LAYER 5	0.116	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	2.9 FEET	
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4071

Page 5

CASEC-2.OUT

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.2210

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

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

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FINAL WATER STORAGE AT END OF YEAR 5

LAYER	(INCHES)	(VOL/VOL)
1	2.6520	0.2210
2	87.5999	0.2920
3	7.7040	0.3210
4	0.0030	0.0100
5	0.0000	0.0000
6	0.1800	0.7500
SNOW WATER	0.000	

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CASE C-3 (10 YR)


STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18
Jose C. Garza, P.E.

CASEC-3.OUT

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**************************************************************************
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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:\HELP3\JDATA\KGVPR10Y.D4
TEMPERATURE DATA FILE:      C:\HELP3\JDATA\KGVTE10Y.D7
SOLAR RADIATION DATA FILE:  C:\HELP3\JDATA\KGVSO10Y.D13
EVAPOTRANSPIRATION DATA:    C:\HELP3\JDATA\KGVEV10Y.D11
SOIL AND DESIGN DATA FILE:  C:\HELP3\JDATA\CASEC-3.D10
OUTPUT DATA FILE:           C:\HELP3\JDATA\CASEC-3.OUT


TIME:  16:55     DATE:   3/28/2017


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

     TITLE:  CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE C-3

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


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


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  13
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4300 VOL/VOL
          FIELD CAPACITY               =      0.3210 VOL/VOL
          WILTING POINT                =      0.2210 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2288 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.330000003000E-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  18
          THICKNESS                    =    960.00   INCHES
```

```
POROSITY                    =      0.6710 VOL/VOL
FIELD CAPACITY              =      0.2920 VOL/VOL
WILTING POINT               =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2920 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

```
                        LAYER  3
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  13
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4300 VOL/VOL
FIELD CAPACITY              =      0.3210 VOL/VOL
WILTING POINT               =      0.2210 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3264 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.330000003000E-04 CM/SEC
```

```
                        LAYER  4
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER  20
THICKNESS                   =      0.30   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0173 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    400.0    FEET
```

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                        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         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      2.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

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

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  17
THICKNESS                   =      0.24   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
```

CASEC-3.OUT

WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	88.40	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.745	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.160	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.652	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	291.085	INCHES
TOTAL INITIAL WATER	=	291.085	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

STATION LATITUDE	=	27.77 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	12.00 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	78.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.63	1.69	1.20	1.57	3.29	3.12
2.26	2.78	5.31	2.92	1.61	1.17

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

CASEC-3.OUT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
56.30	59.30	65.90	73.00	78.10	82.70
84.90	85.00	81.50	74.00	65.00	59.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CORPUS CHRISTI TEXAS
AND STATION LATITUDE = 27.77 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.06	2.35	1.01	1.50	1.80	3.09
	2.20	2.82	5.84	2.94	1.59	1.30
STD. DEVIATIONS	0.59	1.23	0.57	1.13	1.89	2.37
	2.21	1.84	2.64	1.94	1.41	0.78
RUNOFF						
TOTALS	0.004	0.077	0.003	0.077	0.093	0.379
	0.420	0.200	0.838	0.189	0.131	0.005
STD. DEVIATIONS	0.012	0.085	0.005	0.147	0.142	0.379
	0.881	0.181	0.865	0.263	0.328	0.014
EVAPOTRANSPIRATION						
TOTALS	0.837	2.069	1.231	1.216	1.552	1.840
	1.576	1.972	3.815	2.349	1.158	1.220
STD. DEVIATIONS	0.545	0.838	0.630	0.808	1.406	1.199
	1.136	1.234	1.009	1.143	0.939	0.656
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	0.1341	0.0543	0.2213	0.1294	0.0830	0.1827
	0.5066	0.4847	0.4113	0.8904	0.6710	0.3744
STD. DEVIATIONS	0.1048	0.0662	0.2797	0.1439	0.1040	0.2545
	0.5799	0.7149	0.6365	0.7029	0.6512	0.5271
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)

CASEC-3.OUT

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0015	0.0007	0.0025	0.0015	0.0009	0.0021
	0.0058	0.0055	0.0048	0.0101	0.0079	0.0043
STD. DEVIATIONS	0.0012	0.0008	0.0032	0.0017	0.0012	0.0030
	0.0066	0.0081	0.0075	0.0080	0.0077	0.0060

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	27.50 (5.539)	99843.1	100.00
RUNOFF	2.416 (1.3408)	8769.43	8.783
EVAPOTRANSPIRATION	20.836 (3.1022)	75634.62	75.753
LATERAL DRAINAGE COLLECTED FROM LAYER 4	4.14329 (2.03325)	15040.131	15.06376
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.007	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.004 (0.002)		
CHANGE IN WATER STORAGE	0.110 (0.4586)	398.97	0.400

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 10

	(INCHES)	(CU. FT.)
PRECIPITATION	4.96	18004.801
RUNOFF	2.477	8990.2607
DRAINAGE COLLECTED FROM LAYER 4	0.16300	591.69366
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00006
AVERAGE HEAD ON TOP OF LAYER 5	0.058	
MAXIMUM HEAD ON TOP OF LAYER 5	0.115	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	1.1 FEET	
SNOW WATER	0.00	0.0000
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4122	

CASEC-3.OUT

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.2210

*** 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 10

LAYER	(INCHES)	(VOL/VOL)
1	2.9749	0.2479
2	280.3199	0.2920
3	8.7003	0.3625
4	0.0089	0.0297
5	0.0000	0.0000
6	0.1800	0.7500
SNOW WATER	0.000	

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CASE C-4 (5 YR)


STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18
Jose C. Garza, P.E.

CASEC-4.OUT

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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:\HELP3\JDATA\KGVPRE5Y.D4
TEMPERATURE DATA FILE:      C:\HELP3\JDATA\KGVTEM5Y.D7
SOLAR RADIATION DATA FILE:  C:\HELP3\JDATA\KGVSOL5Y.D13
EVAPOTRANSPIRATION DATA:    C:\HELP3\JDATA\KGVEVA5Y.D11
SOIL AND DESIGN DATA FILE:  C:\HELP3\JDATA\CASEC-4.D10
OUTPUT DATA FILE:           C:\HELP3\JDATA\CASEC-4.OUT


TIME:  16:59     DATE:   3/28/2017


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

     TITLE:  CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE C-4

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


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


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  13
          THICKNESS                     =     12.00   INCHES
          POROSITY                      =      0.4300 VOL/VOL
          FIELD CAPACITY                =      0.3210 VOL/VOL
          WILTING POINT                 =      0.2210 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.2288 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.330000003000E-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  18
          THICKNESS                     =   1440.00   INCHES
                                                  Page 1
```

POROSITY	=	0.6710 VOL/VOL
FIELD CAPACITY	=	0.2920 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2920 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 13

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4300 VOL/VOL
FIELD CAPACITY	=	0.3210 VOL/VOL
WILTING POINT	=	0.2210 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3265 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.330000003000E-04 CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20

THICKNESS	=	0.30 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0174 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000 CM/SEC
SLOPE	=	2.00 PERCENT
DRAINAGE LENGTH	=	400.0 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	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.24 INCHES
POROSITY	=	0.7500 VOL/VOL
FIELD CAPACITY	=	0.7470 VOL/VOL

```
WILTING POINT                =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.300000003000E-08 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	88.40	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.745	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.160	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.652	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	431.246	INCHES
TOTAL INITIAL WATER	=	431.246	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

STATION LATITUDE	=	27.77 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	12.00 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	78.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.63	1.69	1.20	1.57	3.29	3.12
2.26	2.78	5.31	2.92	1.61	1.17

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

CASEC-4.OUT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
56.30	59.30	65.90	73.00	78.10	82.70
84.90	85.00	81.50	74.00	65.00	59.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CORPUS CHRISTI TEXAS
AND STATION LATITUDE = 27.77 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	0.95	2.68	1.37	1.91	0.88	2.95
	1.12	3.27	5.24	3.31	0.66	1.38
STD. DEVIATIONS	0.67	1.67	0.39	1.21	0.54	3.03
	0.86	1.72	2.95	2.46	0.35	0.68
RUNOFF						
TOTALS	0.000	0.067	0.006	0.059	0.007	0.320
	0.016	0.162	0.904	0.295	0.000	0.009
STD. DEVIATIONS	0.000	0.074	0.006	0.092	0.011	0.501
	0.025	0.107	1.227	0.351	0.000	0.020
EVAPOTRANSPIRATION						
TOTALS	0.796	2.050	1.690	1.514	1.066	1.962
	1.227	2.222	3.837	2.265	0.678	1.352
STD. DEVIATIONS	0.808	1.153	0.323	0.898	0.820	1.208
	0.918	1.206	1.049	1.361	0.460	0.649
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	0.1181	0.0180	0.3283	0.1848	0.1021	0.0524
	0.4175	0.1174	0.1634	0.7393	0.8220	0.1938
STD. DEVIATIONS	0.0556	0.0167	0.3371	0.1691	0.0935	0.0973
	0.7742	0.1749	0.2064	0.7935	0.9141	0.1539
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)

CASEC-4.OUT

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0013	0.0002	0.0037	0.0022	0.0012	0.0006
	0.0048	0.0013	0.0019	0.0084	0.0097	0.0022
STD. DEVIATIONS	0.0006	0.0002	0.0038	0.0020	0.0011	0.0011
	0.0088	0.0020	0.0024	0.0090	0.0108	0.0018

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	25.71 (6.634)	93341.8	100.00
RUNOFF	1.844 (1.6270)	6694.63	7.172
EVAPOTRANSPIRATION	20.658 (3.2310)	74988.53	80.338
LATERAL DRAINAGE COLLECTED FROM LAYER 4	3.25720 (2.39929)	11823.637	12.66703
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.006	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.003 (0.002)		
CHANGE IN WATER STORAGE	-0.045 (0.3334)	-164.99	-0.177

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 5

	(INCHES)	(CU. FT.)
PRECIPITATION	3.84	13939.199
RUNOFF	1.387	5034.9873
DRAINAGE COLLECTED FROM LAYER 4	0.16310	592.06091
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00006
AVERAGE HEAD ON TOP OF LAYER 5	0.058	
MAXIMUM HEAD ON TOP OF LAYER 5	0.115	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	1.2 FEET	
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4071

Page 5

CASEC-4.OUT

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.2210

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

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

****

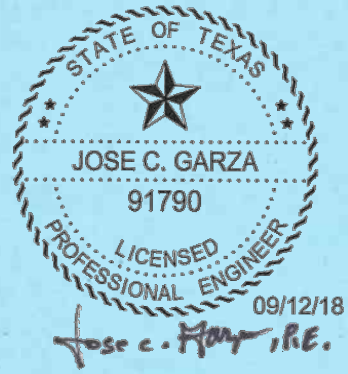
****

FINAL WATER STORAGE AT END OF YEAR 5

LAYER	(INCHES)	(VOL/VOL)
1	2.6520	0.2210
2	420.4799	0.2920
3	7.7040	0.3210
4	0.0030	0.0100
5	0.0000	0.0000
6	0.1800	0.7500
SNOW WATER	0.000	

****
****

CASE C-5 (30 YR)


STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18
Jose C. Garza, P.E.

CASEC-5.OUT

```
**************************************************************************
**************************************************************************
**                                                                      **
**                                                                      **
**            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:\HELP3\JDATA\KGVPR30Y.D4
TEMPERATURE DATA FILE:      C:\HELP3\JDATA\KGVTE30Y.D7
SOLAR RADIATION DATA FILE:  C:\HELP3\JDATA\KGVSO30Y.D13
EVAPOTRANSPIRATION DATA:    C:\HELP3\JDATA\KGVEV30Y.D11
SOIL AND DESIGN DATA FILE:  C:\HELP3\JDATA\CASEC-5.D10
OUTPUT DATA FILE:           C:\HELP3\JDATA\CASEC-5.OUT


TIME:  17: 2     DATE:   3/28/2017


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

     TITLE:  CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE C-5

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


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


                              LAYER  1
                              --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                   MATERIAL TEXTURE NUMBER  13
          THICKNESS                    =     24.00   INCHES
          POROSITY                     =      0.4300 VOL/VOL
          FIELD CAPACITY               =      0.3210 VOL/VOL
          WILTING POINT                =      0.2210 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2734 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.330000003000E-04 CM/SEC
        NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.63
                FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.



                              LAYER  2
                              --------

                TYPE 2 - LATERAL DRAINAGE LAYER
                  MATERIAL TEXTURE NUMBER  20
          THICKNESS                    =      0.20   INCHES
```

```
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    400.0    FEET
```

```
                      LAYER  3
                      --------

           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    =      2.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

```
                      LAYER  4
                      --------

            TYPE 3 - BARRIER SOIL LINER
            MATERIAL TEXTURE NUMBER  17
THICKNESS                   =      0.24   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.300000003000E-08 CM/SEC
```

```
                      LAYER  5
                      --------

         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  13
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4300 VOL/VOL
FIELD CAPACITY              =      0.3210 VOL/VOL
WILTING POINT               =      0.2210 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3210 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.330000003000E-04 CM/SEC
```

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

         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  18
THICKNESS                   =   1440.00   INCHES
POROSITY                    =      0.6710 VOL/VOL
FIELD CAPACITY              =      0.2920 VOL/VOL
```

```
WILTING POINT               =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2920 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                      LAYER  7
                      --------

         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  13
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4300 VOL/VOL
FIELD CAPACITY              =      0.3210 VOL/VOL
WILTING POINT               =      0.2210 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3210 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.330000003000E-04 CM/SEC


                      LAYER  8
                      --------

           TYPE 2 - LATERAL DRAINAGE LAYER
             MATERIAL TEXTURE NUMBER  20
THICKNESS                   =      0.30   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    400.0    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         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      2.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD


                      LAYER 10
                      --------

           TYPE 3 - BARRIER SOIL LINER
             MATERIAL TEXTURE NUMBER  17
THICKNESS                   =      0.24   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
```

EFFECTIVE SAT. HYD. COND. = 0.300000003000E-08 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	84.10	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.709	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.160	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.652	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	438.962	INCHES
TOTAL INITIAL WATER	=	438.962	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

STATION LATITUDE	=	27.77 DEGREES
MAXIMUM LEAF AREA INDEX	=	3.50
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	12.00 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	78.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.63	1.69	1.20	1.57	3.29	3.12
2.26	2.78	5.31	2.92	1.61	1.17

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CORPUS CHRISTI TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

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

CASEC-5.OUT

56.30	59.30	65.90	73.00	78.10	82.70
84.90	85.00	81.50	74.00	65.00	59.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CORPUS CHRISTI TEXAS
AND STATION LATITUDE = 27.77 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.37	1.81	1.19	1.40	2.51	2.59
	2.36	2.86	5.39	2.99	1.49	1.25
STD. DEVIATIONS	0.81	1.21	0.57	1.05	1.80	1.82
	2.23	2.36	2.96	1.90	1.16	0.84
RUNOFF						
TOTALS	0.004	0.013	0.003	0.045	0.163	0.132
	0.327	0.178	0.541	0.151	0.042	0.003
STD. DEVIATIONS	0.015	0.028	0.018	0.170	0.495	0.186
	0.773	0.317	0.810	0.290	0.172	0.015
EVAPOTRANSPIRATION						
TOTALS	1.075	1.761	1.316	1.248	1.928	2.038
	1.735	2.149	3.437	2.385	1.307	1.112
STD. DEVIATIONS	0.678	0.900	0.617	0.800	1.169	1.209
	1.224	1.478	1.216	1.102	0.896	0.697
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.0869	0.2389	0.1096	0.0578	0.2351	0.4082
	0.3721	0.4338	0.9888	0.7897	0.2886	0.0840
STD. DEVIATIONS	0.1570	0.3017	0.1202	0.1586	0.3415	0.5746
	0.6041	0.6776	1.0338	0.8366	0.4085	0.1179
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 10

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

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0010	0.0030	0.0012	0.0007	0.0122	0.0571
	0.0544	0.0687	0.3034	0.1265	0.0208	0.0010
STD. DEVIATIONS	0.0018	0.0038	0.0014	0.0019	0.0341	0.1882
	0.2276	0.1888	0.6781	0.2805	0.0868	0.0013

DAILY AVERAGE HEAD ON TOP OF LAYER 9

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

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	27.20 (5.704)	98722.7	100.00
RUNOFF	1.603 (1.1727)	5817.88	5.893
EVAPOTRANSPIRATION	21.493 (3.7274)	78019.59	79.029
LATERAL DRAINAGE COLLECTED FROM LAYER 2	4.09366 (2.12562)	14859.999	15.05226
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00002 (0.00002)	0.064	0.00007
AVERAGE HEAD ON TOP OF LAYER 3	0.054 (0.079)		
LATERAL DRAINAGE COLLECTED FROM LAYER 8	0.00002 (0.00002)	0.062	0.00006
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000 (0.00000)	0.003	0.00000
AVERAGE HEAD ON TOP OF LAYER 9	0.000 (0.000)		
CHANGE IN WATER STORAGE	0.007 (0.4310)	25.17	0.025

CASEC-5.OUT

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.07	18404.102
RUNOFF	2.585	9382.0957
DRAINAGE COLLECTED FROM LAYER 2	0.56863	2064.11230
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000022	0.07855
AVERAGE HEAD ON TOP OF LAYER 3	21.972	
MAXIMUM HEAD ON TOP OF LAYER 3	28.936	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	137.2 FEET	
DRAINAGE COLLECTED FROM LAYER 8	0.00004	0.15089
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	0.000	
LOCATION OF MAXIMUM HEAD IN LAYER 8 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.02	73.7433

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4300
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.2210

*** 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 30

LAYER	(INCHES)	(VOL/VOL)
1	6.7694	0.2821

CASEC-5.OUT

2	0.0020	0.0100
3	0.0000	0.0000
4	0.1800	0.7500
5	3.8520	0.3210
6	420.4799	0.2920
7	7.7040	0.3210
8	0.0030	0.0100
9	0.0000	0.0000
10	0.1800	0.7500
SNOW WATER	0.000	

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APPENDIX B

HYDRAULIC CALCULATIONS

JOB NO. 8514-3 **HANSON PROFESSIONAL SERVICES INC.** SHEET NO. 1
DESCRIPTION: SAMPLE CALCULATIONS – City of Kingsville Landfill DATE: 08/13/2018
Leachate Collection System - Hydrologic

OBJECTIVES:

- Compute the design leachate flow rates/volumes for the leachate collection facilities.
- Compute the maximum depth of leachate in the collection system.
- Compute the size of the sump pump and the storage time in the sump.
- Compute the capacity required for the facility's leachate evaporation pond.

I. OBJECTIVE: Compute the design leachate flow rates/volumes for the various leachate collection facilities.

A. Approach:

1. Calculations are shown for one acre disposal area.
2. Review the leachate generation rates computed using the HELP model to determine the largest, to use in the design of the leachate system hydraulics.
3. Multiply the selected leachate generation rate by the required safety factor to compute the design flow rates.
4. Review the leachate generation rates computed using the HELP model to determine the long term average, to use in the design of the leachate evaporation pond.

B. Assumptions: The rainfall data used to run the HELP model (Kingsville, Texas) is applicable to this site.

C. Calculations:

1. The output from the HELP models indicate that the Peak Daily generation rate is 622 cubic feet (ft^3).

   Q = 622 ft^3/day-acre x 1 day/24 hrs. x 1 hr./60 min x 1 min/60 sec
   = **0.007 ft^3/sec-acre**

2. Multiply the selected leachate generation rates by the required safety factor to compute the design flow rates.

   As required by the TNRCC Leachate Collection System Handbook, the design flow rates must be increased by fifty percent (50%).

   Q = 0.007 ft^3/sec-acre x 1.5 = **0.01080 ft^3/sec-acre**

JOB NO. 8514-3 **HANSON PROFESSIONAL SERVICES INC.** SHEET NO. 2
DESCRIPTION: SAMPLE CALCULATIONS – City of Kingsville Landfill DATE: 08/13/2018
Leachate Collection System - Hydrologic

3. Review the leachate generation rates computed using the HELP model to determine the long term average, to use in the design of the leachate evaporation pond.

   The output from the HELP models indicates that the Annual Average generation rate is 16,880 ft^3 on a per acre basis. This equates to a daily volume of:

Volume = 16,880 ft^3/year-acre x 1 year/365 days = 46.25 ft^3/day-acre

Volume = 46.25 ft^3/day-acre x 7.48 gallons/ft^3 = 345.92 gallons/day-acre

Volume = 345.92 gallons/day-acre x 82 Acres = 28,365.80 gallons/day;
Use 28,366 gallons/day

II. OBJECTIVE: Compute the maximum depth of leachate in the collection system.

A. Approach: Compute the depth using the equation from the TNRCC Leachate Collection System Handbook (page 13).

B. Assumptions:

1. Dimensions are taken from the facility construction drawings.
2. HDPE drainage net is used for the leachate collection system and has a minimum transmissivity of 8.0 x 10^{-3} m^2/sec (t_{ult}) and a compressed thickness of 287 mils. However, transmissivity (t_{ult}) is reduced to 7.4 x 10^{-4} (t) due to reduction factors as follows:

   $t = t_{ult}$ [(1/RFcr x RFin x RFcc x RFbc x RFcb)]; where
   RFcr = 1.5; creep reduction factor
   RFin = 1; intrusion reduction factor
   RFcc = 1.2; chemical clogging reduction factor
   RFbc = 1.5; biological clogging reduction factor
   RFcb = 4; soil clogging reduction factor

C. Calculations: The equation is as follows:

$$\mathbf{T_{max}} = L * \frac{[4\left(\frac{e}{k}\right) + \tan^2 B]^{1/2} - \tan B}{2 \cos B}$$

Where, $\mathbf{T_{max}}$ = Thickness of leachate in the collection layer (meters[m])
L = Length of horizontal projection of leachate layer (m)
e = Impingement rate (m/sec)
k = Hydraulic conductivity of drainage layer (m/sec)

JOB NO. 8514-3 **HANSON PROFESSIONAL SERVICES INC.** SHEET NO. 3
DESCRIPTION: SAMPLE CALCULATIONS – City of Kingsville Landfill DATE: 08/13/2018
Leachate Collection System - Hydrologic

B = Slope angle of the base of leachate collection layer (degrees)

Compute L in m: L = 500 ft. x 0.3049 m/ft.=152.5 m

Compute e in m/sec:

e = [(0.01080 ft^3/sec-acre)/(1 acre/43,560 ft^2)] x 0.3049 m/ft. = 7.55 x 10^{-8} m/sec

Compute k in m/sec:

k = t/T

Where, T = Thickness of leachate collection layer (meters[m])
t = Transmissivity of the leachate collection layer (m^2/sec)

T = 287 mils x 1 in/1,000 mils x 2.54 cm/in x 1 m/100 cm =0.00729 m

k = 7.4 x 10^{-4} m^2/sec x 1/0.00729 m = 0.102 m/sec

Compute slope in degrees: tan B = 2 ft./100 ft. = 0.02
B = arctan (0.02) = 1.146°

$$\mathbf{T_{max}} = L * \frac{[4\left(\frac{e}{k}\right) + \tan^2 B]^{1/2} - \tan B}{2 \cos B}$$

= 0.00566 m x 1 ft./0.3049 m = 0.01856 ft. x 12 in/ft.

= **0.2227 in = 222.7 mils**

III. OBJECTIVE:

A. Approach:

1. Compute the sump pump size using the design flow rate.
2. Compute the sump pump time using design flow rate.

B. Assumptions:

1. Dimensions are taken from the facility construction drawings.
2. The sump is two (2) foot deep, thirty-four (34) feet square at the top, twenty-two (22) feet at the bottom with 3:1 side slopes; sized based on average yearly volume of leachate.
3. A sump pump is placed into the collection header and is turned on by a level control in the sump.

JOB NO. 8514-3 **HANSON PROFESSIONAL SERVICES INC.** SHEET NO. 4
DESCRIPTION: SAMPLE CALCULATIONS – City of Kingsville Landfill DATE: 08/13/2018
Leachate Collection System - Hydrologic

C. Calculations:

Q = 0.01080 ft^3/sec –acre x 60 sec/min x 7.48 gal/ft^3 = 4.847 gal/min-acre;
Q = 4.847 gal/min-acre x 19 acre = 92.08 gal/min
Q = 0.01080 ft^3/sec –acre x 19 acre = 0.2052 ft^3/sec

Time = 478 ft^3 (sump volume) x 1 sec/0.2052 ft^3 x 1 min/60 sec = 38.82 min
Time = 0.65 hrs.
Time = 0.027 days

IV. OBJECTIVE: Compute the capacity required for the facility's leachate evaporation pond.

A. Approach: Compute the onsite leachate evaporation pond capacity using the design flow rate.

B. Assumptions:

1. None of the leachate is re-circulated back onto the working face of the landfill.
2. The landfill leachate will be pumped directly into an onsite leachate evaporation pond.

C. Calculations:

V = 28,366 gal/day x 7 days = **198,562 gallons**
V = 28,366 gal/day x 14 days = **397,124 gallons**
V = 28,366 gal/day x 21 days = **595,686 gallons**
V = 28,366 gal/day x 28 days = **794,248 gallons**
V = 28,366 gal/day x 30 days = **850,980 gallons**

CITY OF KINGSVILLE MUNICIPAL SOLID WASTE LANDFILL
HELP MODEL RESULTS

CASE	AVERAGE YEARLY (C.F.)	Peak Daily (In.)	PEAK DAILY (C.F.)	MAX HEAD ON LAYER (IN.)
1. CASE A-1 (1 YR)	16,880	0.171	622	0.150
2. CASE A-2 (5 YR)	11,818	0.162	590	0.143
3. CASE A-3 (10 YR)	15040	0.160	580	0.139
4. CASE A-4 (5 YR)	11,825	0.154	560	0.135
5. CASE A-5 (30 YR)	0.078	0.000	0.1701	0.013
6. CASE B-1 (1 YR)	16,586	0.169	613	0.045
7. CASE B-2 (5 YR)	9,704	0.163	593	0.043
8. CASE B-3 (10 YR)	12,031	0.165	598	0.043
9. CASE B-4 (5 YR)	9,708	0.156	568	0.041
10. CASE B-5 (30 YR)	0.008	0.000	0.00021	0.005
11. CASE C-1 (1 YR)	16,880	0.173	629	0.121
12. CASE C-2 (5 YR)	11,817	0.166	603	0.116
13. CASE C-3 (10 YR)	15,040	0.163	592	0.115
14. CASE C-4 (5 YR)	11,824	0.163	592	0.115
15. CASE C-5 (30 YR)	0.062	0.000	0.151	0.000

Appendix B Hydraulic Calculations

1. Objective: Compute the design leachate flow rates/volumes for the various leachate collection facilities.

	Q=	0.007	ft^3/sec
FOS 50%	Q=	0.01080	ft^3/sec
34'x34'x2' (3:1)	sump vol	478	ft^3 (Refer to Leachate Collection System Design)
Annual Average	Volume	3,792.22	ft^3/day (for 82 acres)
Annual Average	Volume	28,365.80	gallons/day
Annual Average	Use	28,366	gallons/day

2. Objective: Compute the maximum depth of leachate in the collection system.

$$T_{max} = L \frac{[4(e/k) + \tan^2 B]^{1/2} - \tan B}{2 \cos B}$$

where,

T_{max}= Thickness of leachate in the collection layer (meters (m))
L= Length of horizontal projection of leachate layer (m)
e= impingement rate (m/sec)
k= hydraulic conductivity of drainage layer (m/sec)
B= Slope angle of the base of leachate collection layer (degrees)

L=500 ft	L=	152.45	m	
use surface area	(1 ac.) e=	7.56E-08	m/sec	
compressed thickness of 287 mils	T=	0.00729	m	Use GSE HyperNet Geonet (300 mil)
8.0×10^{-3} m^2/sec transmissivity	t=	0.0007407	m^2/sec	Use t = t allow = 0.008 x [(1/1.5x1x1.2x1.5x4)]
k=t/T	k=	0.102	m/sec	t allow = t ult [(1/RFcr x Rfin x RFcc x RFbc x RFcb)]
				RFcr=Creep Reduction Factor=1.5
	tan B=	0.0200027		RFin= Intrusion Reduction Factor=1
	B=arctan(0.02)	1.146	deg	RFcc=Chemical Clogging Reduction Factor=1.2
	T_{max}=	0.0056595	m	RFbc=Biological Clogging Reduction Factor=1.5
		0.01856	ft	RFcb=Soil Clogging Reduction Factor=4
		0.2227	in	
		222.7	mils	

3. Objective: Compute the size of the sump pump and the storage.

For 19 Acres	A=	19	ac
Sump Pump Size	Q=	92.08	gpm
Sump Time	Time=	39	min
		0.65	hrs
		0.03	days

4.Objective: Compute the capacity required for the facility's leachate storage pond.

Annual Average	Volume=	28,366	gal/day
7	days	198,562	gal
14	days	397,124	gal
21	days	595,686	gal
28	days	794,248	gal
30	days	850,980	gal

CITY OF KINGSVILLE MUNICIPAL SOLID WASTE LANDFILL
HELP MODEL RESULTS

CASE	AVERAGE YEARLY (C.F.)	Peak Daily (In.)	PEAK DAILY (C.F.)	MAX HEAD ON LAYER (IN.)
1. CASE A-1 (1 YR)	16,880	0.171	622	0.150
2. CASE A-2 (5 YR)	11,818	0.162	590	0.143
3. CASE A-3 (10 YR)	15040	0.160	580	0.139
4. CASE A-4 (5 YR)	11,825	0.154	560	0.135
5. CASE A-5 (30 YR)	0.078	0.000	0.1701	0.013
6. CASE B-1 (1 YR)	16,586	0.169	613	0.045
7. CASE B-2 (5 YR)	9,704	0.163	593	0.043
8. CASE B-3 (10 YR)	12,031	0.165	598	0.043
9. CASE B-4 (5 YR)	9,708	0.156	568	0.041
10. CASE B-5 (30 YR)	0.008	0.000	0.00021	0.005
11. CASE C-1 (1 YR)	16,880	0.173	629	0.121
12. CASE C-2 (5 YR)	11,817	0.166	603	0.116
13. CASE C-3 (10 YR)	15,040	0.163	592	0.115
14. CASE C-4 (5 YR)	11,824	0.163	592	0.115
15. CASE C-5 (30 YR)	0.062	0.000	0.151	0.000

Appendix B Hydraulic Calculations

1. Objective: Compute the design leachate flow rates/volumes for the various leachate collection facilities.

	Q=	0.007	ft^3/sec
FOS 50%	Q=	0.01064	ft^3/sec
34'x34'x2' (3:1)	sump vol	478	ft^3 (Refer to Leachate Collection System Design)
Annual Average	Volume	3,726.17	ft^3/day (for 82 acres)
Annual Average	Volume	27,871.75	gallons/day
Annual Average	Use	27,872	gallons/day

2. Objective: Compute the maximum depth of leachate in the collection system.

$$T_{max} = L \frac{[4(e/k) + \tan^2 B]^{1/2} - \tan B}{2 \cos B}$$

where,

T_{max}= Thickness of leachate in the collection layer (meters (m))
L= Length of horizontal projection of leachate layer (m)
e= impingement rate (m/sec)
k= hydraulic conductivity of drainage layer (m/sec)
B= Slope angle of the base of leachate collection layer (degrees)

L=150 ft	L=	45.735	m	
use surface area	(1 ac.) e=	7.45E-08	m/sec	
compressed thickness of 187 mils	T=	0.00475	m	Use GSE HyperNet Geonet (200 mil)
2.0×10^{-3} m^2/sec transmissivity	t=	0.0001852	m^2/sec	Use t = t allow = 0.002 x [(1/1.5*1*1.2*1.5*4)]
k=t/T	k=	0.039	m/sec	t allow = t ult [(1/RFcr x Rfin x RFcc x RFbc*RFcb)]
				RFcr=Creep Reduction Factor=1.5
	tan B=	0.0200027		RFin= Intrusion Reduction Factor=1
	B=arctan(0.02)	1.146	deg	RFcc=Chemical Clogging Reduction Factor=1.2
	T_{max}=	0.0043485	m	RFbc=Biological Clogging Reduction Factor=1.5
		0.01426	ft	RFcb=Soil Clogging Reduction Factor=4
		0.1711	in	
		171.1	mils	

3. Objective: Compute the size of the sump pump and the storage.

For 4.7 Acres	A=	4.7	ac
Sump Pump Size	Q=	22.45	gpm
Sump Time	Time=	39	min
		0.66	hrs
		0.03	days

4.Objective: Compute the capacity required for the facility's leachate storage pond.

Annual Average	Volume=	27,872	gal/day
7	days	195,102	gal
14	days	390,205	gal
21	days	585,307	gal
28	days	780,409	gal
30	days	836,153	gal

CITY OF KINGSVILLE MUNICIPAL SOLID WASTE LANDFILL
HELP MODEL RESULTS

CASE	AVERAGE YEARLY (C.F.)	Peak Daily (In.)	PEAK DAILY (C.F.)	MAX HEAD ON LAYER (IN.)
1. CASE A-1 (1 YR)	16,880	0.171	622	0.150
2. CASE A-2 (5 YR)	11,818	0.162	590	0.143
3. CASE A-3 (10 YR)	15040	0.160	580	0.139
4. CASE A-4 (5 YR)	11,825	0.154	560	0.135
5. CASE A-5 (30 YR)	0.078	0.000	0.1701	0.013
6. CASE B-1 (1 YR)	16,586	0.169	613	0.045
7. CASE B-2 (5 YR)	9,704	0.163	593	0.043
8. CASE B-3 (10 YR)	12,031	0.165	598	0.043
9. CASE B-4 (5 YR)	9,708	0.156	568	0.041
10. CASE B-5 (30 YR)	0.008	0.000	0.00021	0.005
11. CASE C-1 (1 YR)	16,880	0.173	629	0.121
12. CASE C-2 (5 YR)	11,817	0.166	603	0.116
13. CASE C-3 (10 YR)	15,040	0.163	592	0.115
14. CASE C-4 (5 YR)	11,824	0.163	592	0.115
15. CASE C-5 (30 YR)	0.062	0.000	0.151	0.000

Appendix B Hydraulic Calculations

1. Objective: Compute the design leachate flow rates/volumes for the various leachate collection facilities.

	Q=	0.007	ft^3/sec
FOS 50%	Q=	0.01092	ft^3/sec
34'x34'x2' (3:1)	sump vol	478	ft^3 (Refer to Leachate Collection System Design)
Annual Average	Volume	3,792.22	ft^3/day (for 82 acres)
Annual Average	Volume	28,365.80	gallons/day
Annual Average	Use	28,366	gallons/day

2. Objective: Compute the maximum depth of leachate in the collection system.

$$T_{max} = L \frac{[4(e/k) + \tan^2 B]^{1/2} - \tan B}{2 \cos B}$$

where,

T_{max}= Thickness of leachate in the collection layer (meters (m))
L= Length of horizontal projection of leachate layer (m)
e= impingement rate (m/sec)
k= hydraulic conductivity of drainage layer (m/sec)
B= Slope angle of the base of leachate collection layer (degrees)

L=400 ft	L=	121.96	m	
use surface area	(1 ac.) e=	7.64E-08	m/sec	
compressed thickness of 287 mils	T=	0.00729	m	Use GSE HyperNet Geonet (300 mil)
8.0×10^{-3} m^2/sec transmissivity	t=	0.0007407	m^2/sec	Use t = t allow = 0.008 x [(1/1.5*1*1.2*1.5*4)]
k=t/T	k=	0.102	m/sec	t allow = t ult [(1/RFcr x Rfin x RFcc x RFbc*RFcb)]
				RFcr=Creep Reduction Factor=1.5
	tan B=	0.0200027		RFin= Intrusion Reduction Factor=1
	B=arctan(0.02)	1.146	deg	RFcc=Chemical Clogging Reduction Factor=1.2
	T_{max}=	0.0045785	m	RFbc=Biological Clogging Reduction Factor=1.5
		0.01502	ft	RFcb=Soil Clogging Reduction Factor=4
		0.1802	in	
		180.2	mils	

3. Objective: Compute the size of the sump pump and the storage.

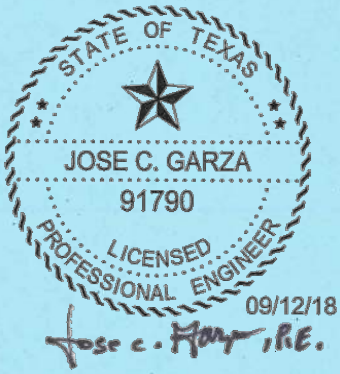
For 13.5 Acres	A=	13.5	ac
Sump Pump Size	Q=	66.16	gpm
Sump Time	Time=	54	min
		0.90	hrs
		0.04	days

4.Objective: Compute the capacity required for the facility's leachate storage pond.

Annual Average	Volume=	28,366	gal/day
7	days	198,562	gal
14	days	397,124	gal
21	days	595,686	gal
28	days	794,248	gal
30	days	850,980	gal

APPENDIX C

LEACHATE COLLECTION SYSTEM STRUCTURAL CALCULATIONS



JOB NO. 8514-3 **HANSON PROFESSIONAL SERVICES INC.** SHEET NO. 1
DESCRIPTION: CALCULATIONS – City of Kingsville Landfill DATE: 08/14/2018
Leachate Collection System – Pipe Structural

I. OBJECTIVE: Check the structural capacity of the leachate collector pipe.

II. APPROACH:

A. Review the dimensions of the pipe from manufacturer's literature.

B. Compute the worst case loading condition assuming three cases:

Case 1: 168 ft. of overburden (waste fill) with compactor (Bomag 572RB-2).
Case 2: 5 ft. of overburden (waste fill) with compactor (Bomag 572RB-2).
Case 3: 2 ft. of overburden (protective cover) and AASHTO HS20 point load.

C. Compute the Factor of Safety for wall crushing.

D. Compute the Factor of Safety for wall buckling.

E. Compute the Factor of Safety for excessive ring deflection.

III. ASSUMPTIONS:

A. The ultimate height of the fill will be 168 feet. Assume that the waste fill has a unit weight of 60 lbs. per cubic foot (ft^3).

B. Onsite compactor loading (63,052 lbs.) is split into 2 (31,195 lb. front axle load and 31, 857 lbs. rear axle load. Assume the rear axle is imposed on top of 5 ft. of waste fill (60 lbs. per cubic foot (ft^3)) after the protective cover has been placed.

C. AASHTO H20 loading (32,000 lbs. axle load) is split into 2 - 16,000 lb. point loads. Assume 1 is imposed on top of pipe, after protective soil cover has been placed. Assume protective soil cover has a unit weight of 120 lbs. per cubic foot ($ft^{3).}$

D. Smooth wall HDPE pipe is used. Calculations will be made for nominal 6", 8", 10" pipe, and 18" pipe. A Standard Dimension Ratio (SDR) of 17 will be used (100 psi = 14,400 lbs./ft^2).

E. Assume E' (modulus of soil reaction) is 3,000 psi. Soil type bedding material A (Unified Classification System) in pipe envelope on floor.

F. Maximum average unit weight of protective cover soil is 120 lbs./ft^3.

G. Minimum acceptable Factor of Safety is 2.0.

JOB NO. 8514-3 **HANSON PROFESSIONAL SERVICES INC.** SHEET NO. 2
DESCRIPTION: CALCULATIONS – City of Kingsville Landfill DATE: 08/14/2018
Leachate Collection System – Pipe Structural

IV. CALCULATIONS

A. Review the dimensions of the pipe from manufacturer's literature.

In accordance with the attached chart, the appropriate dimensions are shown below:

Nominal	Outside Diameter	Inside Diameter	Wall Thickness
6”	6.625”	5.799”	0.390”
8”	8.625”	7.549”	0.507”
10”	10.750”	9.409”	0.632”
18”	18.000”	15.755”	1.059”

B. Compute the worst case loading condition assuming ultimate fill height, and AASHTO H20 point load on top of pipe. The equation describing the loading on the pipe is:

$$\sigma = \gamma * D + C\,[(P * F)/(L * B)]$$

Where,
- σ Stress on pipe (lbs./ft^2)
- γ Unit weight of overburden (lbs./ft^3)
- D Height of fill (ft.)
- C Load Coefficient (from ASCE)
- P Point Load (lbs.)
- F Impact Factor (from ASCE)
- L Effective Length (ft.) (arbitrarily defined as 3ft)
- B Outside diameter of pipe

The load coefficient is based on the following relationships B/(2D) and L/(2D).

Case 1 - 168 feet of waste fill.

6”
B/(2D) = (6.625/12)/(2*168) =0.0016
L/(2D) = 3/(2*168) = 0.0089
From Table: C < 0.019

8”
B/(2D) = (8.625/12)/(2*168) = 0.0021
L/(2D) = 3/(2*168) = 0.0089
From Table: C < 0.019

10”
B/(2D) = (10.75/12)/(2*168) =0.0027
L/(2D) = 3/(2*168) = 0.0089
From Table: C < 0.019

18”
B/(2D) = (18.00/12)/(2*168) = 0.0045
L/(2D) = 3/(2*168) = 0.0089
From Table: C < 0.019 (LCS Handbook)

JOB NO. 8514-3 **HANSON PROFESSIONAL SERVICES INC.** SHEET NO. 3
DESCRIPTION: CALCULATIONS – City of Kingsville Landfill DATE: 08/14/2018
Leachate Collection System – Pipe Structural

For 6" $\sigma = 60 * 168 + 0.019[(31{,}857 * 1.5)/(3 * \{6.625/12\})] = 10{,}628$ lbs./ft^2
For 8" $\sigma = 60 * 168 + 0.019[(31{,}857 * 1.5)/(3 * \{8.625/12\})] = 10{,}501$ lbs./ft^2
For 10" $\sigma = 60 * 168 + 0.019[(31{,}857 * 1.5)/(3 * \{10.75/12\})] = 10{,}418$ lbs./ft^2
For 18" $\sigma = 60 * 168 + 0.019[(31{,}857 * 1.5)/(3 * \{18.00/12\})] = 10{,}282$ lbs./ft^2

Case 2 - 5 feet of waste fill.

6"
B/(2D) = (6.625/12)/(2*5) =0.055
L/(2D) = 3/(2*5) = 0.30
From Table: C < 0.053

8"
B/(2D) = (8.625/12)/(2*5) = 0.07
L/(2D) = 3/(2*5) = 0.3
From Table: C < 0.053

10"
B/(2D) = (10.75/12)/(2*5) =0.090
L/(2D) = 3/(2*5) = 0.30
From Table: C < 0.053

18"
B/(2D) = (18.00/12)/(2*5) = 0.150
L/(2D) = 3/(2*5) = 0.30
From Table: C < 0.078 (LCS Handbook)

For 6" $\sigma = 60 * 5 + 0.053[(31{,}857 * 1.5)/(3 * \{6.625/12\})] = 1{,}829$ lbs./ft^2
For 8" $\sigma = 60 * 5 + 0.053[(31{,}857 * 1.5)/(3 * \{8.625/12\})] = 1{,}475$ lbs./ft^2
For 10" $\sigma = 60 * 5 + 0.053[(31{,}857 * 1.5)/(3 * \{10.75/12\})] = 1{,}242$ lbs./ft^2
For 18" $\sigma = 60 * 5 + 0.078[(31{,}857 * 1.5)/(3 * \{18.00/12\})] = 1{,}128$ lbs./ft^2

Case 3 – 16,000 lb. load with 2 foot of protective cover.

6"
B/(2D) = (6.625/12)/(2*2) = 0.138
L/(2D) = 3/(2*2) = 0.75
From Table: C = 0.147

8"
B/(2D) = (8.625/12)/(2*2) = 0.180
L/(2D) = 3/(2*2) = 0.75
From Table: C = 0.185

10"
B/(2D) = (10.75/12)/(2*2) = 0.224
L/(2D) = 3/(2*2) = 0.75
From Table: C = 0.217

18"
B/(2D) = (18.00/12)/(2*2) = 0..375
L/(2D) = 3/(2*2) = 0.75
From Table: C = 0.35 (LCS Handbook)

For 6" $\sigma = 120 * 2 + 0.147[(16{,}000 * 1.5)/(3 * \{6.625/12\})] = 2{,}370$ lbs./ft^2
For 8" $\sigma = 120 * 2 + 0.185[(16{,}000 * 1.5)/(3 * \{8.625/12\})] = 2{,}259$ lbs./ft^2
For 10" $\sigma = 120 * 2 + 0.217[(16{,}000 * 1.5)/(3 * \{10.75/12\})] = 2{,}238$ lbs./ft^2
For 18" $\sigma = 120 * 2 + 0.35[(16{,}000 * 1.5)/(3 * \{18.00/12\})] = 2{,}167$ lbs./ft^2

Worst case loading condition for 6" is **10,628 lb./ft^2**
Worst case loading condition for 8" is **10,501 lb./ft^2**
Worst case loading condition for 10" is **10,418 lb./ft^2**
Worst case loading condition for 18" is **10,282 lb./ft^2**

JOB NO. 8514-3 **HANSON PROFESSIONAL SERVICES INC.** SHEET NO. 4
DESCRIPTION: CALCULATIONS – City of Kingsville Landfill DATE: 08/14/2018
Leachate Collection System – Pipe Structural

C. Compute the Factor of Safety for wall crushing.

$$FS = \frac{2\sigma_{pipe}}{(SDR-1)\sigma_{max}}$$

6" FS = (2 * 1600 * 12^2)/([17-1] * 10,628) = 2.71
8" FS = (2 * 1600 * 12^2)/([17-1] * 10,501) = 2.74
10" FS = (2 * 1600 * 12^2)/([17-1] * 10,418) = 2.76
18" FS = (2 * 1600 * 12^2)/([17-1] * 10,282) = 2.80

D. Compute the Factor of Safety for pipe wall buckling.

$$FS = (1.2/\sigma_{max}) * ([E' * E]/SDR^3)^{1/2}$$

6" FS = (1.2/[10,628/144]) * (3,000*130,000/17^3)$^{1/2}$ = 3.24
8" FS = (1.2/[10,501/144]) * (3,000*130,000/17^3)$^{1/2}$ = 3.28
10" FS = (1.2/[10,418/144]) * (3,000*130,000/17^3)$^{1/2}$ = 3.30
18" FS = (1.2/[10,282/144]) * (3,000*130,000/17^3)$^{1/2}$ = 3.35

E. Compute the Factor of Safety for excessive ring deflection.

$$FS = \frac{dE'}{100\sigma_{max}}$$

6" FS = (5*3,000)/(100 * [10,628/144]) = 2.03
8" FS = (5*3,000)/(100 * [10,501/144]) = 2.06
10" FS = (5*3,000)/(100 * [10,418/144]) = 2.07
18" FS = (5*3,000)/(100 * [10,282/144]) = 2.10

6" 8", 10", or 18" smooth walled HDPE pipe, with minimum SDR of 17, is acceptable for this installation.

SDR 17

Appendix C
Leachate Collection System Structural Calculations

1. Objective: Check the structural capacity of the leachate collector pipe.

II. Approach:

A. Review the dimensions of the pipe from manufacturer's literature.
B. Compute the worst case loading condition assuming three cases.
Case 1: 168 ft of overburden (waste fill) with Bomag 572RB-2
Case 2: 5 ft of overburden (waste fill); Use Υ=60 lbs/ft^3
Case 3: 2 ft of overburden; use Υ=120 lbs/ft^3 for protective cover; use AASHTO HS20 load
C. Compute Factor of Safety for wall crushing.
D. Compute the Factor of Safety for pipe wall buckling.
E. Compute the Factor of Safety for excessive ring deflection.

III. Assumptions:

A. The ultimate height of the fill will be 168 feet. Assume that the fill has a unit weight of 60 lbs per cubic foot (ft^3).
B. Onsite compactor loading (63,052 lbs) is split into 2 (31,195 lb. front axle load and 31,857 lbs. rear axle load. Assume rear axle is imposed on top of 5 ft. of waste fill (60 lbs./ft^3) after protective soil has been placed.
C. HS20 truck loading (32,000 lbs/axle); split into 2 (16,000 lbs for wheel load).
D. Smooth wall HDPE pipe is used. Calculations will be made for nominal 6", 8", 10", & 18" pipe. A Standard Dimension Ratio (SDR) of 17 will be used.
E. Assume E' (modulus of soil reaction) is 3,000 psi. Soil type bedding material A (Unified Classification System) in pipe envelope on floor.
F. Maximum average unit weight of protective cover soil is 120 lbs/ft^3.
G. Minimum acceptable Factor of Safety is 2.0.

IV. Calculations:

A. Review the dimensions of the pipe from manufacturer's literature.

In accordance with the attached chart, the appropriate dimensions are shown below:

Nominal	ActualOutside Diameter	Avg.Inside Diameter	Min. Wall Thickness
6"	6.625 "	5.799 "	0.390 "
8"	8.625	7.549 "	0.507 "
10"	10.750 "	9.409 "	0.632 "
18"	18.000 "	15.755 "	1.059 "

B. Compute the Worst Case loading condition assuming three overburden and point load load cases on top of pipe. The equation describing the loading on the pipe is:

$\sigma = \Upsilon D + C [(P*F)/(L*B)]$

where	Case 1	Case 2	Case 3
σ Stress on pipe (lbs/ft^2)			
Υ Unit weight of overburden (lbs/ft^3)	60	60	120
D Height of fill or cover (ft)	168	5	2

C Load Coefficient (from ASCE)	0.019	varies	varies
P Point Load (lbs)	31,857	31,857	16,000
F Impact Factor (dynamic-from ASCE)	1.5	1.5	1.5
L Effective Length (ft)	3	3	3
B Outside diameter of pipe			

The load coefficient is based on the following relationships B/(2D) and L/(2D).

Case 1-168 feet of waste fill
USE 60 lb/ft^3 overburden (waste)

	6"	8"	10"	18"
B/(2D)=	0.0016	0.0021	0.0027	0.0045
L/(2D)=	0.0089	0.0089	0.0089	0.0089
from Table A: C=	0.019	0.019	0.019	0.019

Page 16 (LCS Handbook)
σ= YD + C [(P*F)/(L*B)]

For 6"	σ=	10,628	lbs/ft^2
For 8"	σ=	10,501	lbs/ft^2
For 10"	σ=	10,418	lbs/ft^2
For 18"	σ=	10,282	lbs/ft^2

Case 2-31,857 lb load (Bomag 572RB-2) with 5 foot of waste fill
USE 60 lb/ft^3 overburden (waste)

	6"	8"	10"	18"
B/(2D)=	0.055	0.07	0.090	0.150
L/(2D)=	0.30	0.30	0.30	0.30
from Table A: C=	0.053	0.053	0.053	0.078

Page 16 (LCS Handbook)
σ= YD + C [(P*F)/(L*B)]

For 6"	σ=	1829	lbs/ft^2
For 8"	σ=	1475	lbs/ft^2
For 10"	σ=	1242	lbs/ft^2
For 18"	σ=	1128	lbs/ft^2

Case 3-16,000 lb load (HS20 Wheel Load) with 2 foot of protective cover
USE 120 lb/ft^3 overburden (protective cover)

	6"	8"	10"	18"
B/(2D)=	0.138	0.180	0.224	0.375
L/(2D)=	0.75	0.75	0.75	0.75
from Table A: C=	0.147	0.185	0.217	0.35

Page 16 (LCS Handbook)
σ= YD + C [(P*F)/(L*B)]

For 6"	σ=	2370	lbs/ft^2
For 8"	σ=	2359	lbs/ft^2
For 10"	σ=	2238	lbs/ft^2
For 18"	σ=	2167	lbs/ft^2

Worst case loading condition for 6" is	**10,628**	**lbs/ft^2**
Worst case loading condition for 8" is	**10,501**	**lbs/ft^3**
Worst case loading condition for 10" is	**10,418**	**lbs/ft^4**
Worst case loading condition for 18" is	**10,282**	**lbs/ft^5**

C. Compute the Factor of Safety for wall crushing.

$FS=2\sigma_{pipe}/(SDR-1)\sigma_{max}$ Yield Strength= 1600 psi

6"	FS=	2.71
8"	FS=	2.74
10"	FS=	2.76
18"	FS=	2.80

D. Compute the Factor of Safety for pipe wall buckling.

$FS=(1.2/\sigma_{max})*((E'*E)/SDR^3)^{1/2}$

E'=	1,500	psi-modulus of soil reaction for pipe bedding
E=	130,000	psi-modulus of elasticity of pipe material

6"	FS=	3.24
8"	FS=	3.28
10"	FS=	3.30
18"	FS=	3.35

E. Compute the Factor of Safety for excessive ring deflection.

$FS=dE'/100\sigma_{max}$

E'=	3,000	modulus of soil reaction for pipe bedding
d=	5	% allowable ring deflection in percent

6"	FS=	2.03
8"	FS=	2.06
10"	FS=	2.07
18"	FS=	2.10

6", 8", 10", 18" smooth walled HDPE pipe, with a minimum SDR of 17, is acceptable for this installation.

APPENDIX D

LEACHATE COLLECTION SYSTEM PIPE & SUMP DESIGN CALCULATIONS

Leachate Collection System Design

Calculations:

1. Leachate Collection Pipe-HDPE SDR 17

Determine the full flow capacity of the 6", 8", 10", & 18" diameter pipe using Manning's equation:

Nominal	Actual Diamter	Avg. Inside Diamter	Min Wall Thickness
6"	**6.625 "**	**5.799 "**	**0.390 "**
8"	8.625 "	7.549 "	0.507 "
10"	10.75 "	9.409 "	0.632 "
18"	18.00 "	15.755 "	1.059 "

$Q = (1.486/n)\, AR^{2/3}S^{1/2}$

Where: Q = peak flow rate (cfs)
n = Mannings Roughness Coefficient
A = cross-sectional area of pipe (ft^2)
R = hydraulic radius of pipe (ft)
S = slope of pipe (ft/ft) = 1%

	Q (cfs)	n	A (ft^2)	R (ft)	S
6"	**0.740**	0.009	0.183	0.121	0.01
8"	1.494	0.009	0.311	0.157	0.01
10"	2.689	0.009	0.483	0.196	0.01
18"	10.631	0.009	1.353	0.328	0.01

It is noted that capacity of the pipe to convey **0.740 cfs** significantly exceeds the peak flow rate that will develop for a 19 acre cell (0.00719 cfs-acre x 1.5 = 0.0108 cfs-acre; or 0.0108 cfs-acre x 19 acre = **0.2052 cfs**
Therefore, it is appropriately sized to handle peak flow rates.

Note: From HELP Model Results Case A-1 (1 YR) the Peak Daily Rate = 622 (cf/day-acre) & From HELP Model Results Case C-1 (1 YR) the Peak Daily Rate = 629 (cf/day-acre) As required by the TNRCC Leachate Collection System Handbook, the design flow rate is increased by 50% (FOS of 1.5 - Page 4)

Case A-1

Design Flow Rate	=	622	cf/day-acre
	=	0.01080	cfs-acre
19 ac	=	0.2052	cfs

Case C-1

Design Flow Rate	=	629	cf/day-acre
	=	0.01092	cfs-acre
13.5 ac	=	0.1474	cfs

2. Peforations Required

Case A-1

Design Flow Rate =		622	cf/day-acre
	=	0.01080	cfs-acre
19 ac	=	0.2052	cfs

For Case A-1, Distributing the design flow (0.2052 cfs) equally along the length of the perforated pipe (1,100 feet = total pipe length) yields an average flow distribution of : L= 1,100 ft

0.000187 cfs/ft 0.084 gpm/ft

Using the orifice flow equation and an assumed head of one inch, compute the capacity of one, 3/8" diameter perforation:

$Q = C_d \times A \times (2 \times g \times h)^{.5}$

C_d	0.6	orifice discharge coefficient
A	0.000767	orifice area, ft^2
g	32.2	gravitational constant, 32.2 ft/sec^2
h	0.08333	hydraulic head, ft

Q= 0.0011 cfs

The capacity of one orifice (0.0011 cfs) is greater than the requirement for one linear foot of perforated pipe of (.000187 cfs). The proposed perforation design has two holes per row around the cirumference of the pipe at 120° from the top center and one per row around the circumference of the pipe at the top of the pipe. The bottom perforations will be spaced 6" apart and the top perforations will be spaced 6" apart aligned between the bottom perforations. There will be 8 perforations per linear foot of pipe and an approximate factor of safety of 46

Case C-1

Design Flow Rate =		629	cf/day-acre
	=	0.01092	cfs-acre
13.5 ac	=	0.1474	cfs

For Case C-1, Distributing the design flow (0.1474 cfs) equally along the length of the perforated pipe (400 feet = total pipe length) yields an average flow distribution of : L= 400 ft

0.000369 cfs/ft 0.165 gpm/ft

Using the orifice flow equation and an assumed head of one inch, compute the capacity of one, 3/8" diameter perforation:

$Q = C_d \times A \times (2 \times g \times h)^{.5}$

C_d	0.6	orifice discharge coefficient
A	0.000767	orifice area, ft^2
g	32.2	gravitational constant, 32.2 ft/sec^2
h	0.08333	hydraulic head, ft

Q= 0.0011 cfs

The capacity of one orifice (0.0011 cfs) is greater than the requirement for one linear foot of perforated pipe of (.000369 cfs). The proposed perforation design has two holes per row around the cirumference of the pipe at 120° from the top center and one per row around the circumference of the pipe at the top of the pipe.

The bottom perforations will be spaced 6" apart and the top perforations will be spaced 6" apart aligned between the bottom perforations. There will be 8 perforations per linear foot of pipe and an approximate factor of safety of 23

3. Leachate Sump

Determine the required dimensions for a 2-foot deep sump to accommodate the average yearly flow rate of leachate produced during the open conditions for 12 hours.

Convert the max average yearly flow rate of leachate from (ft^3/yr-acre) to (ft^3/sec-acre):	16,880	ft^3/yr-acre
16,880 ft^3/year-acre x (1 yr/365 days) x (1 day/24 hrs) x (1 hr/60 min) x (1min/60 sec):	0.0005353	ft^3/sec-acre
multiply by 19 acres:		
Where: Q = flow rate during open conditions for the largest cell (19 acres):	0.010170	ft^3/sec
$V_{required}$ = Q x (.5 days) x (24 hrs/1 day) x (60 min/1 hr) x (60 sec/1 min)	439	ft^3

Calculate the volume of a sump (truncated pyramid) that is 34 ft wide by 34 ft long at the top with a depth of 2 feet and sideslope of 3H:1V.

$V = 1/3\ (a^2+ab+b^2)h$

Where:

a=	34	ft		
b=	34 ft-(2*(slope*height))=		22	ft
h=	2	ft		

V_{sump} = 1,592 ft^3

$V_{available} = V_{sump}$ X P

Where:

V_{sump} =	1,592	ft^3	
P = Porosity of gravel fill in sump =			0.3

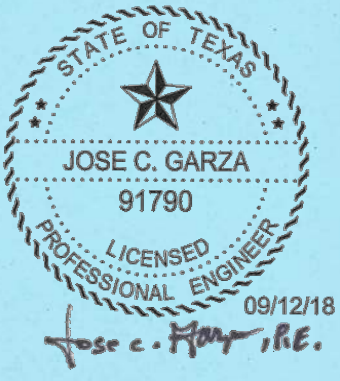
$V_{available}$ = 478 ft^3

The available volume of the leachate sump is 478 ft^3, which is greater than the required 439 ft^3.

RESULTS:
The leachate collection pipe and leachate sump are both designed to adequately handle the maximum leachate production of the largest cell during operational conditions.

APPENDIX E

FILTER CALCULATIONS



JOB NO. 8514-3 **HANSON PROFESSIONAL SERVICES INC.** SHEET NO. 1
DESCRIPTION: CALCULATIONS – City of Kingsville Landfill DATE: 08/14/18
Leachate Collection System – Geotextile Filter

I. OBJECTIVE: Check the filter characteristics of the geotextile fabric.

II. APPROACH:

A. Determine the Apparent Opening Size, based on the soil characteristics.
B. Determine the minimum permeability of the geotextile fabric.
C. Compute the Factor of Safety for this design.

III. ASSUMPTIONS:

A. The soil material to be used for the protective soil layer is characterized by the attached grain size curve.
B. From the geotechnical report, this soil is classified as a clayey sand. Permeability for this type of soil is approximately 1 x 10^{-4} cm/sec.

IV. CALCULATIONS

A. Determine the Apparent Opening Size (AOP), based on the soil characteristics.

$AOS = 10 \times d_{50}/C_u$ From: "LCS Handbook"

Where, d_{50} is the median grain size (50% finer, 50% coarser), in mm
C_u is the Coefficient of Uniformity (d_{60}/d_{10})

From the curve, d_{60} is 0.1 mm, d_{50} is 0.09 mm, and d_{10} is 0.003 mm.
$C_u = 0.1/0.003 = 3.3$
AOS = 10 x 0.09 mm / 3.3 = **0.27 mm**

B. Determine the minimum permeability of the geotextile fabric.

$$k_{req} = (t \times k_s)/(5 \times d_{50})$$

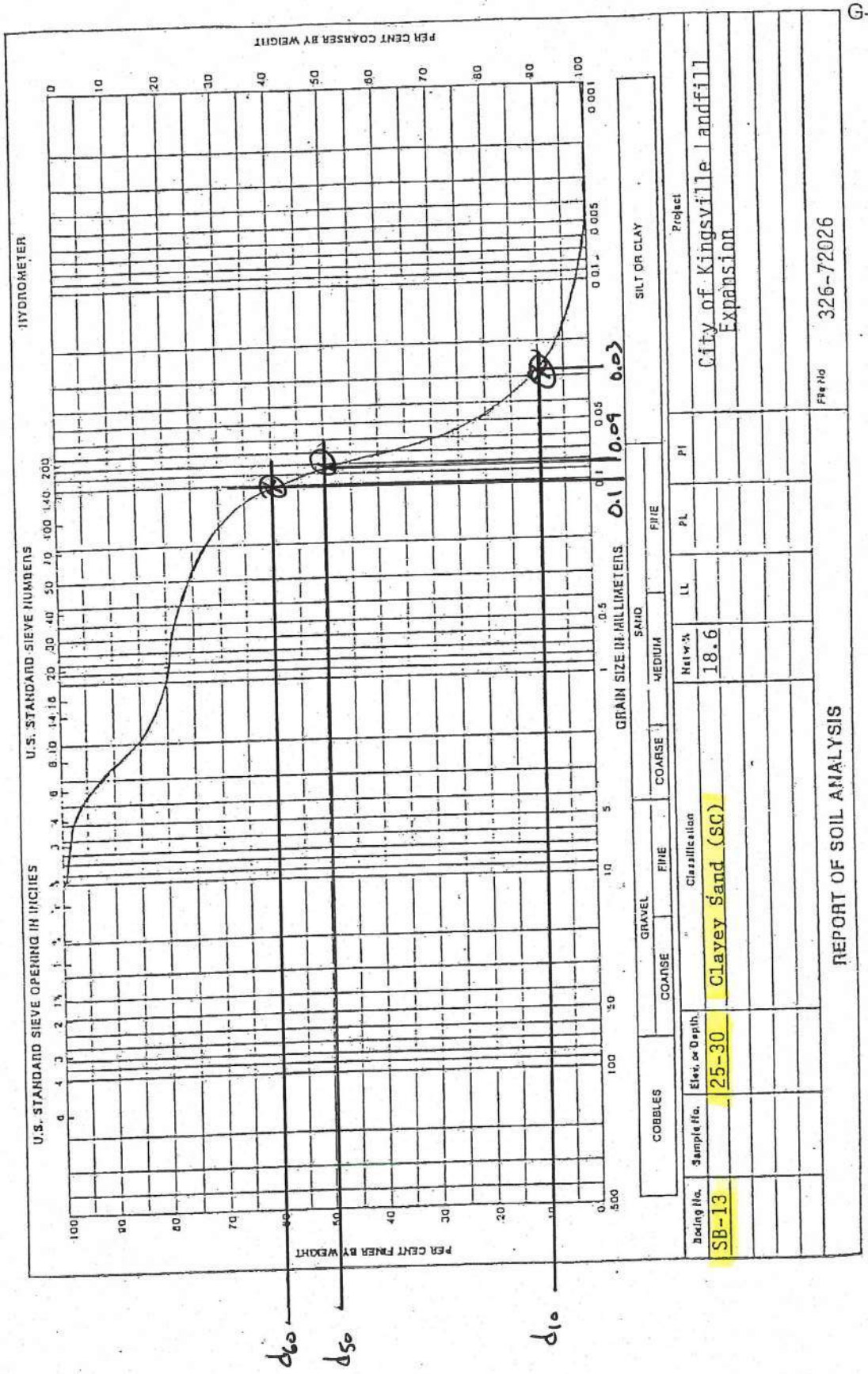
Where, k_{req} is the minimum required permeability, in cm/sec
k_s is the permeability of the soil, in cm/sec
d_{50} is the median grain size (50% finer, 50% coarser), in cm
t is the thickness of the fabric, in cm

k_{req} = (0.095 in x 2.54 cm/in x 1 x 10^{-4} cm/sec)/(5 x 0.09 mm x 1 cm/10mm)
=**5.4 x 10^{-4} cm/sec**

C. Compute the Factor of Safety for this design.

Since the specified minimum permeability of the fabric is 0.35 cm/sec, the FS is:
$FS = k_{available}/k_{required}$ FS = 0.30 cm/sec / 5.4 x 10^{-4} cm/sec = 559

G-42


REPORT OF SOIL ANALYSIS
Project
City of Kingsville Landfill Expansion
File No. 326-72026
Boring No. SB-13
Sample No.
Elev. or Depth 25-30
Classification Clayey Sand (SC)
Nat'l % 18.6
LL
PL
PI
COBBLES
GRAVEL COARSE FINE
SAND COARSE MEDIUM FINE
SILT OR CLAY
GRAIN SIZE IN MILLIMETERS
U.S. STANDARD SIEVE OPENING IN INCHES
U.S. STANDARD SIEVE NUMBERS
HYDROMETER
PER CENT FINER BY WEIGHT
PER CENT COARSER BY WEIGHT
0.1
0.09
0.03
D60
D50
D10

I. Objective: Check the filter characteristics of the geotextile fabric.

II. Approach:

A. Determine the Apparent Opening Size, based on soil characteristics.
B. Determine the minimum permeability of the geotextile fabric.
C. Compute the Factor of Safety for this design.

III. Assumptions:

A. The soil material to be used for the protective soil layer is characterized by the attached grain size curve.
B. From the geotechnical report, this soil has a permeability of approximately
0.0001 cm/sec (SC-clayey sands, sand clay mixture)

IV. Calculations:

A. Determine the (AOS), based on the soil characteristics.

$AOS=10*d_{50}/C_u$ from "LCS Handbook"

where d_{50} is the median grain size (50% finer, 50% coarser) in mm
C_u is the Coefficient of Uniformity (d_{60}/d_{10})

From the curve,

d_{60} =	0.1	mm
d_{50} =	0.09	mm
d_{10} =	0.03	mm
C_u =	3.3	
AOS	0.27	mm

B. Determine the minimum permeability of the geotextile fabric.

k_{req} (cm/sec) = $(t*k_s)/(5*d_{50})$

where k_{req} is the minimum required permeability, in cm/sec

k_s is the permeability of the soil, in cm/sec	0.0001	cm/sec		
d_{50} is the median grain size (50% finer, 50% coarser) in cm	0.09	mm	0.009	cm
t is the thickness of the fabric, in cm	0.095	in	0.241	cm

k_{req}= 0.00054 cm/sec

C. Compute the Factor of Safety for this Design.

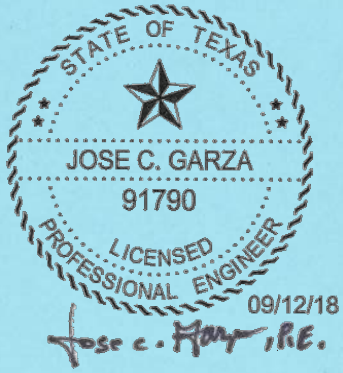
$FS=k_{available}/k_{required}$

Since the specified minimum permeability of the fabric ($K_{available}$) is : 0.3 cm/sec

the Factor of Safety (FS) = 559

APPENDIX F

CITY OF KINGSVILLE, TX CODE OF ORDINANCES



INDUSTRIAL WASTES

Sec. 5-2-15. - Definitions.

For the purpose of this subarticle, the following definitions shall apply unless the context clearly indicates or requires a different meaning:

Approving authority. The City Manager or his duly authorized representative.

Average quality. The arithmetic average (weighted by flow value) of all daily determinations of concentrations made during a calendar month. Daily determinations of concentrations made using a composite sample shall be the concentration of the composite sample. When grab samples are used, the daily determination of concentration shall be the arithmetic average (weighted by flow value) of all samples collected during the calendar day.

Biochemical oxygen demand (BOD). The quantity of oxygen utilized in the biochemical oxidation of organic matter under standard laboratory procedures for five days at a temperature of 20° C, usually expressed as a concentration milligrams per liter (mg/l).

Building sewer. The extension from the building drain to the public sewer or other place of disposal (also called the house lateral and house connection).

C.O.D. (chemical oxygen demand). Measure of the oxygen consuming capacity of and organic matter present in the water or wastewater expressed in mg/1 as the amount of oxygen consumed from a chemical oxidant in a specific test, but not differentiating between stable and unstable organic matter and thus not necessarily correlating with biochemical oxygen demand.

Commercial grease generator. Every food preparation and food service establishment including, but not limited to bakeries, bars, butcher shops, cafes, clubhouses, delicatessens, ice cream parlors, hospitals, hotels, restaurants, schools or similar places where meat, poultry, seafood, dairy products, or fried foods are prepared or served, but shall not apply to any residence not used for the commercial preparation and sale of food items.

Commercial/industrial grit generator. Every commercial or industrial generator of liquid waste containing petroleum based oil and grease wastes, and inorganic solids including, but not limited to automotive or heavy machinery repair and/or washing facilities.

Control manhole. A manhole giving access to a building sewer at some point before the building sewer discharge mixes with other discharges in the public sewer.

Control point. Point of access to a course of discharge before the discharge mixes with other discharges in the public sewer.

Daily composite quality. The concentration of a sample consisting of a minimum of three grab samples of effluent collected at regular intervals over a normal operating day and combined proportional to flow, or a sample continuously collected proportional to flow over a normal operating day.

Director. The director of the department of water/wastewater of the city, or his/her authorized representative, which may include a person appointed by the director of the department of water/wastewater from any city department.

Garbage. Animal and vegetable wastes and residue from preparation, cooking and dispensing of food; and from the handling, processing, storage and sale of food products and produce.

Generator. A person who causes, creates, generates, stores or otherwise produces liquid waste or owns property upon which liquid waste is caused, created, generated, stored or produced, including but not limited to grease trap waste and grit trap waste as a by-product of a domestic or nondomestic activity other than merely as a result of mere residence at a nonbusiness location.

Grab sample quality. The concentration of an individual sample of effluent collected in less than 15 minutes.

Grease or grit generator. A commercial grease generator or a commercial/industrial grit generator as defined herein.

Grease trap. A receptacle utilized by commercial or industrial generators of liquid waste to intercept, collect and restrict the passage of organic, inorganic, greasy or fatty liquid, semi-liquid, and/or solid wastes into both public and private sanitary sewers to which the receptacle is directly or indirectly connected.

Grease trap waste. Any organic, inorganic, greasy or fatty liquid, semi-liquid, and/or solid wastes collected by and ultimately removed from a grease trap for proper disposal.

Grit trap. A receptacle utilized by commercial or industrial generators of liquid waste to intercept, collect and restrict the passage of petroleum-based oil and grease wastes and inorganic or other solids into private or public sanitary sewers to which the receptacle is directly or indirectly connected.

Grit trap waste. Oil and grease wastes and inorganic solids generated by commercial, industrial, automotive or heavy machinery repair and/or washing facilities that are collected by and ultimately removed from a grit trap for disposal.

Hazardous metal. Each of the metals listed in § 5-2-18(B), either in its elemental state and/or any of its compounds.

Industrial waste charge. The charge made on those persons who discharge industrial wastes into the city's sewerage system.

Liquid waste. Water-borne solids and liquids containing dissolved or suspended waste material, including but not limited to, septage and wastes from grease traps and grit traps.

Manifest. The written, multi-part documentation required to be in the possession of the transporter enabling disposal of hauled grit trap waste, grease trap waste, and septage at a permitted or registered disposal site.

Milligrams per liter (mg/1). The same as parts per million and is a weight-to-volume ratio; the milligram-per-liter value multiplied by the factor 8.34 shall be equivalent to pounds per million gallons of water.

Natural outlet. Any outlet into a watercourse, ditch, lake, or other body of surface water or ground water.

Normal domestic wastewater. Wastewater excluding industrial wastewater discharged by a person into sanitary sewers and in which the average concentration of total suspended solids is not more than 200 mg/1 and BOD is not more than 200 mg/1.

Overload. The imposition of organic or hydraulic loading on a treatment facility in excess of its engineered design capacity.

pH. The logarithm (Base 10) of the reciprocal of the hydrogen ion concentration.

Replacement. All expenditures for obtaining and installing equipment, accessories, or appurtenances which are necessary to maintain the capacity and performance during the service life of the treatment works for which such works were designed and constructed. The term *operation and maintenance* includes replacement.

Sanitary sewer. A system of pipes, conduit and treatment facilities owned or operated by the city which collect, transport, and treat sanitary sewage, and to which storm, surface, and ground waters are not intentionally or normally admitted.

SEPTAGE. Liquid wastes and sludges containing sufficient liquid content, to permit flow by gravity of minimal pumping, which is removed from a portable toilet, chemical toilet, septic tank, or cesspool. *SEPTAGE* does not include nondomestic wastes from commercial or industrial establishments.

Serve.

(1) Personally serve upon the grease or grit generator or his agent;

(2) To send by registered or certified mail, return receipt requested, to the grease or grit generator, or his agent, allowing at least five days for said mail to be retrieved by the recipient, at the address at which the grease or grit generator receives his utility bill for the location of the alleged discharge; or

(3) To place a written notice upon an entrance to the location where the alleged discharge is occurring or flows during normal operation.

Slug. Any discharge of water, wastewater or industrial waste which in concentration of any given constituent or in quantity of flow, exceeds for any period of duration longer then 15 minutes more than five times the average 24-hour concentration or flows during normal operation.

Standard methods. The examination and analytical procedures set forth in the latest edition, at the time of analysis, of "Standard Methods for the Examination of Water and Wastewater" as prepared, approved, and published jointly by the American Public Health Association, the American Water Works Association and the Water Pollution Control Federation.

Storm sewer. A public sewer which carries storm and surface waters and drainage and into which domestic wastewater or industrial wastes are not intentionally passed.

Storm water. Rainfall or any other forms of precipitation.

Superintendent. The Water and Wastewater Superintendent of the city, or his duly authorized deputy, agent or representative.

To discharge. Includes to deposit, conduct, drain, emit, throw, run, allow to seep, or otherwise release or dispose of, or to allow, permit, or suffer any of these acts or omissions.

Total supended solids (TSS). The total suspended matter that floats on the surface of or is suspended in water, wastewater, or other liquid, and which is removal by laboratory filtering.

Trap. A device designed to skim, settle, or otherwise remove grease, oil, sand, flammable wastes or other harmful substances.

Unpolluted wastewater. Water containing no free or emulsified grease or oil; no acids or alkalis; no phenols or other substances producing taste or odor in receiving water; no toxic or poisonous substances in suspension, colloidal state, or solution; no noxious or otherwise obnoxious or odorous gases; not more than an insignificant amount in mg/l each of suspended solids and BOD, as determined by the Texas Water Commission; and color not exceeding 50 units as measured by the Platinum-Cobalt method of determination as specified in Standard Methods.

User charge. A charge levied on users of treatment works for the cost of operating and maintaining such works.

Waste. Rejected, unutilized or superfluous substances in liquid, gaseous, or solid form resulting from domestic, agricultural, or industrial activities.

Wastewater. A combination of the water-carried waste from residences, business buildings, institutions, and industrial establishments, together with any ground, surface, and storm water that may be present.

Wastewater facilities. Includes all facilities for collection, pumping, treating, and disposing of wastewater and industrial wastes.

Wastewater service charge. The charge on all users of the public sewer system whose wastes do not exceed in strength the concentration values established as representative of normal wastewater.

Wastewater treatment plant. Any city-owned facilities, devices, and structures used for receiving, processing and treating wastewater, industrial waste, and sludges from the sanitary sewers.

Watercourse. A natural or man-made channel in which a flow of water occurs, either continuously or intermittently.

(1962 Code, § 8-9-1; Ord. 2004-32, passed 10-11-04)

Sec. 5-2-16. - Prohibited discharges.

(A) No person may discharge to public sewers any waste which by itself or by interaction with other wastes may:

(1) Injure or interfere with wastewater treatment processes or facilities;

(2) Constitute a hazard to humans or animals; or

(3) Create a hazard in receiving waters of the wastewater treatment plant effluent.

(B) All discharges shall conform to requirements of this subarticle.

(1962 Code, § 8-9-2)

Cross reference— Penalty, see § 5-2-99.

Sec. 5-2-17. - Chemical discharges.

(A) No discharge to public sewers may contain:

(1) Cyanide greater than one mg/l;

(2) Fluoride other than that contained in the public water supply;

(3) Chlorides in concentrations greater than 250 mg/1;

(4) Gasoline, benzene, naphtha, fuel oil, or other flammable or explosive liquid, solid or gas; or

(5) Substances causing an excessive Chemical Oxygen Demand (C.O.D.).

(B) No waste or wastewater discharged to public waters may contain:

(1) Strong acid, iron pickling wastes, or concentrated plating solutions whether neutralized or not;

(2) Fats, wax, grease, or oils, whether emulsified or not in excess of 100 mg/1 or containing substances which may solidify or become viscous at temperatures between 32° F and 150° F (0° C and 65° C).

(3) Objectionable or toxic substances, exerting an excessive chlorine requirement, to such degree that any such material received in composite wastewater treatment works exceeds the limits established by the approving authority for such materials; or

(4) Obnoxious, toxic or poisonous solids, liquids, or gases in quantities sufficient to violate the provisions of § 5-2-16(A).

(C)

No waste, wastewater, or other substance may be discharged into public sewers which has a pH lower than five and five-tenths or higher than nine and five tenths or any other corrosive property capable of causing damage or hazard to structures, equipment, and/or personnel at the wastewater facilities.

(D) All waste, wastewater, or other substance containing phenols, hydrogen sulfide, or other taste-and-odor producing substances, shall conform to concentration limits established by the approving authority. After treatment of the composite wastewater, concentration limits may not exceed to requirements established by state, federal or other agencies with jurisdiction over discharges to receiving waters.

(1962 Code, § 8-9-3)

Cross reference— Penalty, see § 5-2-99.

Sec. 5-2-18. - Hazardous metals and toxic materials.

(A) No discharges may contain concentrations of hazardous metals other than amounts specified in division (B) of this section.

(B) The allowable concentrations of hazardous metals, in terms of milligrams per liter (mg/1), for discharge to inland waters, and determined on the basis of individual sampling in accordance with "Standard Methods" are:

Metal	Average	Daily Composite (Not to Exceed)	Grab Sample
Arsenic	0.1	0.2	0.3
Barium	1.0	2.0	4.0
Cadmium	0.05	0.1	0.2
Chromium	0.5	1.0	5.0
Copper	0.5	1.0	2.0
Lead	0.5	1.0	1.5

Manganese	1.0	2.0	3.0
Mercury	0.005	0.005	0.01
Nickel	1.0	2.0	3.0
Selenium	0.05	0.1	0.2
Silver	0.05	0.1	0.2
Zinc	1.0	2.0	6.0

(C) No other hazardous metals or toxic materials may be discharged into public sewers without a permit from the approving authority specifying conditions of pretreatment, concentrations, volumes, and other applicable provisions.

(D) Prohibited hazardous materials include but are not limited to:

(1) Antimony.

(2) Beryllium.

(3) Bismuth.

(4) Cobalt.

(5) Molybdenum.

(6) Uranylion.

(7) Rhenium.

(8) Strontium.

(9) Tellurium.

(10) Herbicides.

(11) Fungicides.

(12) Pesticides.

(1962 Code, § 8-9-4)

Cross reference— Penalty, see § 5-2-99.

Sec. 5-2-19. - Garbage.

(A) No person may discharge garbage into public sewers unless it is shredded to a degree that all particles can be carried freely under the flow conditions normally prevailing in public sewers. Particles greater than one-half inch in any dimension are prohibited.

(B) The approving authority is entitled to review and approve the installation and operation of any garbage grinder equipped with a motor of three-fourths percent horsepower (0.76 hp metric) or greater.

(1962 Code, § 8-9-5)

Cross reference— Penalty, see § 5-2-99.

Sec. 5-2-20. - Storm water and other unpolluted drainage.

(A) No person may discharge to public sanitary sewers any of the following or make any new connections from inflow sources:

(1) Unpolluted storm water, surface water, groundwater, roof runoff or subsurface drainage;

(2) Unpolluted cooling water;

(3) Unpolluted industrial process waters;

(4) Other polluted drainage.

(B) In compliance with the Texas Water Quality Control Act, Tex. Water Code §§ 26.001 et seq. and other statutes, the approving authority may designate storm sewers and other watercourses into which unpolluted drainage described in division (A) of this section may be designated.

(1962 Code, § 8-9-6)

Cross reference— Penalty, see § 5-2-99.

Sec. 5-2-21. - Temperature.

No person may discharge liquid or vapor having a temperature higher than 150° F (65° C), or any substance which causes the temperature of the total wastewater treatment plant influent to increase at a rate of 10° F or more per hour, or a combined total increase of plant influent to 110° F.

(1962 Code, § 8-9-7)

Cross reference— Penalty, see § 5-2-99.

Sec. 5-2-22. - Radioactive wastes.

(A) No person may discharge radioactive wastes or isotopes into public sewers without the permission of the approving authority.

(B) The approving authority may establish, in compliance with applicable state and federal regulations, regulations for discharge of radioactive wastes into public sewers.

(1962 Code, § 8-9-8)

Cross reference— Penalty, see § 5-2-99.

Sec. 5-2-23. - Impairment of facilities.

(A) No person may discharge into public sewers any substance capable of causing:
  (1) Obstruction to the flow in sewers;
  (2) Interference with the operation of treatment processes or facilities; or
  (3) Excessive loading of treatment facilities.

(B) Discharges prohibited by division (A) include, but are not limited to, materials which exert or cause concentrations of:
  (1) Inert suspended solids greater than 250 mg/1 including, but not limited to:
    (a) Fuller's earth;
    (b) Lime slurries; and
    (c) Lime residues.
  (2) Dissolved solids greater than 1,200 mg/1 including, but not limited to:
    (a) Sodium chloride; and
    (b) Sodium sulfate.
  (3) Excessive discoloration including, but not limited to:
    (a) Dye wastes; and
    (b) Vegetable tanning solutions; or
  (4) BOD, COD, or chlorine demand in excess of normal plant capacity.

(C) No person may discharge into public sewers any substance that may:

(1) Deposit grease or oil in the sewer lines in such a manner as to clog the sewers;

(2) Overload skimming and grease handling equipment;

(3) Pass to the receiving waters without being effectively treated by normal wastewater treatment processes due to the nonamenability of the substance to bacterial action; or

(4) Deleteriously affect the treatment process due to excessive quantities.

(D) No person may discharge any substance into public sewers which:

(1) Is not amenable to treatment or reduction by the processes and facilities employed; or

(2) Is amenable to treatment only to such a degree that the treatment plant effluent cannot meet the requirements of other agencies having jurisdiction over discharge to the receiving waters.

(E) The approving authority shall regulate the flow and concentration of slugs when they may:

(1) Impair the treatment process;

(2) Cause damage to collection facilities;

(3) Incur treatment costs exceeding those for normal wastewater; or

(4) Render the waste unfit for stream disposal of industrial use.

(F) No person may discharge into public sewers solid or viscous substances which may violate division (a) of this section if present in sufficient quantity or size including, but not limited to, ashes, cinders, sand, mud, straw, shavings, metal, glass, rags, feathers, tar, plastics, wood, unground garbage, whole blood, paunch manure, hair and fleshings, entrails, paper products, either whole or ground by garbage grinders, slops, chemical residues, paint residues, or bulk solids.

(1962 Code, § 8-9-9)

Cross reference— Penalty, see § 5-2-99.

Sec. 5-2-24. - Compliance with existing authority.

(A) Unless exception is granted by the approving authority the public sanitary sewer system shall be used by all persons discharging:

(1) Wastewater;

(2) Industrial waste;

(3) Polluted liquids.

(B) Unless authorized by the Texas Water Commission, no person may deposit or discharge any waste included in division (A) of this section on public or private property into or adjacent to any:

(1) Natural outlet;

(2) Watercourse;

(3) Storm sewer;

(4) Other area within the jurisdiction of the city.

(C) The approving authority shall verify prior to discharge that wastes authorized to be discharged will receive suitable treatment within the provisions of laws, regulations, ordinances, rules and orders of federal, state and local governments.

(1962 Code, § 8-9-10)

Cross reference— Penalty, see § 5-2-99.

Sec. 5-2-25. - Approving authority requirements; review and approval.

(A) (1) If discharges or proposed discharges to public sewers deleteriously affect wastewater facilities, processes, equipment, or receiving waters; create a hazard to life or health; or create a public nuisance, then the approving authority shall require:

(a) Pretreatment to an acceptable condition for discharge to the public sewers;

(b) Control over the quantities and rates of discharge; and

(c) Payment to cover the cost of handling and treating the wastes.

(2) The approving authority is entitled to determine whether a discharge or proposed discharge is included under subdivision (1) of this division.

(3) The approving authority shall reject wastes when:

(a) It determines that a discharge or proposed discharge is included under subdivision (1) of this division; and

(b) The discharges does not meet the requirements of subdivision (1) of this division.

(1962 Code, § 8-9-11)

(B) (1) If pretreatment or control is required, the approving authority shall review and approve design and installation of equipment and processes.

(2) The design and installation of equipment, and processes must conform to all applicable statutes, codes, ordinances and other laws.

(3) Any person responsible for discharges requiring pretreatment, flow equalizing, or other facilities shall provide and maintain the facilities in effective operating condition at his own expense.

(1962 Code, § 8-9-12)

Cross reference— Penalty, see § 5-2-99.

Sec. 5-2-26. - Requirements for traps.

(A) Discharges requiring a trap include:

(1) Grease or waste containing grease in excessive amounts;

(2) Oil;

(3) Sand;

(4) Flammable wastes; and

(5) Other harmful ingredients.

(B) Any person responsible for discharges requiring a trap shall at his own expense and as required by the approving authority:

(1) Provide equipment and facilities of a type and capacity approved by the approving authority;

(2) Locate the trap in a manner that provides ready and easy accessibility for cleaning and inspection; and

(3) Maintain the trap in effective operating condition.

(C) The city's grease trap waste disposal fee shall be $0.40 per gallon.

(1962 Code, § 8-9-13; Ord. 97026, passed 9-22-97)

Cross reference— Penalty, see § 5-2-99.

Sec. 5-2-27. - Requirements for building sewers.

Any person responsible for discharges through a building sewer carrying industrial wastes shall, at his own expense and as required by the approving authority:

(A) Install an accessible and safely located control manhole;

(B) Install meters and other appurtenances to facilitate observation sampling and measurement of the waste; and

(C) Maintain the equipment and facilities.

(1962 Code, § 8-9-14)

Cross reference— Penalty, see § 5-2-99.

Sec. 5-2-28. - Sampling and testing.

(A) Sampling shall be conducted according to customarily accepted methods, reflecting the effect of constituents upon the sewage works and determining the existence of hazards to health, life, limb, and property (The particular analysis involved will determine whether a 24 hour composite sample from all outfalls of a premise is appropriate or whether a grab sample or samples should be taken. Normally, but not always, BOD and suspended solids analyses are obtained from 24 hour composites of all outfalls. Where applicable, 16 hour, eight hour or some other period may be required. Periodic grab samples are used to determine pH).

(B) Examination and analyses of the characteristics of waters and wastes required by the ordinance shall be:

(1) Conducted in accordance with the latest edition of "Standard Methods;" and

(2) Determined from suitable samples taken at the control manhole provided or other control point authorized by the approving authority.

(C) BOD and suspended solids shall be determined from composite sampling, except to detect unauthorized discharges.

(D) The city is entitled to select the time of sampling at its sole discretion so long as at least annual samples are taken to determine flow, BOD, and suspended solids of any user's discharge or class of user's discharge.

(E) City may select an independent firm or laboratory to determine flow, BOD, and suspended solids, if necessary.

(1962 Code, § 8-9-15)

Sec. 5-2-29. - User charge system.

(A) Persons making discharges of industrial waste into the city's system shall pay a

charge to cover all costs of collection and treatment.

(B) When discharges of any waste into the city's system are approved by the approving authority, the city or its authorized representative shall enter into an agreement or arrangement providing:

(1) Terms of acceptance by the city;

(2) Payment by the person making the discharge, in accordance with the user charge system as established in division (E) herein;

(3) Sewer connection procedures and requirements shall be in accordance with the Uniform Plumbing Code as promulgated by the International Association of Plumbing and Mechanical Officials;

(4) A sewer application approved with connection fee paid; and

(5) Construction of sewer connections shall be approved by city inspectors prior to sewer use.

(C) Each user of the wastewater treatment system will be notified, at least annually, in conjunction with a regular sewer bill, of the rate and that portion of user charges or ad valorem taxes which are attributable to the operation and maintenance of the wastewater treatment system.

(D) The city will apply excess revenues collected from a class of users to the cost of operation and maintenance attributable to the class for the next year and adjust the rates accordingly.

(E) User charge system.

(1) The following symbols shall be defined as follows:

Ct = Total operation and maintenance (O & M) costs per unit of time

Cu = A user's charge for O & M per unit of time

Vt = Total volume contribution from all users per unit of time

Vu = Volume contribution from a user per unit of time

(2) Annual cost for Wastewater Department.

(a) Labor, utilities, supplies, equipment.

Collection System\$ 118,564

3 M.G.D. Plant\245,508

1 M.G.D. Plant\91,591

Administration and Billing Department\ 66,329

$ 521,992

In the city the BOD, suspended solids, and other pollutant concentrations discharged by all users are approximately equal because all wastewater generated is of domestic nature. Our user charges can be developed on a volume basis in accordance with the model:

$$Cu = \frac{Ct}{Vt}(Vu)$$

Cost per 1,000 gallons =	or	
	Annual Cost	(1,000 gallons)
	Annual Volume	
	Treated	

The average annual volume to be treated = (2.75 MG)(365) 1,003,750,000 gallons

Cu =	$521,992	(1,000)
	1,003,750	
Cu =	$0.52/1,000 gallons	

(b) Sewer system fund bond retirement and interest.

Annual payment = $80,635.00(1.50) = $120,952.00

Cu_2 =	$120,952 (1,000)
	1,003,750,000 gal.
Cu_2 =	$0.12/1,000 gal.

(c) Equipment replacement fund.

Equipment replacement fund $40,000.00

(Required by Federal Reg. Vol. 38 #161)

Cu_3 =	$40,000 (1,000)
1,003,750,000 gal.	

Cu_3 = $0.04/1,000 gal.

Total User Charge =	$Cu_1 + Cu_2 + Cu_3$
=	0.52 + 0.12 + 0.04
=	$0.68/1,000 gal.

(1962 Code, § 8-9-16)

Sec. 5-2-30. - Allowable discharge.

A person discharging wastes into public sewers prior to the effective date of this subarticle may continue without penalty so long as he:

(A) Does not increase the quantity or quality of discharge without permission of the approving authority;

(B) Has discharged the waste at least six months prior to the effective date of this subarticle; and

(C) Applies for and is granted a permit no later than 30 days after the effective date of this subarticle.

(1962 Code, § 8-9-17)

Sec. 5-2-31. - Conditions of permits.

(A) The city may grant a permit to discharge to persons meeting all requirements of the savings clause provided that the person:

(1) Submit an application within 30 days after the effective date of this subarticle on forms supplied by the approving authority;

(2) Secure approval by the approving authority of plans and specifications for the facilities when required; and

(3) Has complied with all requirements for agreements or arrangements including, but not limited to, provisions for:

(a) Payment of charges;

(b) Installation and operation of the facilities and of pretreatment facilities, if required; and

(c) Sampling and analysis to determine quantity and strength when directed by the city; and

(4) Provides a sampling point, when requested by the city, subject to the provisions of this subarticle and approval of the approving authority.

(B) A person applying for a new discharge shall meet all conditions of division (A) of this section and secure a permit prior to discharging any waste.

(1962 Code, § 8-9-18)

Cross reference— Penalty, see § 5-2-99.

Sec. 5-2-32. - Power to enter property.

(A) The Superintendent and other duly authorized employees of the city bearing proper credentials and identification are entitled to enter any public or private property at any reasonable time for the purpose of enforcing this subarticle.

(B) Anyone acting under this authority shall observe the establishment's rules and regulations concerning safety, internal security, and fire protection.

(C) Except when caused by negligence or failure of person(s) to maintain safe conditions, the city shall indemnify the person(s) against loss or damage of their property by city employees and against liability claims and demands for personal injury or property damage asserted against the person(s) and growing out of the sampling operation.

(D) The Superintendent and other duly authorized employees of the city bearing proper credentials and identification are entitled to enter all private properties through which the city hold a negotiated easement for the purposes of:

(1) Inspection, observation, measurement, sampling or repair;

(2) Maintenance of any portion of the sewerage system lying within the easements; and

(3)

Conducting any other authorized activity. All activities shall be conducted in full accordance with the terms of the negotiated easement pertaining to the private property involved.

(E) No person acting under authority of this provision may inquire into any processes including metallurgical, chemical, oil refining, ceramic, paper or other industries beyond that point having a direct bearing on the kind and source of discharge to the public sewers.

(1962 Code, § 8-9-19)

Sec. 5-2-33. - Authority to disconnect service.

(A) The city may terminate water and wastewater disposal service and disconnect a customer from the system when:

(1) Acids or chemicals damaging to sewer lines or treatment process are released to the sewer causing rapid deterioration of these structures or interfering with proper conveyance and treatment of wastewater;

(2) A governmental agency informs the city that the effluent from the waste water treatment plant is no longer of a quality permitted for discharge to a watercourse, and it is found that the customer is delivering wastewater to the city's system that cannot be sufficiently treated or requires treatment that is not provided by the city as normal domestic treatment; or

(3) The customer:

(a) Discharges waste or wastewater that is in violation of the permit issued by the approving authority;

(b) Discharges wastewater at an uncontrolled, variable rate in sufficient quantity to cause an imbalance in the wastewater treatment system;

(c) Fails to pay monthly bills for water and sanitary sewer services when due; or

(d) Repeats a discharge of prohibited wastes to public sewers.

(B) If service is discontinued pursuant to subdivision (A)(2) of this section, the city shall:

(1) Disconnect the customer;

(2) Supply the customer with the governmental agency's report and provide the customer with all pertinent information; and

(3)

Continue disconnection until such time as the customer provides pretreatment/additional pretreatment or other facilities designed to remove the objectionable characteristics from his wastes.

(1962 Code, § 8-9-20)

Sec. 5-2-34. - Notice of violation; continuing prohibited discharges.

(A) The city shall serve persons discharging in violation of this subarticle with written notice stating the nature of the violation and providing a reasonable time limit for satisfactory compliance.

(1962 Code, § 8-9-21)

(B) No person may continue discharging in violation of this subarticle beyond the time limit provided in the notice.

(1962 Code, § 8-9-22)

Cross reference— Penalty, see § 5-2-99.

Sec. 5-2-35. - Failure to pay.

In addition to sanctions provided for by this subarticle, the city is entitled to exercise sanctions provided for by the other ordinances of the city for failure to pay the bill for water and sanitary sewer service when due.

(1962 Code, § 8-9-24)

Cross reference— Penalty, see § 5-2-99.

Sec. 5-2-36. - Additional criminal and civil remedies.

The city may pursue all criminal and civil remedies to which it is entitled under authority of the statutes and ordinances against a person negligently, wilfully or maliciously causing loss by tampering with or destroying public sewers or treatment facilities or continuing prohibited discharges.

(1962 Code, §§ 8-9-23, 8-9-25; Ord. 07934, passed 12-17-79)

Sec. 5-2-37. - Grease and grit traps required.

(A) *Commercial grease generators.* All commercial grease generators shall discharge all wastes from sinks, dishwashers and drains into an approved and properly maintained and functioning grease trap before entering the sanitary sewer drain. Such grease traps shall be inspected, cleaned, and repaired regularly, as needed, by the commercial grease generator at his/her expense.

(B) *Commercial/industrial grit generators.* All commercial/industrial grit generators shall discharge all grit trap wastes into an approved and properly maintained and functioning grit trap before entering the sanitary sewer drain. Such grit traps shall be inspected, cleaned and repaired regularly, as needed, by the commercial/industrial grit generator at his/her expense.

(Ord. 2004-32, passed 10-11-04)

Sec. 5-2-38. - Construction of grease and grit traps and sample port.

(A) The construction requirements of this section shall apply to all new construction, expansions, and improvements involving plumbing changes, change in ownership, or change in occupancy, or otherwise in compliance with a determination of the director. In addition to new construction, expansions and improvements, all grease or grit generators shall construct sample ports in accordance with the plumbing code.

(B) Grease traps shall be constructed to prevent fats, oils or greases of animal or vegetable origin from entering the sanitary sewer in concentrations greater than 100 milligrams per liter. Grit traps shall be constructed to prevent petroleum-based oil and grease wastes and inorganic or other solids from entering the sanitary sewer. The size, type and location of each grease or grit trap must be approved by the director prior to any discharge therein.

(C) A commercial grease or grit generator shall install grease or grit traps so that they are easily accessible for cleaning and as close as possible to the source of production.

(D) A grease or grit generator shall install a sample port for ease in sampling the waste stream as close as possible to the connection with the city sanitary sewer main within the bounds of the facility property. The port shall be installed according to industrial standard and specifications of the director. The port shall be installed

and maintained at the user's expense. The port shall be installed perpendicular to the effluent flow to allow visual observation and sampling. The port shall be accessible for monitoring authorities.

(E) If the director finds that there is a need for installation or upgrading of sample ports, grease traps, or grit traps on an existing establishment, the director may order the installation or upgrading of grease and/or grit traps on that existing establishments. Within 30 days of the order the generator shall present a construction plan to be approved by the director. Within 60 days of the approved construction plan all upgrading or installation shall be complete. If the director orders such installation, then the director shall serve notice of such order upon the grease or grit generator. Within ten days of receipt of such order, the grease or grit generator may demand a hearing to review such order, in which case the director shall schedule a hearing to review such order within 30 days of receiving the demand for review from the grease or grit generator. If a hearing to review the order is scheduled, the director shall serve notice of the hearing to review such order upon the grease or grit generator at least ten days before the date of such hearing. At the hearing to review the order, the grease or grit generator may present evidence, and the director may make new findings and issue new orders concerning the subject of the original hearing. After receiving notice of the order to install or upgrade ports or traps on an existing establishment, it shall be unlawful for a grease or grit generator to allow or cause any discharge into the sanitary sewer not in compliance with such order.

(F) A grease or grit generator with a water connection for cooling or operating a grease or grit trap shall protect it with a cross connection control device approved by the director prior to installation.

(G) Construction of items listed herein in accordance herewith or in accordance the director's specifications shall not constitute a defense to unlawful discharge and shall not limit the grease or grit generator's liability for any surcharge stated in this division.

(H) A grease or grit generator shall be liable for an administrative fee as established herein or by separate ordinance if a report is submitted more than ten days after the date set for submittal by this section or the director.

(Ord. 2004-32, passed 10-11-04)

Sec. 5-2-39. - Maintenance of grease and grit traps.

(A) A grease or grit generator shall have traps serviced as frequently as necessary to prevent bypass or overflow, and to insure proper operation of the trap. Such generators shall, at a minimum, have grease and/or grit traps serviced quarterly or as otherwise approved in advance in writing by the director.

(B) A grease or grit generator shall cause the liquid waste hauler to completely evacuate all grease and/or grit traps and other interceptors during servicing. It shall be unlawful for a grease or grit generator to allow in the servicing of his trap, the discharge of liquid, semi-solids, or solids to be discharged back into a grease or grit trap after servicing.

(C) A grease or grit generator shall sign the manifest presented by the liquid waste transporter and shall keep the receipt for a period of three years. Receipts shall be maintained at the facility for inspection by the authorized city representative upon request. The manifest will be inspected quarterly.

(D) It shall be unlawful for a commercial grease generator to allow frying vats to discharge into a grease trap at any time.

(E) A grease or grit generator shall properly monitor and maintain the collection point, so that wastewater samples taken from the collection point are representative of wastewater leaving the grease or grit trap. Authorized representatives will conduct quarterly inspections.

(F) It shall be unlawful for a grease or grit generator to divert sewage around a collection point into the sanitary sewer.

(G) If the director finds that a change in pumpage or servicing of a grease or grit trap is necessary for an establishment to meet the discharge limits stated in this division, the director may order a change in pumpage or servicing of a grease or grit trap. If the director orders a change in the pumpage or servicing, then the director shall serve notice of such order upon the grease or grit generator. Within ten days of receipt of such order, the grease or grit generator may demand a hearing to review such order, in which case the director shall schedule a hearing to review such order within 30 days of receiving the demand for review from the grease or grit generator. If a hearing to review the order is scheduled, the director shall serve notice of the hearing to review such order upon the grease or grit generator at least ten days before the date of such hearing. At the hearing to review the order, the grease or grit generator may present evidence, and the director may make new

findings and issue new orders concerning the subject of the original hearing. After receiving notice of an order by the director to change the frequency and/or methods of pumpage or servicing, it shall be unlawful for a grease or grit generator to allow or cause any discharge into the sanitary sewer not in compliance with such order.

(H) The following fees shall be charged as services related to grease or grit trap testing and inspections.

(1) Pretreatment program:

Quarterly inspection fee\$25.00

Reinspection fee\25.00

(2) Miscellaneous fees:

Sampling and testing\30.00

Outside lab analysis\25.00 plus actual cost of analysis

(Ord. 2004-32, passed 10-11-04; Ord. 2008-27, passed 9-22-08)

Sec. 5-2-40. - Prohibited discharges.

No person may discharge to public sewers any waste which by itself or by interaction with other wastes may:

(A) Contain hazardous chemicals or by products;

(B) Interfere with wastewater treatment processes or operation of its facilities;

(C) Interfere with proper conveyance of sanitary flows in the course.

(Ord. 2004-32, passed 10-11-04)

Sec. 5-2-41. - Chemical discharges.

(A) Fats, wax, grease, or oils, whether emulsified or not in excess of 100 mg/1 or containing substances which may solidify or become viscous at temperatures between 32° F and 150° F (0° C and 65° C).

(B)

No waste, wastewater, or other substance may be discharged into public sewers which has a pH lower than 5.5 or higher than 9.5 or any other corrosive property capable of causing damage or hazard to structures, equipment, and/or personnel at the wastewater facilities.

(Ord. 2004-32, passed 10-11-04)

Sec. 5-2-42. - Sampling and testing.

(A) The city is entitled to select the time of sampling at its sole discretion so long as at least annual samples are taken to determine flow, BOD, and suspended solids of any user's discharge or class of user's discharge.

(B) The city may select an independent firm or laboratory to determine flow, BOD, and suspended solids, if necessary.

(Ord. 2004-32, passed 10-11-04)

Sec. 5-2-43. - User charge system.

Persons making discharges of industrial waste into the city's system shall pay a charge to cover all costs of collection and treatment.

(Ord. 2004-32, passed 10-11-04)

Sec. 5-2-44. - Power to enter property.

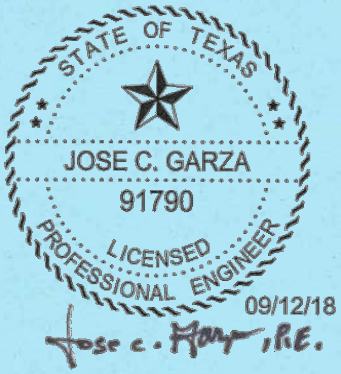
The Superintendent and other duly authorized employees of the city bearing proper credentials and identification are entitled to enter all private properties through which the city holds a negotiated easement for the purposes of inspection, observation, measurement, sampling or repair.

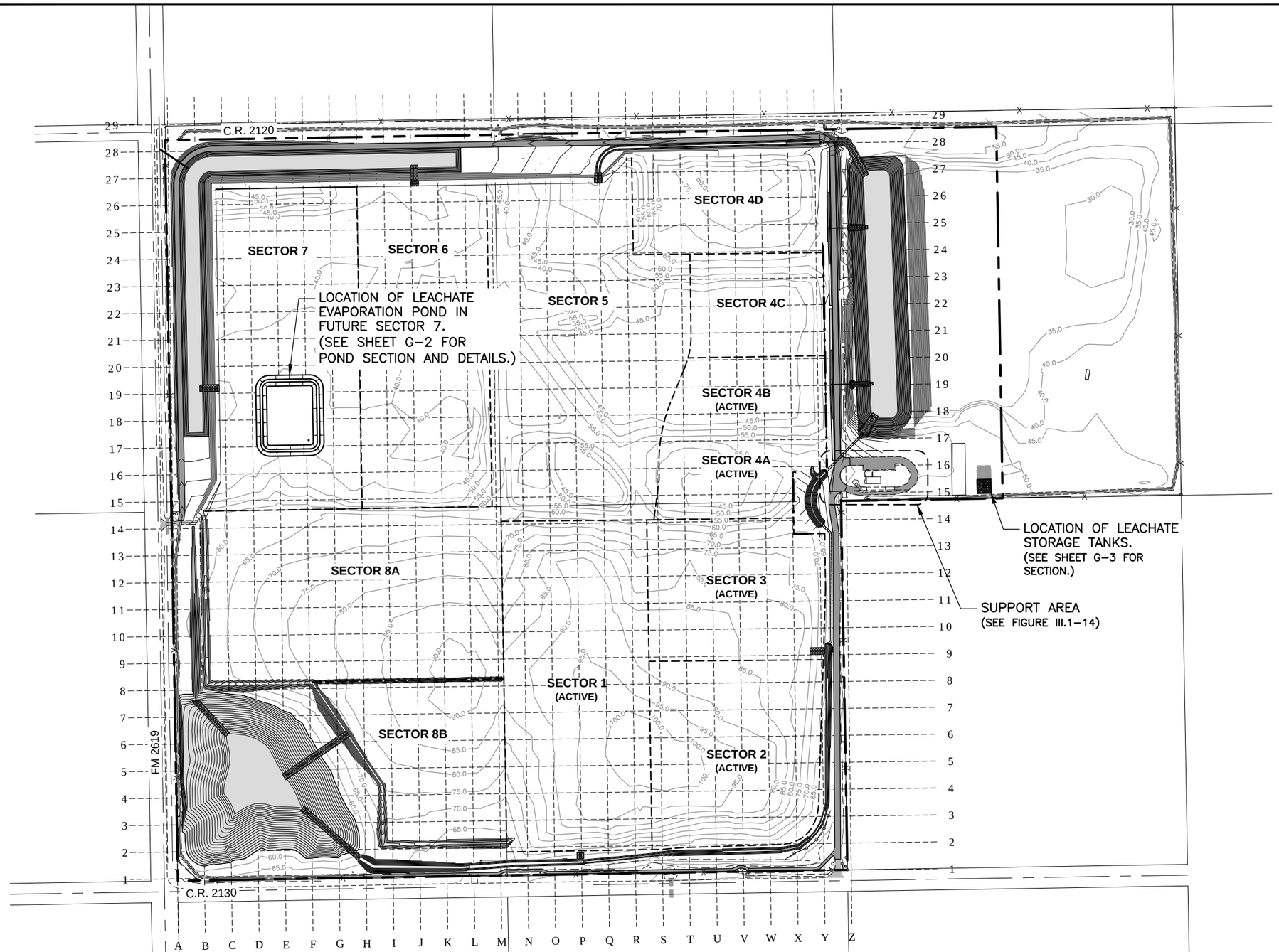
(Ord. 2004-32, passed 10-11-04)

Secs. 5-2-45—5-2-49. - Reserved.

APPENDIX G

LEACHATE STORAGE FACILITY DESIGN





N
W E
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400 200 0 400

GRAPHIC SCALE IN FEET

LEGEND:

- EXISTING FENCE CORNER
- EXISTING FENCE
- EXISTING CONTOUR
- EXISTING ROAD
- PERMIT BOUNDARY LIMITS
- PROPOSED ROAD
- PROPOSED STORMWATER LETDOWN STRUCTURE
- PROPOSED STORMWATER PONDS

NUMBER	REVISION	DATE	DRAWN	DESIGNED	REVIEWED

STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18

Jose C. Garza, P.E.

Hanson No. 16L0438
Filename
Scale 1"=40'
Date 09/12/2018

LAYOUT	DT	09/12/2018
DRAWN	DT	09/12/2018
REVIEWED	JMR	09/12/2018

HANSON

Hanson Professional Services Inc.
4501 Gollihar Rd.
Corpus Chrisiti, Texas 78411

TBPE F-417
TBPLS F-10039500
TBPG F-50556
TBAE F-BR 2458

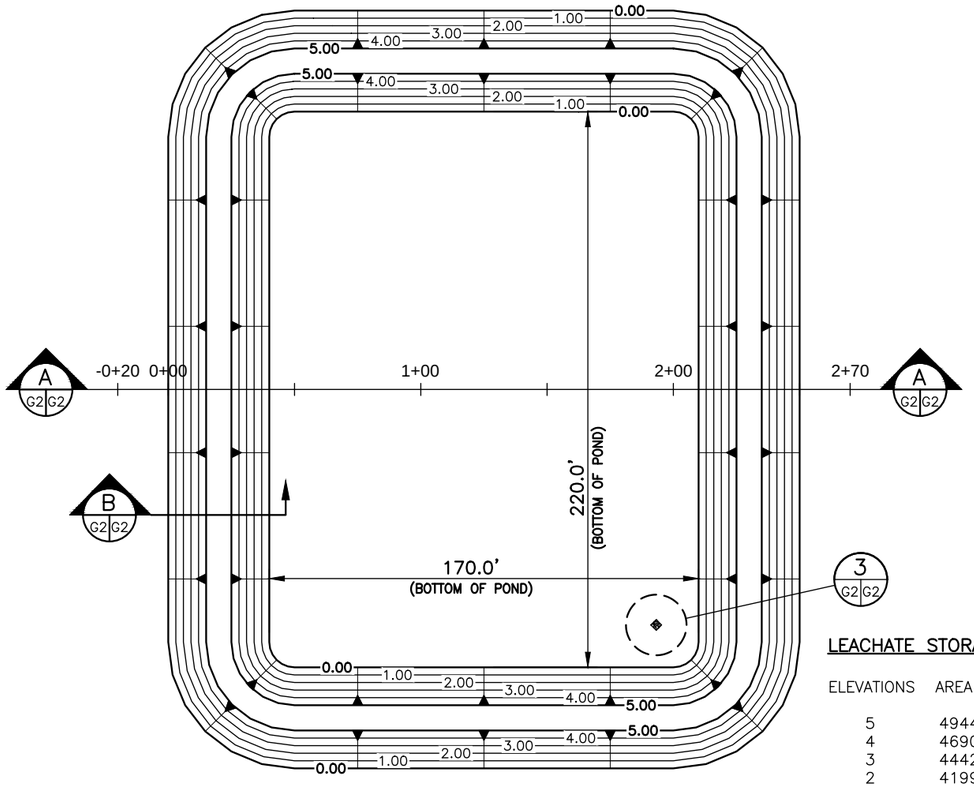
Phone: (361) 814-9900
(800) 677-2831
www.hanson-inc.com
Offices Nationwide

PART III, ATTACHMENT 15, APPENDIX G
LEACHATE STORAGE FACILITY SITE PLAN
CITY OF KINGSVILLE LANDFILL

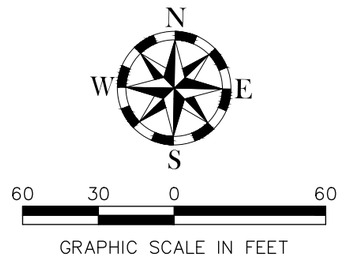
MSW PERMIT No. 235-C
KINGSVILLE, TEXAS
KLEBERG COUNTY, TEXAS

FIGURE:
III.15-G-1

SEP 11, 2018 1:45 PM TORRE01809
I:\16JOBS\16L0438\8514-CITY OF KINGSVILLE\8514-03\CAD-PART-II\8514-03-LEACHATESTORAGEFACILITY-SITEPLAN.DWG

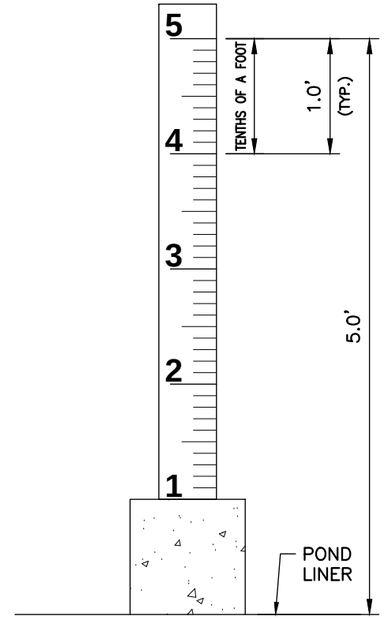


1 G2 G2 PLAN – LEACHATE STORAGE POND
SCALE: 1"=60'

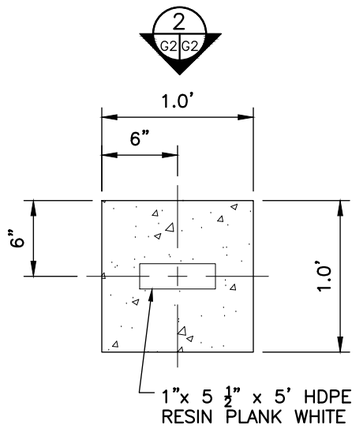


LEACHATE STORAGE POND

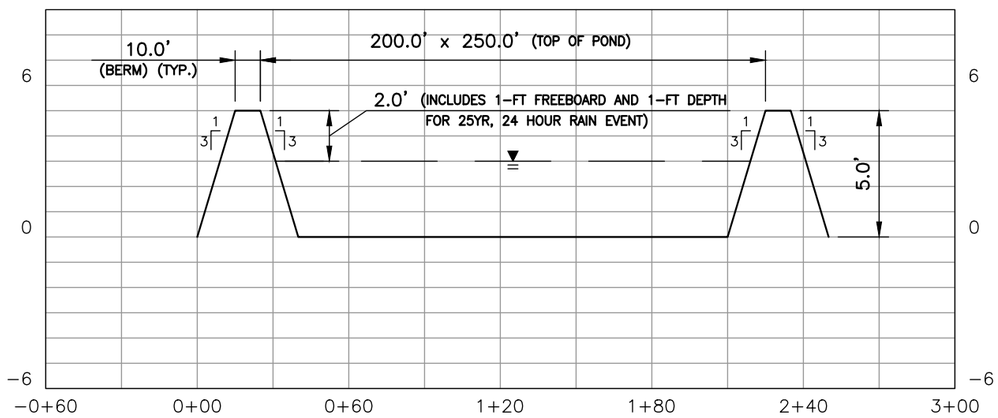
ELEVATIONS	AREA (SF)	AREA (AC)	PERIMETER	GALLONS
5	49441.14	1.14	856.63	1,617,699.60
4	46903.22	1.08	837.84	1,257,469.61
3	44421.20	1.02	819.04	915,888.60
2	41995.09	0.96	800.24	592,797.03
1	39624.89	0.91	781.45	287,576.90
0	37310.58	0.86	762.65	0.00



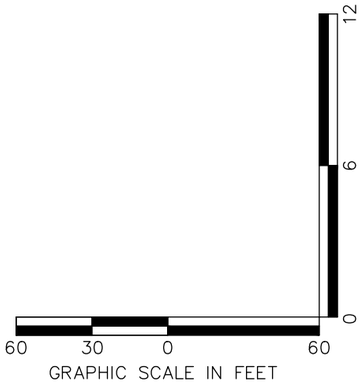
2 G2 G2 ELEVATION – POND LEVEL GAUGE
SCALE: N.T.S.

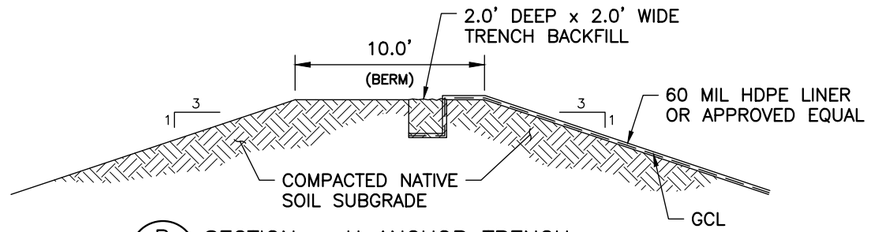


3 G2 G2 PLAN – LEVEL GAUGE
SCALE: N.T.S.



A G2 G2 SECTION – LEACHATE STORAGE POND
SCALE: H:1"=60', V:1"=6'





B G2 G2 SECTION – U ANCHOR TRENCH
SCALE: N.T.S.

NUMBER	REVISION	DATE	DRAWN	DESIGNED	REVIEWED

STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18
Jose C. Garza, P.E.

Hanson No. 16L0438
Filename
Scale AS SHOWN
Date 09/12/2018

LAYOUT	DT	09/12/2018
DRAWN	DT	09/12/2018
REVIEWED	JMR	09/12/2018

HANSON

Hanson Professional Services Inc.
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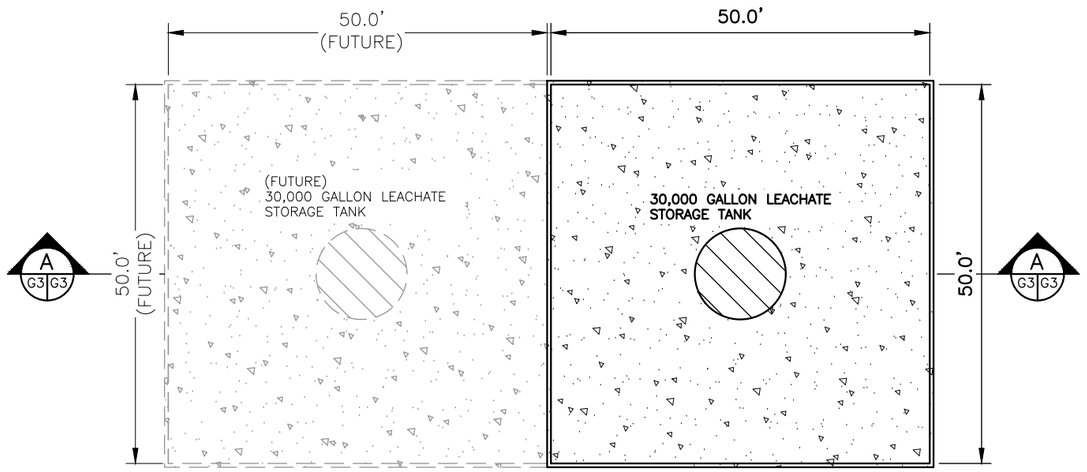
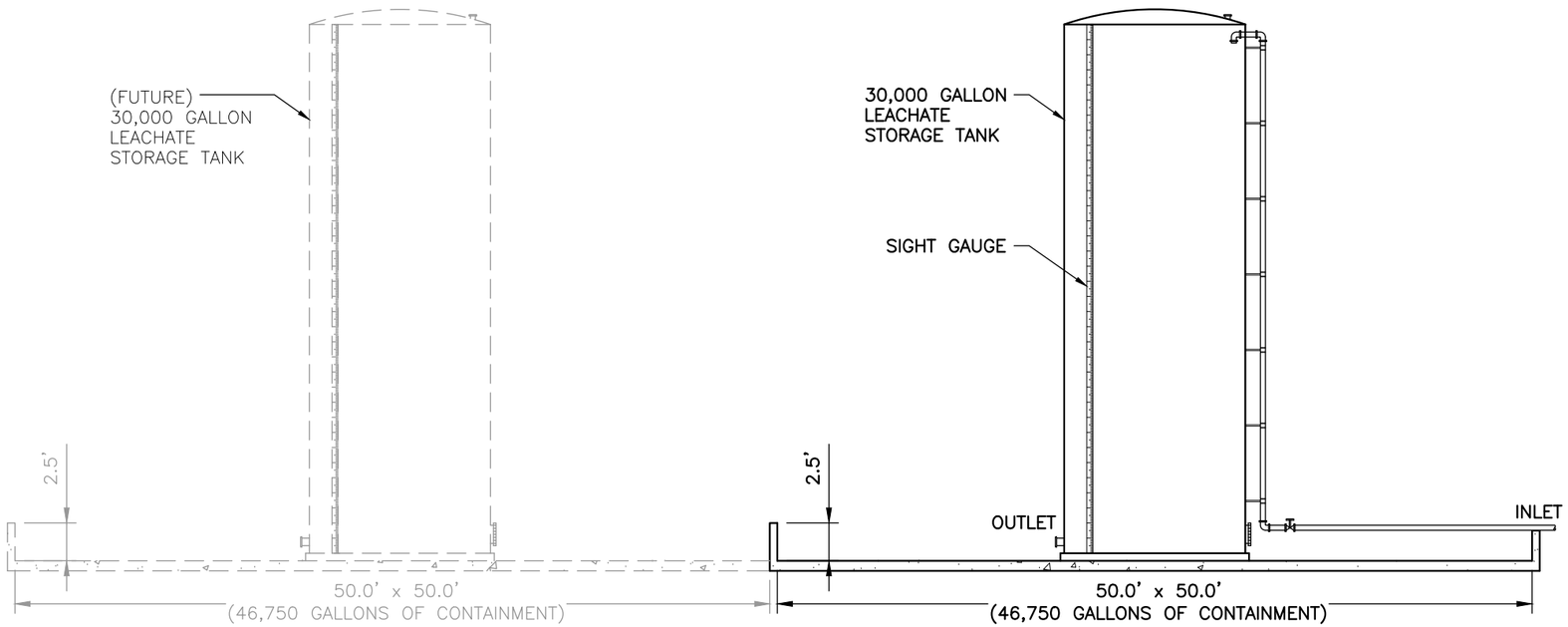
PART III, ATTACHMENT 15, APPENDIX G
LEACHATE STORAGE POND
CITY OF KINGSVILLE LANDFILL
MSW PERMIT No. 235-C
KINGSVILLE, TEXAS
KLEBERG COUNTY, TEXAS

FIGURE:
III.15-G-2



1 / G3 G3 PLAN – LEACHATE STORAGE TANK & CONTAINMENT
1"=20'

NOTE:
THE LEACHATE WILL BE PERIODICALLY COLLECTED AND TAKEN OR PUMPED DIRECTLY TO THE CITY OF KINGSVILLE MUNICIPAL WASTEWATER TREATMENT PLANT.



A / G3 G3 SECTION – LEACHATE STORAGE TANK & CONTAINMENT
1"=10'

NUMBER	REVISION	DATE	DRAWN	DESIGNED	REVIEWED

STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED
PROFESSIONAL ENGINEER
09/12/18
Jose C. Garza, P.E.

Hanson No. 16L0438
Filename
Scale AS SHOWN
Date 09/12/2018

LAYOUT	DT	09/12/2018
DRAWN	DT	09/12/2018
REVIEWED	JMR	09/12/2018

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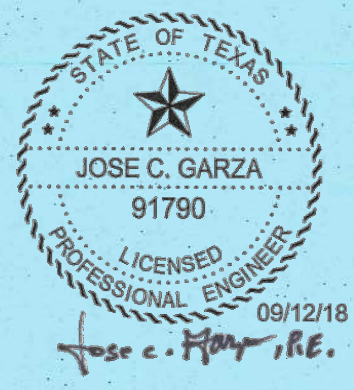
PART III, ATTACHMENT 15, APPENDIX G
LEACHATE STORAGE TANK & CONTAINMENT
CITY OF KINGSVILLE LANDFILL
MSW PERMIT No. 235-C
KINGSVILLE, TEXAS
KLEBERG COUNTY, TEXAS

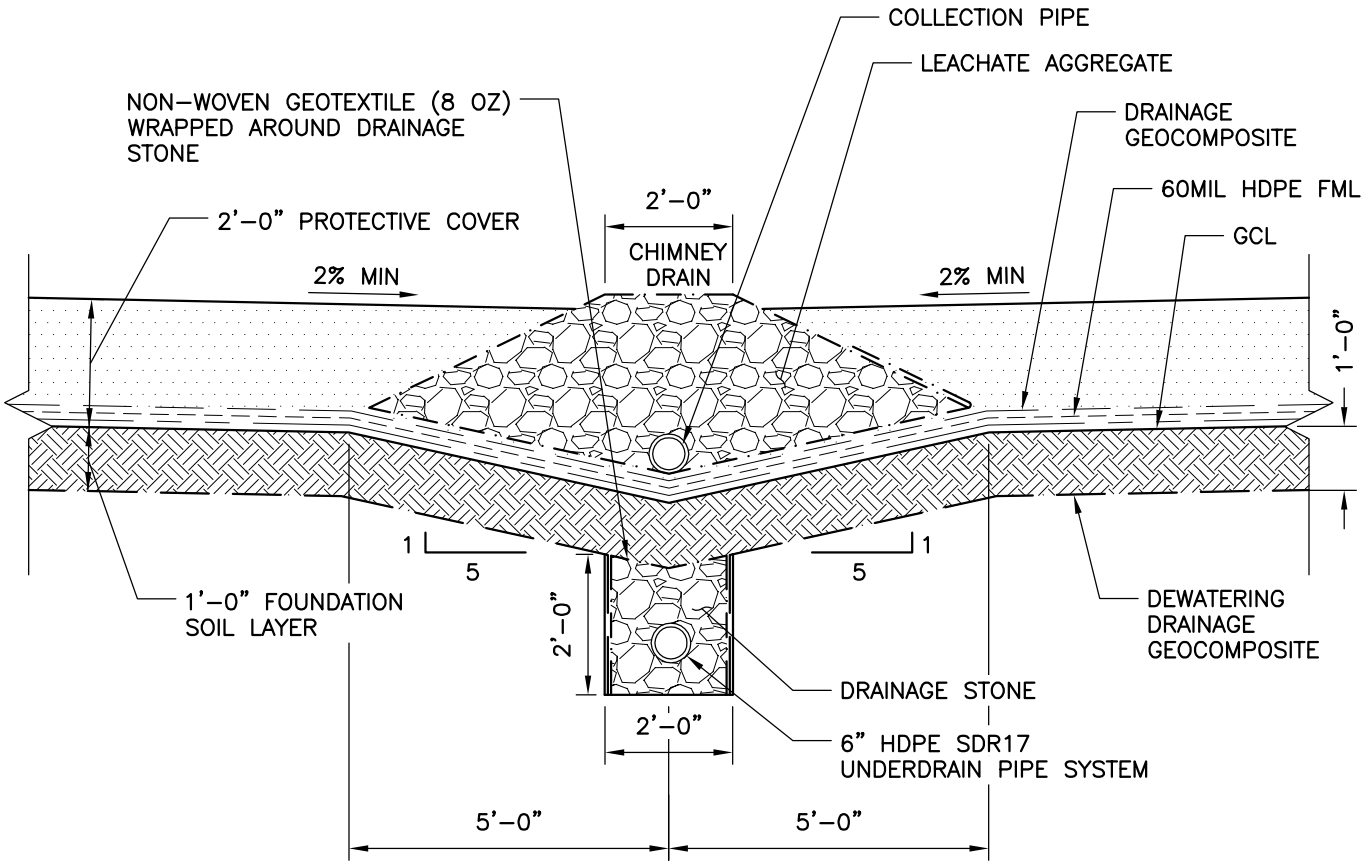
FIGURE:
III.15-G-3

SEP 11, 2018 1:50 PM TORREO1809
I:\16JOBS\16L0438\8514-CITY OF KINGSVILLE\8514-03\CAD-PART-II\8514-03-LEACHATESTORAGETANKCONTAINMENT.DWG

APPENDIX H

LEACHATE COLLECTION SYSTEM DESIGN DETAILS





1 III.15-H-1 III.15-H-1

LEACHATE SYSTEM – DETAIL

SCALE: 1"=3'

STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED PROFESSIONAL ENGINEER
09/12/18

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PART III, ATTACHMENT 15, APPENDIX H
LEACHATE SYSTEM - DETAIL
CITY OF KINGSVILLE LANDFILL

MSW PERMIT No.235-C
KINGSVILLE, TEXAS
KLEBERG COUNTY, TEXAS

Drawn By: DT	Appr. By: JCG	Scale: AS SHOWN	Dwg. File: 8514-03-LeachateSystem-Detail	FIGURE: III.15-H-1
Checked By: JCG	Project No.: 16L0438	Date: 09/12/2018	Rev.:	

SEP 12, 2018 8:00 PM TORRE01809
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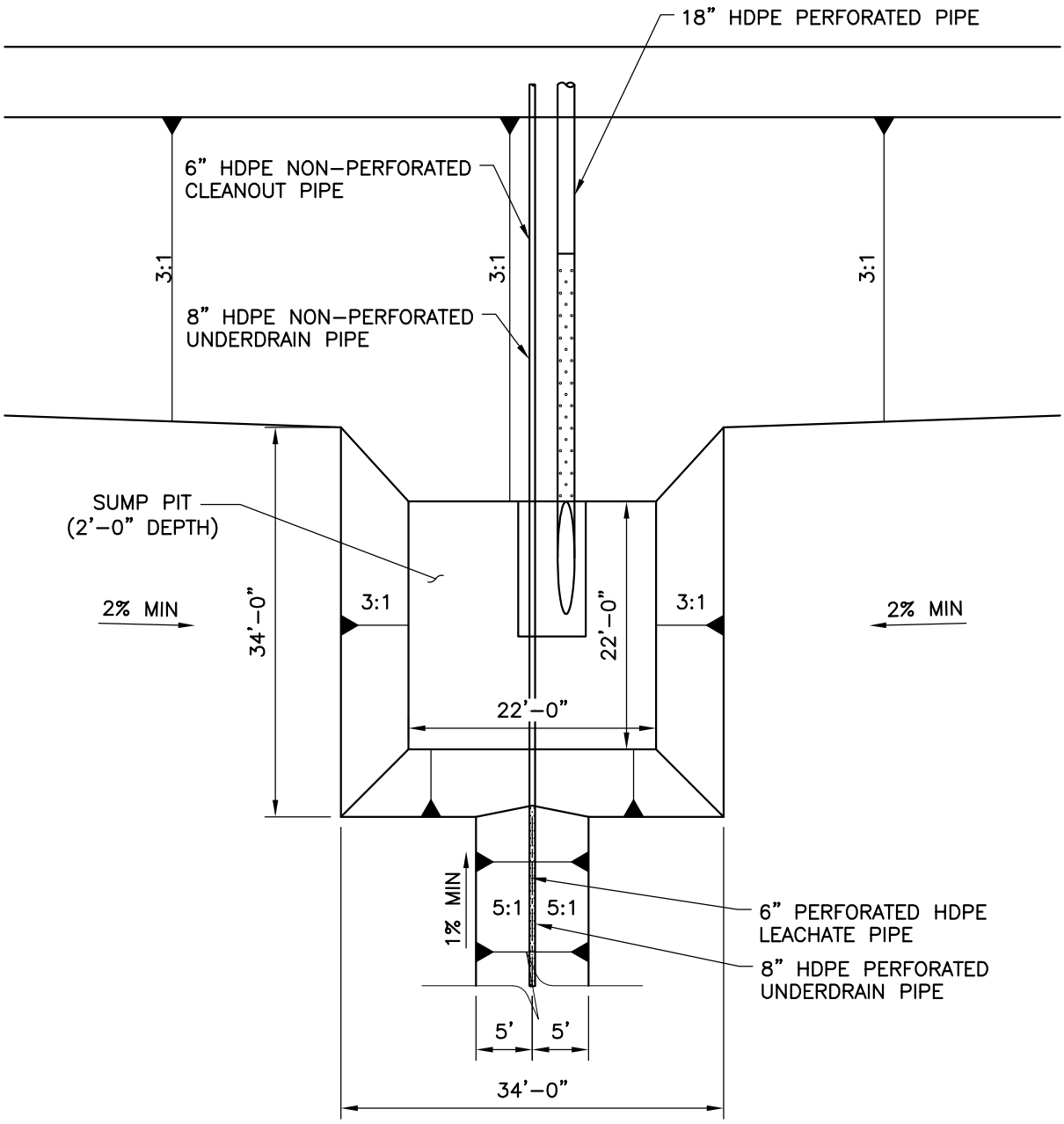

1 — LEACHATE COLLECTION SUMP – DETAIL

SCALE: N.T.S.

STATE OF TEXAS
JOSE C. GARZA
91790
LICENSED PROFESSIONAL ENGINEER
09/12/18

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PART III, ATTACHMENT 15, APPENDIX H
LEACHATE SYSTEM SUMP DETAIL
CITY OF KINGSVILLE LANDFILL
MSW PERMIT No.235-C
KINGSVILLE, TEXAS
KLEBERG COUNTY, TEXAS

Drawn By:	Appr. By:	Scale:	Dwg. File:	FIGURE:
DT	JMR	AS SHOWN	8514-03-LeachateSystem-Detail	III.15-H-2
Checked By: JMR	Project No.: 16L0438	Date: 09/12/2018	Rev.:	

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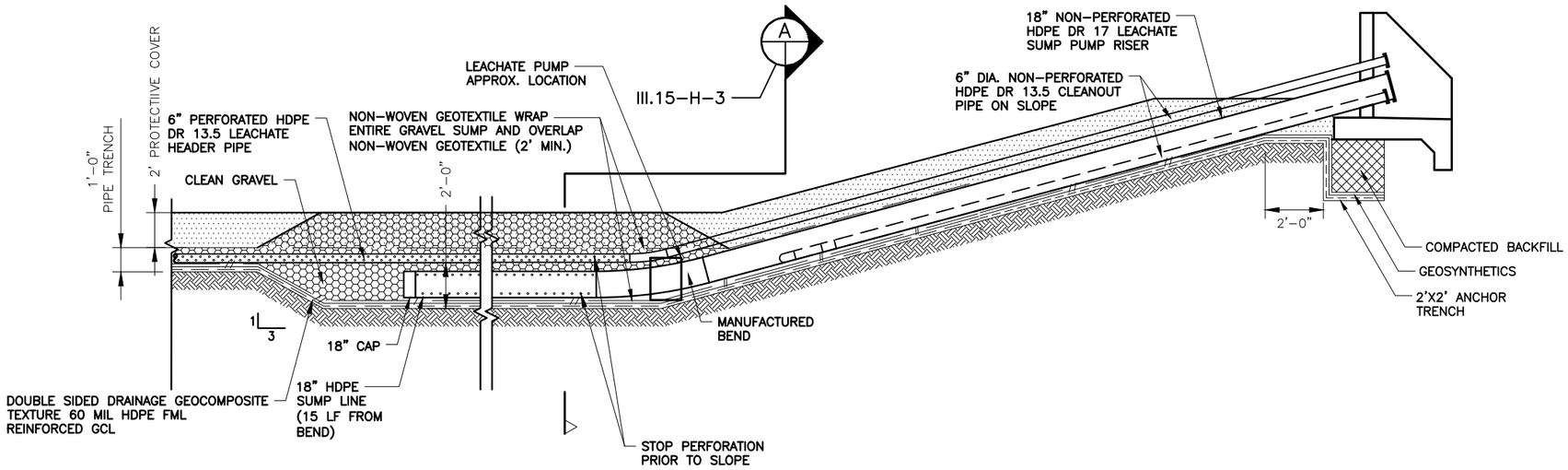
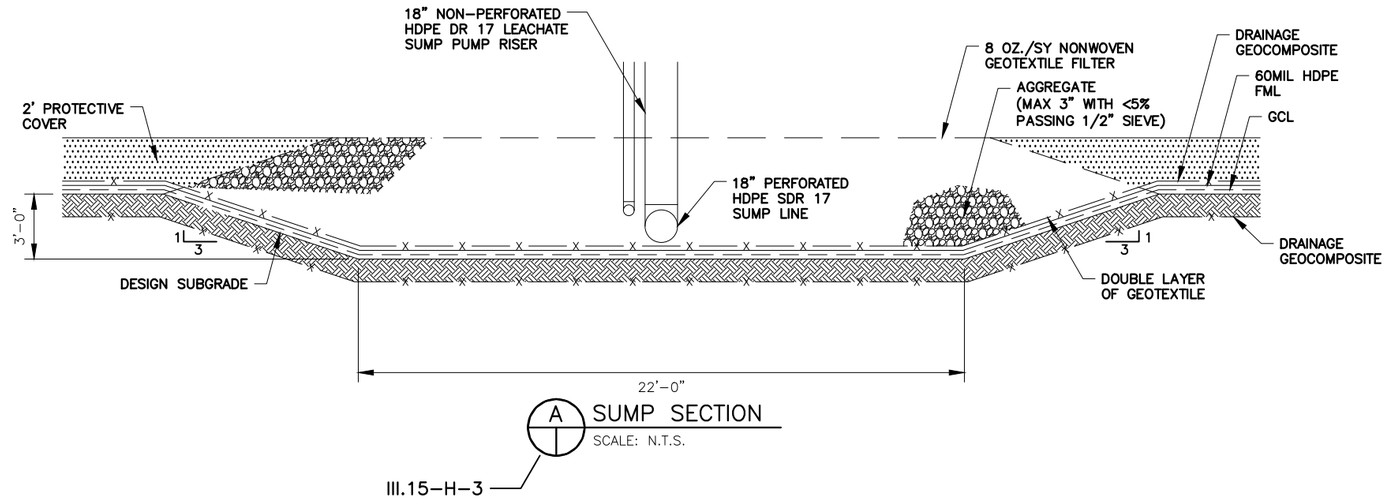


NOTE:
INSTALL 2 LAYERS OF 60MIL HPDE GEOMEMBRANE ABOVE PRIMARY GEOMEMBRANE. TACK WELD 2 LAYERS 10' BEYOND TOP OF SUMP.

1 TYPICAL SUMP SECTION
SCALE: N.T.S.
III.15-H-3



A SUMP SECTION
SCALE: N.T.S.
III.15-H-3

SEP 13, 2018 11:39 AM TORREO1809
I:\16JOBS\16L0438\8514-03\CAD-PART-III\8514-03-PERMIT DETAILS.DWG

NUMBER	REVISION	DATE	DRAWN	DESIGNED	REVIEWED

STATE OF TEXAS
JON M. REINHARD
64541
LICENSED
PROFESSIONAL ENGINEER
09/12/18

Hanson No. 16L0438
Filename 8514-03-PERMIT DETAILS
Scale AS SHOWN
Date 09/12/2018

LAYOUT	DT	09/12/2018
DRAWN	DT	09/12/2018
REVIEWED	JMR	09/12/2018

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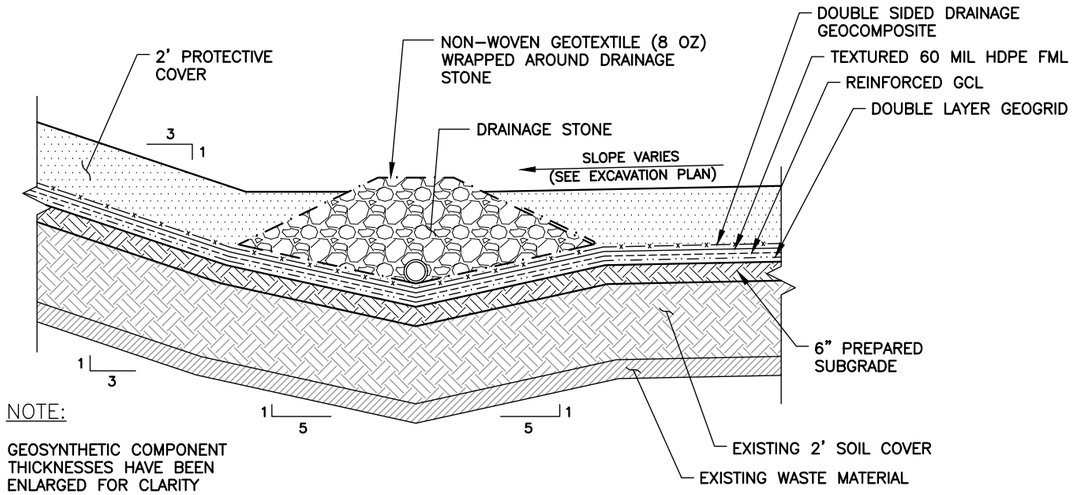
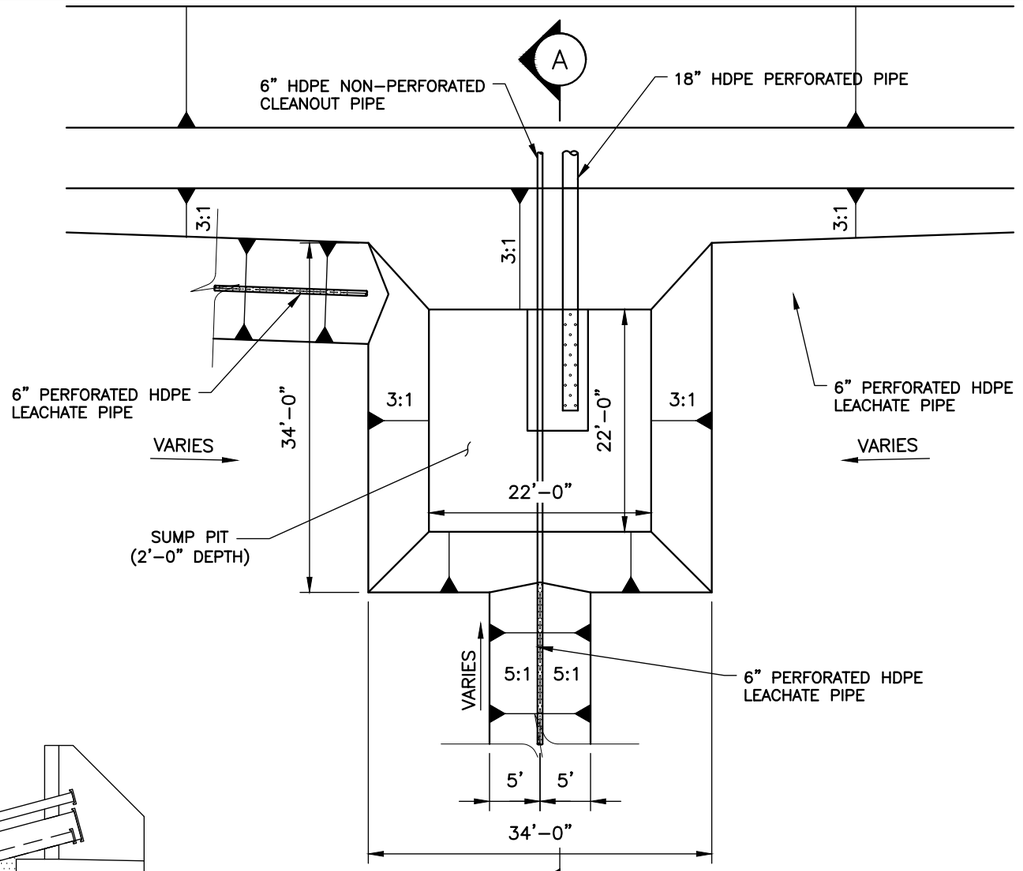
PART III, ATTACHMENT 15, APPENDIX H
LEACHATE COLLECTION SUMP SECTIONS
CITY OF KINGSVILLE LANDFILL
MSW PERMIT No. 235-C
KINGSVILLE, TEXAS
KLEBERG COUNTY, TEXAS

FIGURE:
III.15-H-3

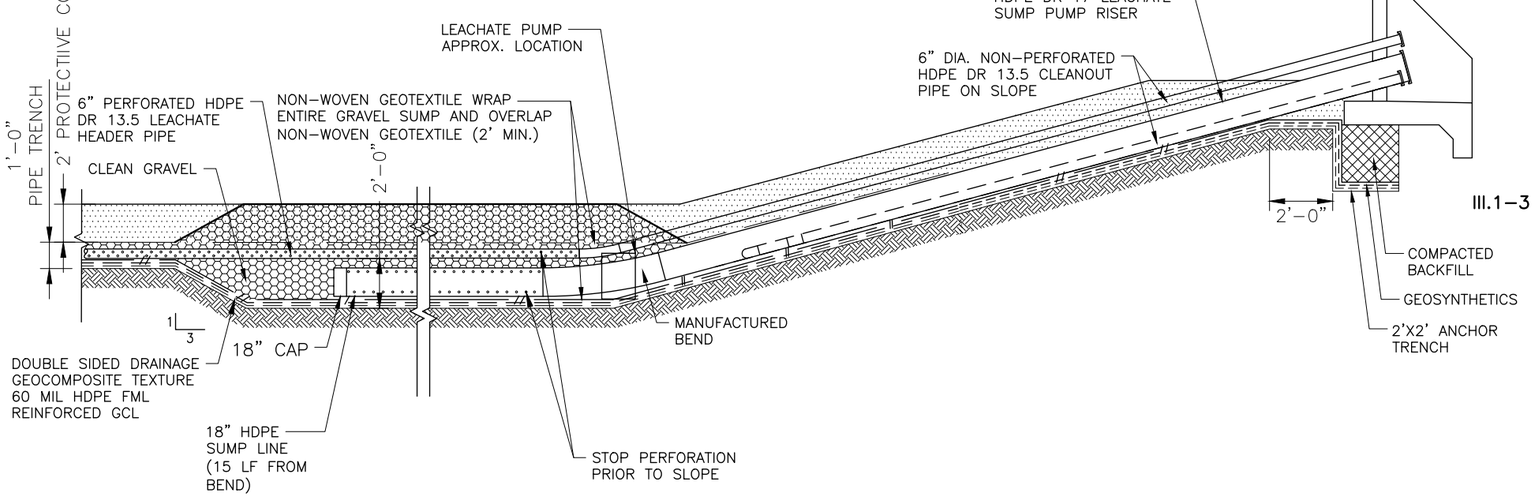


NOTE:
GEOSYNTHETIC COMPONENT THICKNESSES HAVE BEEN ENLARGED FOR CLARITY

1 LEACHATE SYSTEM – PIGGY BACK OVERLINER – DETAIL
SCALE: 1"=3'
III.1–3



2 LEACHATE COLLECTION SUMP – PIGGY BACK OVERLINER
SCALE: N.T.S.
III.1–3



NOTE:
INSTALL 2 LAYERS OF 60MIL HPDE GEOMEMBRANE ABOVE PRIMARY GEOMEMBRANE. TACK WELD 2 LAYERS 10' BEYOND TOP OF SUMP.

A TYPICAL SUMP – SECTION
SCALE: N.T.S.

NUMBER	REVISION	DATE	DRAWN	DESIGNED	REVIEWED

STATE OF TEXAS
JON M. REINHARD
64541
LICENSED PROFESSIONAL ENGINEER
09/12/18

Hanson No. 16L0438
Filename
Scale AS SHOWN
Date 09/12/2018

LAYOUT	DT	09/12/2018
DRAWN	DT	09/12/2018
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PART III, ATTACHMENT 15, APPENDIX H
LEACHATE DETAILS - PIGGY BACK OVERLINER
CITY OF KINGSVILLE LANDFILL
MSW PERMIT No. 235-C
KINGSVILLE, TEXAS
KLEBERG COUNTY, TEXAS

FIGURE:
III.15-H-4

THE CITY OF KINGSVILLE LANDFILL
TCEQ PERMIT MSW 235-C

PERMIT AMENDMENT APPLICATION
PART IV

CITY OF KINGSVILLE, TEXAS

September 2018

Revision 0

Prepared by

HANSON
Engineering | Planning | Allied Services

HANSON PROJECT NO. 16L0438-0003

TABLE OF CONTENTS

STATE OF TEXAS
JON M. REINHARD
64541
LICENSED PROFESSIONAL ENGINEER
09/12/18
For Pages i - v

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

LIST OF ACRONYMS

ADC – Alternate Daily Cover
CESQG – Conditionally Exempt Small Quantity Generator
CFC – Chlorinated Fluorocarbon
CFR – Code of Federal Regulations
DIY – Do It Yourself
EPA – Environmental Protection Agency
GLER – Geosynthetics Liner Evaluation Report
GWSAP – Groundwater Sampling and Analysis Plan
LCS – Leachate Collection System
LCWMP – Leachate and Contaminated Water Management Plan
LFG – Landfill Gas
LGMP – Landfill Gas Management Plan
LQCP – Liner Quality Control Plan
M/S – Landfill Manager/Supervisor
MSW – Municipal Solid Waste
MSWLF – Municipal Solid Waste Landfill
MSWMR – Municipal Solid Waste Management Regulations
PCB – Polychlorinated Biphenyl
RRC – Railroad Commission of Texas
SDP – Site Development Plan
SLER – Soil Liner Evaluation Report
SOP – Site Operating Plan
SOR – Site Operating Record
SPCC – Spill Prevention, Control, and Countermeasures Plan
SWAP – Special Waste Acceptance Plan
SWPPP – Stormwater Pollution Prevention Plan
TAC – Texas Administrative Code
TCEQ – Texas Commission on Environmental Quality
TPDES – Texas Pollutant Discharge Elimination System
TXDOT – Texas Department of Transportation

1 INTRODUCTION

The City of Kingsville Landfill (Kingsville Landfill/facility), Municipal Solid Waste Permit 235-B, is located southeast of the City of Kingsville at the northeast corner of the intersection of Farm to Market Road 2619 and County Road 2130. The City of Kingsville Landfill is owned and operated by the City of Kingsville (City). The facility services residences and businesses within Kleberg County and portions of several surrounding counties, including Nueces, Jim Wells, Brooks and Kenedy.

This Site Operating Plan (SOP) is being submitted as part of a lateral and vertical landfill expansion permit amendment. The SOP consists of procedures to be followed by the landfill personnel for day-to-day operations at the City of Kingsville Landfill, a Type I Municipal Solid Waste (MSW) facility that may also receive construction and demolition debris, and other non-putrescible wastes and special wastes. The SOP is submitted to address the requirements of 30 TAC §330.65 and §330.121 through §330.179.

Pursuant to §330.121 this SOP, along with the site permit, site development plan, records specified in §330.125, and a current copy of the Municipal Solid Waste Management Regulations (MSWMR), will be maintained in the Site Operating Record (SOR). The City of Kingsville Landfill will be operated in accordance with the requirements of this SOP and other applicable local, state, or federal regulations. The SOP will be retained as part of the operating record during the active life of the site and throughout the post-closure maintenance period.

1.1 PRE-OPERATION NOTICE §330.123

The facility, in accordance with §330.123, will provide written notice to TCEQ in the form of a Soils and Liner Evaluation Report (SLER), and/or Geosynthetic Clay Liner Evaluation Report (GCLER) and Geomembrane Liner Evaluation Report (GLER) detailing the final construction and lining of a new disposal cell. The reports will be submitted to the Texas Commission on Environmental Quality (TCEQ) for review and approval prior to the placement of any waste in the new cell. If verbal or written response from the TCEQ is not provided by the end of the 14th day following TCEQ receipt of the report(s), the Municipal Solid Waste Landfill (MSWLF) unit will be considered approved for placement of solid waste.

1.2 RECORDKEEPING REQUIREMENTS §330.125

A copy of the current SOP, Site Permit, Site Development Plan (SDP), Final Closure Plan, Post-Closure Plan, Leachate and Contaminated Water Management Plan (LCWMP), Groundwater Sampling and Analysis Plan (GWSAP), Landfill Gas Management Plan (LGMP), and any other plans required by the permit along with all issued modifications, and any temporary authorizations granted will be maintained in the Site Operating Record (SOR) at the City of Kingsville Landfill or at an alternated location approved by the TCEQ.

The owner or operator will within seven working days of completion or receipt of analytical data, as appropriate, record and retain the following information in the SOR.

- Any and all Location Restriction Demonstrations (§330.125(b)(1));
- Inspection records, training procedures, and notification procedures relating to excluding the receipt of prohibited waste (§330.125(b)(2));
- Results from gas monitoring and any remediation plans relating to explosive and other gases (§330.125(b)(3));
- Unit design documentation for the placement of leachate or gas condensate in a municipal solid waste landfill (§330.125(b)(4));
- Demonstration, certification, findings, monitoring, testing, and analytical data relating to groundwater monitoring and collective action (§330.125(b)(5));
- Closure and post-closure care plans, and any monitoring, testing, or analytical data relating to post-closure requirements (§ 330.125(b)(6));
- Cost estimates and financial assurance documentation relating to financial assurance for closure and post-closure care (§330.125(b)(7));
- Any and all information demonstrating compliance with the small community exemption criteria (§330.125(b)(8));
- Copies of all correspondence and responses relating to the operation of the facility, modifications to the permit, approvals, and other matters pertaining to technical assistance (§330.125(b)(9));
- Documents, manifests, trip tickets, etc. involving special waste (§330.125(b)(10));
- For any spray-applied alternative daily cover (ADC) material, records of the application rate and total amount of ADC applied to the working face on those days in which ADC is applied;
- Training records (§330.125(e));
- Personnel operator licenses (§330.125(f));
- Annual waste acceptance rate (§330.125(h));
- Records of unauthorized material removal (§330.125(b));
- Records of alternate or additional operating hours (§330.125(c));
- Documentation of weekly landfill marker inspection (§330.143);
- Landfill gas management plan required reports and submittals (§330.159);
- Cover inspection record (§330.165(h));
- RACM acceptance records (§330.171(e)(3)(B)) NOTE SITE DOES NOT ACCEPT RACM; and
- Any other document(s) as specified by the approved permit or by the TCEQ Executive Director.

Recordkeeping requirements and recommendations are further summarized in the table below.

The SOR will maintain all required documents in an organized format and in accordance with the time frames specified in 330.125(b), and will be furnished upon request to the executive director and will be made available for inspection by the executive director. The executive director may set alternative schedules for recordkeeping and notification requirements.

TABLE 1: RECORDKEEPING REQUIREMENTS AND RECOMMENDATIONS

RECORDS TO BE MAINTAINED	FREQUENCY	RULE CITATION
Location restriction demonstration	Submittal of Permit Application	§330.125(b)(1)
Prohibited waste inspection records, training and receipt notification procedures	Per Occurrence	§330.125(b)(2)
Gas monitoring results	Quarterly	§330.125(b)(3);§330.125
Remediation plans for explosive and other gases	Per Occurrence	§330.125(b)(3)
Unit design documentation for leachate or gas condensation placement	As Required	§330.125(b)(4)
Groundwater monitoring and corrective action demonstration, certification, monitoring, testing, and analytical data	Per Occurrence	§330.125(b)(5)
Closure and post-closure care plans	Submittal of Permit Application	§330.125(b)(6)
Post-closure monitoring, testing and analytical data	Per Occurrence	§330.125(b)(6)
Cost estimates and financial assurance documentation for closure and post-closure	Annually	§330.125(b)(7)
Facility operation, permit modification, approvals and technical assistance correspondence and responses	Per Occurrence	§330.125(b)(9)
Special waste manifests, trip tickets and all other documents relating to special waste	Per Occurrence	§330.125(b)(10)
Spray-applied ADC application rate and total amount ADC applied to working face	Per Occurrence	§330.125(b)(11)
Other documents specified in the permit or by the Executive Director	As Needed	§330.125(b)(12)
Personnel training records per §335.586(d)-(e)	As Needed	§330.125(e)
Personnel operator licenses	As Needed	§330.125(f)
Annual waste acceptance documentation	Annually	§330.125(h)
Quarterly solid waste summary report	Quarterly	§330.675
Annual solid waste summary report	Annually	§330.675
Unauthorized material removal	Per Occurrence	§330.133(b)
Weekly landfill marker inspections	Weekly	§330.143
Landfill gas management reports and submittals	Per Occurrence	§330.159
Cover inspection record	Daily	§330.165(h)
Site access road records	Monthly	Section 4.16
Access control inspections and maintenance	Daily/Weekly	Section 4.5
Notices for access control breaches and repairs	Per Occurrence	Section 4.5
Fire occurrence notices	Per Occurrence	Section 4.4
Ponded water records	Weekly	Section 4.23
Daily log of on-site litter pickup	Daily	Section 4.9
Daily log of litter and debris pickup along public roads	Daily	Section 4.12
Additional temporary operating hours	Per Occurrence	Section 4.7

1.2.1 Breach Related Reporting and Records

Pursuant to §330.131, a notice is required to be given to the commission's regional office to document when a breach is detected and when a repair is completed, if the repair is not completed within eight hours. The commission's regional office must be notified of the breach within 24 hours of detection. The breach must be temporarily repaired within 24 hours of detection and must be permanently repaired by the time specified to the commission's regional office when it was reported in the initial breach report. If a permanent repair can be made within eight hours of detection, no notice to the commission's regional office is required. A copy of these notices will be retained in the Site Operating Record (SOR) in accordance with §330.125(b)(9). Also, a log of access inspections will be generated and maintained to demonstrate compliance with §330.131

The following table summarizes the repair and reporting requirements for access breaches repaired within 8 hours and not permanently repaired in 8 hours.

TABLE 2: REPAIR AND REPORTING REQUIREMENTS FOR ACCESS BREACHES

REQUIREMENTS	ACCESS BREACH CAN BE PERMANENTLY REPAIRED WITHIN 8 HOURS	ACCESS BREACH CANNOT BE PERMANENTLY REPAIRED WITHIN 8 HOURS
Notification to TCEQ regional office of breach and repair schedule	**NOT** required	**Required** within **24 hours**
Temporary repairs **Must** be completed	Does **NOT** apply	Within **24 hours**
Permanent repairs **Must** be completed	Within 8 hours	Within the schedule submitted to TCEQ regional office in the initial notice
Notification to TCEQ regional office when permanent repair is completed	**NOT** Required	Required within the schedule submitted to the TCEQ regional office in the initial notice

1.2.2 Fire Incident Reporting and Records

The permittee will notify the TCEQ's regional office of the occurrence of any fire related to municipal solid waste activities that cannot be extinguished within 10 minutes of detection. This notice will be made by telephone no later than four hours from fire detection and in writing within 14 days of detection in accordance with 30 TAC §330.129. Documentation of these notices will be maintained in the SOR.

The following agencies or personnel will be contacted

- Fire – 911
- Landfill Manager – Landfill Office
- TCEQ Regional Office

1.2.3 Personnel Training Records

The facility will maintain personnel training records in accordance with 30 TAC §335.586(d) and (e), as follows:

1. The job title for each position at the facility related to waste management, and the name of the employee filling each job;
2. A written job description for each position listed under paragraph (1). This description must include the requisite skill, education, or other qualifications, and duties of employees assigned to each position;
3. A written description of the type and amount of both introductory and continuing training that will be given each person filling a position listed under paragraph (1); and
4. Records that document that the required training or job experience has been given to, and completed by, facility personnel.

A designated manager with supervisory responsibility over the facility will maintain appropriate operator licenses in accordance with 30 TAC §30, Subchapter F (30 TAC §30.201 to 30.212).

1.2.4 Waste Inspections and Unauthorized Waste Reporting

The facility will maintain and include in the Site Operating Record (SOR), load inspection reports and records of regulated hazardous or PCB waste notifications. The reports will include the date and time of the inspection, the name of the hauling company and driver, the type of vehicle, the size and source of the load, contents of the load, indicators of prohibited waste, and the results of the inspection. A record of any removal of unauthorized material will be maintained in the site operating record.

1.2.5 Windblown Litter Control Records

A log documenting the daily litter pick up activities will be generated and maintained to demonstrate compliance with §330.139 and 330.145.

A log documenting the daily clean up of mud and debris from the site access roads will be generated and maintained to demonstrate compliance with §330.153.

1.2.6 Intermediate and Final Cover Reporting and Records

As intermediate/final cover is applied to the landfill, a log will be maintained of the area covered, date applied, thickness and activities and management practices as per 30 TAC §330.165(h). Any damage to the cover, including anticipated repairs will be reported to the TCEQ and repaired within five days.

1.2.7 Long-Term Record Keeping

All information contained in the operating record will be available for inspection upon request. The permittee will retain the different plans required for the facility and all information contained within the SOR, for the life of the facility, including the post-closure care period.

1.3 ANNUAL WASTE ACCEPTANCE RATE §330.125(h)

As per waste acceptance rate requirements of 30 TAC §330.125(h) and 30 TAC §330.675, the City of Kingsville is required to perform quarterly reporting to TCEQ. The waste acceptance rate monitoring is intended to ensure that the facility's operations continue to be adequate when the waste acceptance rates increase. The City of Kingsville will maintain records to document the annual waste acceptance rate for the facility. Documentation will include maintaining the quarterly solid waste summary reports and the annual solid waste summary reports.

Whenever the waste acceptance rate as established by the sum of the previous four quarterly summary reports exceeds the current operating rate upon which equipment and personnel staffing has been based, and the waste increase is not due to a temporary occurrence, the Landfill Manager or Supervisor (M/S) will implement the personnel and equipment changes specified in Table 3-City of Kingsville Waste Volume Equipment Schedule to ensure that the site personnel and equipment necessary to safely manage the waste are available. Data will be generated from actual scale data.

If any annual waste acceptance rate exceeds the rate estimated in the landfill permit application and the waste increase is not due to a temporary occurrence, the permittee will file an application to modify the permit, including the revised estimated waste acceptance rate, within 90 days of the exceedance as established by the sum of the previous four quarterly summary reports. This modification application will be submitted to the Executive Director. The permit modification application will propose any needed changes in the site operating plan necessary to manage the increased waste volume in terms of equipment and manpower to protect public health and the environment that are beyond the scope addressed in the current approved permit application. The estimated waste acceptance rate in the facility permit application is not intended to establish a limiting parameter of the landfill permit or the facility operation.

As provided in Part II, Section 2.2 the estimated waste acceptance rate is based on the annual acceptance rate of 31,444 tons reported in the 2017 MSW Annual Report and an annual increase of one (1) percent based on the Texas State Center population projections for Kleberg County. The estimated waste acceptance rate per §330.125(h) for 2018 is 101.46 tons per day of waste. If the site is operated 6 days a week for 313 days a year, this equates to an annual waste acceptance rate of 31,758 tons. The estimated annual waste acceptance rate projections for the next five (5) years are provided in Part II, Section 2.1, Table 1: Estimated Maximum Annual Waste Acceptance Rate.

2 PERSONNEL §330.127(1)

The landfill personnel will include, at a minimum, a M/S, two Equipment Operators, a Gate/Scale Attendant, and at least one Laborer(s) for other assigned tasks. The organizational chart (Figure 1) at the end of this section provides the positions and chain-of-command of personnel necessary to operate this facility.

2.0 Landfill Manager/Supervisor

The M/S will be responsible for all activities at the landfill and will be the designated contact person for regulatory compliance matters. He/she will provide on-site management of the landfill operations and will be responsible for the implementation of site permit requirements. The M/S will maintain an adequate level of competency, training and experience to fulfil these duties.

The M/S's responsibilities include, but are not limited to, the following:

- Supervising personnel including Laborers, Equipment Operators, and Scale/Gate Attendants in the performance of daily landfill operations and assigning duties as necessary.
- Ensuring adequate staffing to provide facility operation in accordance with the Site Development Plan (SDP), the SOP, and the TCEQ regulations.
- Monitoring and evaluating the performance of employees with respect to assigned duties and compliance with regulatory requirements.
- Ensuring compliance of day-to-day operations with TCEQ operating requirements and with the current SOP.
- Ensuring that all equipment and operating systems required under the permit (i.e., leachate collection systems, methane gas collection system, etc.) are properly maintained.
- Anticipating changes to the operating practices necessary due to changes in the weather, disposal location, or other conditions affecting site operations.
- Performing inspections and completing inspection forms and checklists.
- Overseeing all construction activities.
- Coordinating fire protection training of landfill employees according to Section 4.4 of this plan.
- Serving as the emergency contact and coordinator for the facility.

The minimum qualifications for the M/S include the following: (1) must hold a Class-A, B or C license as defined in 30 TAC §30.210, (2) must be an experienced personnel manager, and (3) must be familiar with and have the aptitude to implement operational aspects of solid waste disposal operations (including knowledge of relevant regulations and permit requirements, waste-handling and safe management practices for disposal of municipal solid waste, health and safety, and waste identification).

2.1 Equipment Operators

Equipment Operators will be trained in the safe operation of landfill vehicles and heavy equipment. Duties to be performed may include spreading and compacting waste and cover soil as needed for the placement and containment of waste, maintaining access roads, establishing and maintaining storm water drainage, excavation of soils, and construction activities in accordance with the SDP. The equipment operators will also be responsible for daily inspection of equipment for operational and safety conditions. The equipment operators will visually observe waste loads as they are placed to help ensure that prohibited wastes are not deposited within the unit. If prohibited wastes are observed, the equipment operators will immediately notify the M/S. The equipment operators will also assist other landfill personnel in fire protection operations, moving of litter fences, and other duties as directed by the M/S.

The minimum qualifications for an equipment operator include a demonstrated proficiency in the operation of heavy equipment and the ability to comprehend and implement the training schedule included in Section 4.1, Personnel Training.

2.2 Gate Attendant

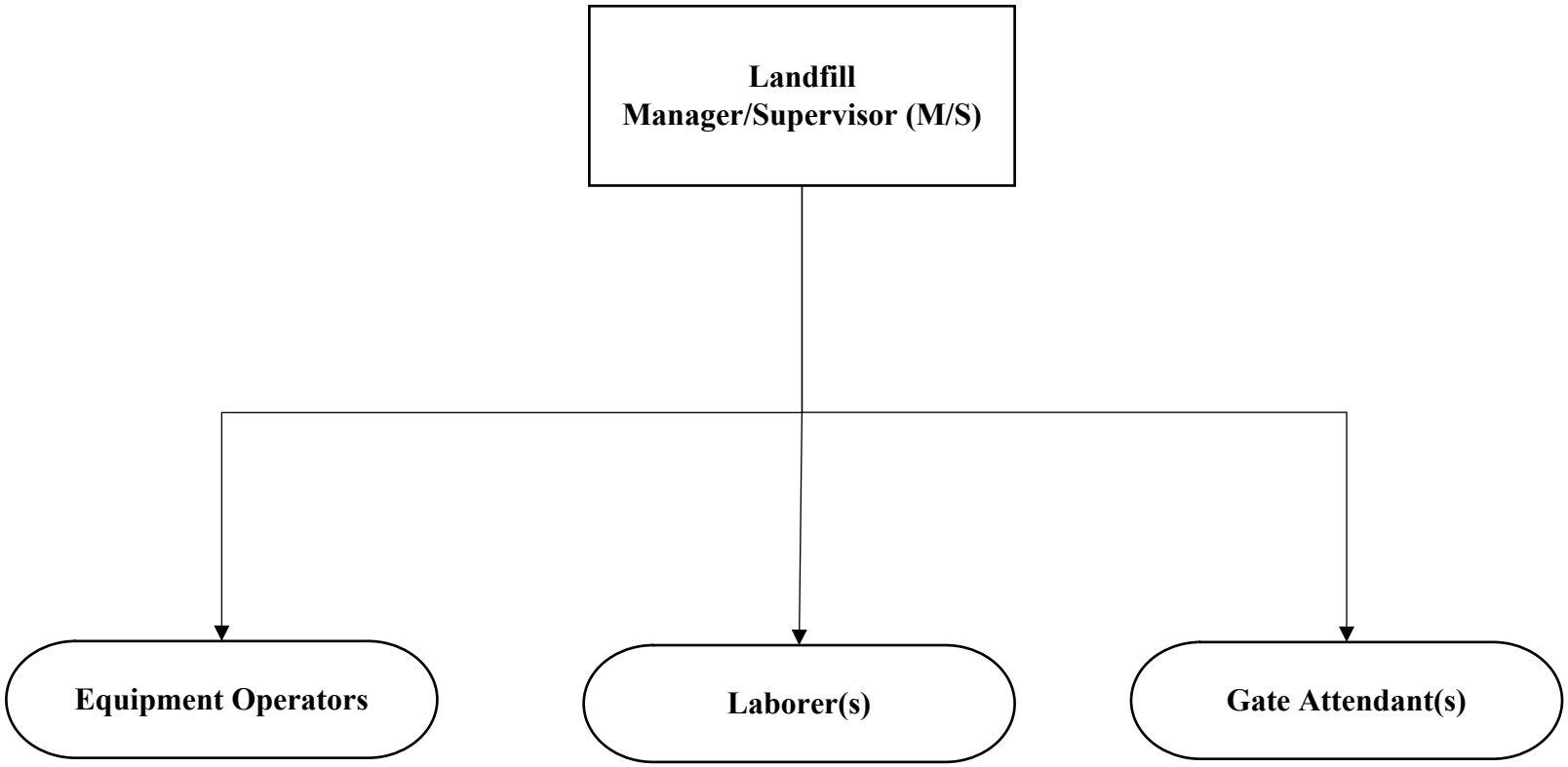
The gate attendant(s) will be responsible for monitoring, documenting and measuring incoming waste and collection of appropriate fees. Duties may include selection of random loads for waste inspections in accordance with Section 4.2 of this plan, and directing waste loads to the appropriate disposal area(s). The gate attendant will be trained in safety procedures and the identification of prohibited wastes. If prohibited wastes are observed, the attendant will not allow the waste into the landfill and will immediately notify the M/S.

The minimum qualifications for a gate attendant include a demonstrated ability to communicate with the customers and the ability to comprehend and use the gatehouse equipment (i.e., scales, computers, etc.) and the training included in Section 4.1, Personnel Training.

2.3 Laborer

Landfill laborers will have responsibilities as directed by the M/S. These duties may include on and off-site litter control, fire protection operations, dust control, inspection and maintenance of perimeter fences and gate(s) and litter fences and other duties as necessary. Appropriate training will be provided commensurate to the duties and responsibilities of the laborer(s).

FIGURE 1: CITY OF KINGSVILLE LANDFILL ORGANIZATIONAL CHART



3 EQUIPMENT §330.127(2)

Sufficient equipment will be provided to conduct site operations in accordance with the landfill design and permit conditions.

Heavy equipment available for day to day operations of the disposal areas will consist of at least one landfill compactor, one bulldozer, earth moving equipment (scraper or excavator and dump truck(s)), and a water truck with power spray capabilities. When major repairs to heavy equipment are needed that will cause an interruption in the minimum required equipment, the Landfill Operator or Contractor will make additional equipment of similar size and function available.

The landfill compactor will be a wheeled compactor with a minimum weight of 40,000 pounds with appropriate cleats for sufficient compaction of wastes. The bulldozer will be capable of spreading MSW and soils for cover, and performing construction maintenance of on-site roads. The water truck will be used for spreading water for dust control and fire prevention/protection, as well as watering vegetation for sustained growth as necessary. The earth moving equipment (i.e., excavator and dump truck(s) and/or scraper) will be capable of moving sufficient volumes of soil as necessary.

In addition to the required equipment listed in Table 3, miscellaneous pickups, and/or other light utility vehicles as well as various portable water pumps, instruments, and safety and training equipment will be on site as necessary. The pickup truck will be used to haul landfill personnel within the site to conduct site duties and collect windblown and spilled litter (both on and off site). The portable pump will be used for pumping stormwater from excavations and from ponded areas. Portable litter screens will be constructed of a mesh attached to a portable frame. Additional information regarding numbers and sizes of equipment are included in Table 3.

TABLE 3: CITY OF KINGSVILLE WASTE VOLUME EQUIPMENT SCHEDULE

EQUIPMENT TYPE	MINIMUM SIZE	WASTE ACCEPTANCE RATE (TONS PER DAY)			FUNCTION
		0-750	750-1,500	1,500-2,250	
Landfill Compactor(s)	40,000 pounds (2- 40,000 lb. compactors may be replaced by 1 – 80,000 lb. compactor)	1	2	3	Waste and soil spreading and compaction
Bulldozer(s)	CAT D7 or similar	0	1	1	Support compactor with waste/soil spreading, soil compaction
	CAT D6 or similar	1	0	0	
	CAT D5 or similar	0	0	1	
Earth Mover(s)	10 to 30 CY	1	1	2	Transportation of cover soil, excavation of new cells
Water Truck (s)	Size varies (1 – 4, 000 gallon water truck may be replaced by 2 – 2,000 gallon water trucks)	1 (2,000 gal)	1 (2,000 gal)	1 (4,000 gal)	Dust control, fire fighting support
Portable Litter Screen(s)	20 feet wide by 10 feet high	4	6	8	Active face litter control
Fuel Storage Tank(s)	Size varies	1 (1,000 gal)	1 (2,000 gal)	1 (3,000 gal)	Equipment fuel

Notes:

The number, types and equipment manufacturers of the heavy equipment and miscellaneous vehicles and equipment may vary during operations of the site based on operational needs and availability. See also section 4.4.1.2.4.6, Working Face/Landfill Fires for additional equipment requirements.

4 GENERAL INSTRUCTIONS §330.127(3)

The operational procedures outlined in this SOP will be followed and will be considered a part of the SOR of this MSWLF facility. This facility is designed for Type I MSW disposal and consists of separate cells.

Each cell will be constructed as the operation advances.

Operations will be conducted in a professional manner by qualified and trained personnel. Operational objectives will consist of placing the maximum amount of waste in a specified area, and operating the site in compliance with the TCEQ regulations, the site permit, and the SOP. The following Facility Operations, Inspection, and Maintenance listing includes general instructions that the operating personnel will follow concerning the operational requirements of the facility.

TABLE 4: GENERAL OPERATIONAL INSTRUCTIONS

DESCRIPTION OF ACTIVITY	TASK	FREQUENCY	INSPECTOR	INSPECTION DOCUMENTATION
Entrance Gate and Perimeter Fences	Conduct inspection of gate and perimeter fences to ensure that no breach has occurred. If breach occurs, notify TCEQ as specified in section 4.5	Weekly	Landfill Manager /Supervisor or Designee	Note status on Access Inspection Log, maintain in SOR
Cover Application Record	Record date of cover, how it was accomplished, and the last area covered, according to 330.165	Daily	Landfill Manager /Supervisor or Designee	Document daily, intermediate and final cover application, sign form and place in SOR
Perimeter Drainage Channel and Pond Maintenance	Inspect channels for litter and debris, clear flowline, inspect detention ponds for damage.	Weekly	Landfill Manager /Supervisor or Designee	Document weekly and place in SOR
Random Load Inspection	Conduct inspection of vehicle to ensure that no unauthorized wastes are in the load	Daily as specified in Section 4.2.3	Landfill Manager /Supervisor or Designee	Place completed Load Inspection Report in SOR
Unauthorized Material Removal	Document removal of unauthorized materials from landfill	Per occurrence	Landfill Manager /Supervisor or Designee	Complete Unauthorized Material Removal form and place in SOR

Leachate Collection System	Measure depth of leachate in sumps, storage tanks, and record volume of leachate removed from site	Quarterly	Landfill Manager /Supervisor or Designee	Complete documentation and place in SOR
Final Cover Inspection	Inspect final cover for erosion, and damage to drainage structures	Weekly and after a rainfall event resulting in runoff	Landfill Manager /Supervisor or Designee	Complete documentation and place in SOR
On-site Litter Collection	Inspect site for litter. Collect Litter on a daily basis and return to working face for proper disposal	Daily	Landfill Manager /Supervisor or Designee	Complete documentation and place in SOR
Mud and Debris Cleaned from Public Roads	Inspect public roads for evidence of mud and debris tracked from site	Daily during periods of inclement weather	Landfill Manager /Supervisor or Designee	Complete documentation and place in SOR
Fire Extinguisher/ Fire Fighting Equipment	Inspect all fire extinguishers and/or fire fighting equipment, promptly repair or replace defective equipment.	Annually	Landfill Manager /Supervisor or Designee	Properly mark tags on fire extinguishers, document results of equipment inspections, place in SOR
Markers and Benchmarks	Inspect markers and benchmarks for damage. Replace markers that are removed or destroyed within 15 days of removal or destruction.	Monthly	Landfill Manager /Supervisor or Designee	Complete documentation and place in SOR
Roadway Regrading	Inspect on-site access roadways to ensure clean and safe condition.	Monthly	Landfill Manager /Supervisor or Designee	Complete documentation and place in SOR
Site Signs	Inspect all site signs for damage, general location, and accuracy of posted information.	Weekly	Landfill Manager /Supervisor or Designee	Complete documentation and place in SOR
Odor	Inspect perimeter of the site to assess the performance of the site operations to control odor	Weekly	Landfill Manager /Supervisor or Designee	Complete documentation and place in SOR
Ponded Water	Inspect site for potential ponding of water and ponded water. Fill and grade low areas as soon as practical.	Weekly	Landfill Manager /Supervisor or Designee	Complete documentation and place in SOR

4.1 PERSONNEL TRAINING §330.127(4)

It will be the responsibility of the permittee to ensure that the M/S is knowledgeable in the proper operation of a municipal solid waste landfill and the current operational standards required by the TCEQ. The M/S will be an experienced manager and will maintain the required license as defined in 30 TAC §30.210. It will be the responsibility of the M/S to ensure that all landfill personnel are properly trained and are operating the landfill in accordance with this SOP and operational standards required by the permit and the TCEQ municipal solid waste regulations.

Training for personnel will be ongoing and will be directed by a person trained in waste management procedures. Facility personnel will be instructed in the required waste management procedures and contingency plan implementation relevant to the positions in which they are employed. The training program will include:

- Prohibited waste recognition training;
- Emergency response procedures, including fire and explosion;
- Use of emergency equipment, communications or alarm systems;
- Response to environmental contamination incidents; and
- Shutdown of operations.

New employees will receive a comprehensive overview of landfill operations, focusing on information that is necessary to protect the health and welfare of the new employee and enable them to perform their duties in accordance with this SOP, the operational standards required by the permit and the TCEQ municipal solid waste regulations. Initial training subject matter will include:

- Review of the SDP and Attachments;
- The SOP;
- The Spill Prevention Control and Countermeasure Plan;
- The Storm Water Pollution Prevention Plan; and
- General safety procedures.

Following the initial training, the new employee will continue during periodic training sessions consisting of on-the-job training. Training meetings will be scheduled and conducted for all employees approximately monthly. If a regular monthly meeting is cancelled, it will be rescheduled or combined with the scheduled training the following month. Topics for training may vary depending on job requirements. Typical training personnel may receive is listed in Table 5.

Facility personnel must take part in an annual review of their initial training in accordance with §335.586(c). The M/S will review each employee on an annual basis to see that adequate training is held to maintain the required licenses.

A written description of the type and amount of introductory and continued training provided to each employee will be maintained in the facility operating record.

TABLE 5: TYPICAL PERSONNEL TRAINING

	Training														
Position	**Job Description**	**Site Orientation**	**Site Operations**	**Endangered Species**	**Hazardous Waste Id.**	**Safety (Job Specific)**	**Fire Prevention**	**Load Inspection**	**Prohibited Waste**	**SPCC**	**Emergency Response**	**Litter Control**	**Random Inspection**	**SWPPP**	**Leachate System Maintenance**
Landfill Manager /Supervisor	Responsible for all activities Ensure adequate Training Inspections	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Gate Attendant	Take receipts Screen and some load inspection Direct vehicles to unloading area	X		X	X	X	X	X	X		X		X		
Equipment Operator	Compact waste Visual inspection of loads Unauthorized waste Apply daily cover	X		X	X	X	X	X	X	X	X		X		As assigned
Laborer	As assigned	X		X		X	X				X	X			

4.2 CONTROL OF PROHIBITED WASTE §330.127(5)

Incoming waste will be controlled in three ways to preclude the inadvertent receipt of prohibited wastes for disposal. One level of control is to inform customers that make inquiries via phone or in person of the types of wastes that are to be excluded from disposal. Screening of waste will also take place at the scale house by the attendant. A second control is to inform all vehicle drivers and transfer station operators of the restrictions. Key personnel will be informed of the typical visible characteristics of these materials. A third control is provided by the M/S, Gate Attendant, and Equipment Operators. Random inspections will be made daily of a certain percent of collection vehicles by the landfill site personnel. The Equipment Operators or other trained staff will observe collection vehicles as they unload.

Regulated hazardous waste as defined in 40 CFR Part 261, polychlorinated biphenyls (PCB) wastes as defined in 40 CRF Part 761, and prohibited wastes as defined in 30 TAC §330.15 will not be accepted for disposal at this landfill. If there is an incident involving the receipt or disposal of regulated hazardous waste or PCB waste at the landfill, the TCEQ will be notified as soon as is practical.

4.2.1 Detection and Prevention of the Disposal of Prohibited Waste, Hazardous Waste, and PCBs §330.127(5)

The M/S will direct a program to prevent the disposal of prohibited waste, hazardous waste, and PCB waste that will include training site personnel to know in detail the regulated wastes, how to perform a random inspection, how to control site access, and procedures required in the event of identification of regulated wastes.

The detection and exclusion program will include at least the following steps:

- Random inspections of incoming loads in accordance with procedures described in Section 4.2.3;
- Maintaining records of all inspections;
- Training for facility personnel responsible for inspecting loads to recognize regulated hazardous waste or a PCB waste at the landfill; and
- Remediation of any regulated hazardous waste or PCB waste discovered at the site in accordance with. Section 4.2.4.

Load inspectors, the facility manager, equipment operators, and gate attendants should maintain a thorough understanding of the SOP and should be trained in the following areas: (1) customer notification and load inspection procedures, (2) identification of regulated hazardous, PCB, and prohibited waste, (3) waste handling procedures, (4) health and safety, and (5) record keeping, including load inspection reports completed for each inspection and recorded on standardized forms. These personnel should have knowledge of barrel types, possible types of liquids, transporter numbers on trucks, and company names on trucks that could be industrial or hazardous waste generators or generators of other unauthorized waste. Personnel training records

should be maintained in the site operating records and should include evidence of successful completion of the training, type of training received, and the name of the instructor. The minimum level of training for the facility manager should be a Class A, B, or C license as defined in §30.210. In addition, key on-site personnel should attend a course for screening for unauthorized waste.

4.2.2 Wastes Prohibited From Disposal

The City of Kingsville Landfill will not accept the following types of waste for disposal:

- Regulated Hazardous Waste other than from a Conditionally Exempt Small Quantity Generator (CESQG) as defined in 30 TAC §330.171(c)(6);
- Polychlorinated Biphenyls (PCBs) as discussed in section 4.2.1;
- Class 1, Class 2, and Class 3 industrial waste;
- Do-it-yourself (DIY) used motor vehicle oil will not be intentionally or knowingly accepted for disposal per §330.15(e)(2);
- Whole used or scrap tires shall not be accepted for disposal or disposed of in any MSW landfill, unless processed prior to disposal in a manner acceptable to the executive director per §330.15(e)(4);
- Lead acid storage batteries will not be intentionally or knowingly accepted for disposal per §330.15(e)(1);
- Used oil filters from internal combustion engines will not be intentionally or knowingly accepted for disposal per §330.171(d);
- Items containing chlorinated fluorocarbon (CFC) unless all the CFC contained within them is properly managed as defined in §330.15(e)(5);
- The following special wastes without prior approval from TCEQ and accompanied with the relevant analytical test results, MSDS documents, or process knowledge documents:
    - Septic tank pumpings which have been stabilized and have passed the paint filter test;
    - Wastes from commercial or industrial wastewater treatment plants; air pollution control facilities; and tanks, drums, or containers used for shipping or storing any material that has been listed as a hazardous constituent in 40 CFR, Part 261, Appendix VIII but has not been listed as a commercial chemical product in 40 CFR Part 261.33(e) or (f);
    - Drugs, contaminated foods, or contaminated beverages, other than those contained in normal household waste;
    - Incinerator ash;
    - Light ballasts and/or small capacitors containing PCB compounds with a PCB content less than 50 parts per million;
    - And waste generated outside the boundaries of Texas that contains:
    - Any industrial waste,

  - Any item listed as a special waste in this section.
  - Any waste stream other than household or commercial garbage, refuse, or rubbish.
- Municipal hazardous waste from a Conditionally Exempt Small Quantity Generator (CESQG) may be accepted, provided the generator provides a certification that it generates no more than 220 pounds of hazardous waste per calendar month;
- Refrigerators, freezers, air conditioners, and any other items containing chlorinated fluorocarbon (CFC) will not be knowingly accepted for at the site unless the generator or transporter provides written certification that:
  - "All refrigerant that had not leaked previously has been recovered from the unit and it was not knowingly allowed to escape into the atmosphere."
  - This statement must include the name and address of the person who recovered the refrigerant and the date the refrigerant was recovered or a contract that refrigerant will be removed prior to delivery. Additionally, if an appliance enters the facility with ruptured lines or holes in the CFC unit, it will not be accepted unless the generator or transporter provides written certification that:
  - "All refrigerant has been evacuated from the unit and it was not knowingly allowed to escape into the atmosphere."
- Liquid waste (any waste material that is determined to contain "free liquids" as defined §330.15(e)(6) and by EPA Method 9095 [Paint Filter Test], as described in "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods" [EPA Publication Number SW -846]) will not be disposed of unless it is:
  1. Bulk or noncontainerized liquid waste that is:
     a) household waste other than septic waste; or
     b) leachate or gas condensate derived from the City of Kingsville Landfill managed and disposed of in accordance with the Leachate and Contaminated Waste Management Plan presented as Attachment 15 of Part III of the Site Development Plan.
  2. Containerized liquid waste and;
     a) the container is a small container similar in size to that normally found in household waste;
     b) the container is designated to hold liquids for use other than storage; or
     c) the waste is household waste.

Landfill personnel will check for indications of prohibited waste as detailed below.

One of the most important means to control the disposal of prohibited waste at the landfill is by the control of access into the facility by unauthorized vehicles. This issue is addressed in Section 4.5 of this operating plan (Access Control). Facility personnel will be trained to inspect vehicles and identify regulated hazardous waste, polychlorinated biphenyl (PCB) waste and any prohibited waste described above. At a minimum, the gate attendant and equipment operators at the working face will be trained in screening and inspection procedures for prohibited waste.

The personnel will receive on-the-job training by the M/S or designated alternate. Records of employee training on prohibited waste control procedures will be maintained in the facility site operating record.

Landfill gate/scale attendants will be trained to recognize trucks with potential sources of prohibited waste such as microelectronics manufacturers, electronic companies, metal plating industry, automotive and vehicle repair service companies, and dry cleaning establishments.

If landfill personnel suspect prohibited waste is present in an incoming load, then that load will be directed to an area out of the flow of traffic, and the personnel will further assess the load. If the load is determined to contain prohibited waste the load will be rejected and directed back to the generator. Municipal hazardous waste from a conditionally exempt small quantity generator may be accepted, provided the amount of waste does not exceed 220 pounds per month per generator.

4.2.3 Random Inspections (30 TAC §330.127(5)(A) & (D))

The gate/scale attendant or other designated landfill personnel will randomly select no less than one percent (1%) of incoming disposal loads for inspection but not less than one (1) load per day, notify the equipment operator, and direct the selected disposal load to the area of the working face. Once the selected load arrives at the working face, the equipment operator will direct the vehicle to a separate location of the working face and out of the flow of normal landfill traffic. At this point, the equipment operator will visually inspect the contents of the load and document the contents for the type of waste observed. Trained staff should visually inspect incoming loads. If any indication of prohibited waste is detected, appropriate landfill personnel should conduct a thorough evaluation of the load.

Characteristics to be first observed might be unusual odors, heat, fumes, large containers, unusual dust, liquids or sludge. The waste pile will be broken up and inspected for any hazardous or prohibited waste. Suspicious wastes should be flagged and samples may be taken for laboratory analysis. Known prohibited waste should be placed back into the vehicle and the driver should be instructed to depart the site with information on where to legally dispose of the waste. If any regulated hazardous waste is detected, the entire load should be refused. The Load Inspection Report Form will be used to document results of the random load inspection. The executive director will be notified of any incident involving the receipt or disposal of regulated hazardous waste or PCB waste at the landfill.

Following any waste inspection, documentation of the inspection will be placed in the site's operating record within 7 days. The documentation will include information such as the date, time, name of inspectors(s), type of inspection/screening (i.e., random screening, suspected unauthorized waste, etc.), transporter/generator information, and waste information. This type of documentation may be provided on a waste inspection/screening form such as the ones included

in Part IV, Attachment 1, which, once complete, will be placed in the site operating record within 7 days.

The M/S is required to maintain and include in the site operating record the following:

1. Load inspection reports,
2. Records of regulated hazardous or PCB waste notifications,
3. Personnel training records, and
4. Load inspection reports, recorded on standardized forms, completed for each inspected load.

The reports should include the date and time of inspection, the name and address of the hauling company and driver, the type of vehicle, the size and source of the load, contents of the load, indicators of prohibited waste, and results of the inspection.

In addition to the random inspections, trained staff will observe each load that is disposed of at the landfill.

4.2.4 Prohibited Waste Remediation Plan (30 TAC §330.127(5)(E))

Prohibited waste remediation procedures may range from loading prohibited waste back onto the generator's vehicle to loading waste in an on-site container, tarping, testing, and removal of the waste to an approved facility. Drums will be marked appropriately with words for the type of prohibited waste it contains, such as "hazardous waste" or "PCBs". Appropriate personnel and equipment will be employed to control prohibited waste. Qualified personnel will be contracted to aid the facility manager if applicable.

If a prohibited waste is discovered at the entry point of the landfill, the gate attendant will immediately notify the M/S or his designee of the situation. The driver will be advised that the waste cannot be accepted and where the waste may be disposed of legally. He or she will be responsible for the proper disposal of this rejected waste. Gate attendants will complete a waste screening form indicating that the load carried a suspected unauthorized waste. The waste screening report will be entered in the Site Operating Record.

When a load is selected for a random inspection or further screening, the unknown wastes undergoing analysis must be properly segregated and protected against the elements, secured against unauthorized removal, and isolated from other waste and activities. If needed, the waste will be containerized, or covered with tarp material until the appropriate method can be determined to properly manage the waste. Known prohibited wastes detected during an inspection will be returned immediately to the hauler or waste generator, and the TCEQ will be notified. If the hauler or generator is not available, the waste will be safely stored until provisions for removal can be arranged. The M/S or his designee will complete a waste screening form indicating that the load carried unauthorized waste. The waste screening report will be entered in the Site Operating Record.

Prohibited wastes that are not discovered until after they have been unloaded for disposal at the working face will also be immediately returned to the hauler or waste generator. The driver will be advised where the waste may be disposed of legally and he or she will be responsible for the proper disposal of this rejected waste. Personnel at the working face or other personnel assigned by the M/S or his designee will complete a waste screening form indicating that the load carried a suspected unauthorized waste. The waste screening report will be entered in the Site Operating Record. In the event that the unauthorized waste is not discovered until after the hauler is gone, the waste will be segregated and controlled as necessary. An effort will be first made to identify the entity that deposited the prohibited waste and have them return to the site and remove the waste. In the event that identification is not possible, the M/S will notify the TCEQ and ensure the material is sent to an authorized facility. The M/S or his designee will enter the incident in the Site Operating Record.

The TCEQ will be notified whenever regulated hazardous or PCB waste is detected. Records of the notification will be kept in the site operating record and will include the date and time of notification, the individual contacted, and the information reported. Remediation procedures for any prohibited waste incident will be documented and included in the facility operating record within 7 days. Upon determination that a waste is prohibited waste and will not be accepted, the landfill operator will make arrangements for returning such waste to the generator and/or coordinating transportation to a facility approved for the specific waste in question.

4.3 OTHER SITE ACTIVITIES

The M/S has full responsibility for providing training and implementation to ensure that all activities are conducted as required by the site permit, TCEQ regulations, or any other local, state, or federal regulation.

Some of these activities are briefly discussed below.

4.3.1 Pond and Ditch Maintenance

Periodically, as directed by the M/S site drainage ditches and storm water ponds may require maintenance and/or cleaning to ensure that they function as intended. The required maintenance may be conducted by site personnel or by a contractor. The maintenance will consist of cleaning up litter and/or small brush/limbs to excavating and removing excessive silt deposits. The amount of maintenance will be predetermined by the M/S. If landfill personnel conduct the activities, on-site equipment will be used if possible. Otherwise, appropriate equipment may require rental. In any case, if excavation is required, the work will be conducted so as not to change elevations documented within the site permit.

4.3.2 Leachate System Maintenance

It will be the responsibility of the M/S to ensure that the leachate collection system remains in good working order. As leachate systems are installed for new cell constructions, landfill personnel will be trained on the operation and maintenance procedures associated with the

equipment. The leachate system at each cell location will be inspected at least quarterly to ensure that it is operating properly. Any system found to not be operating properly will be brought to the immediate attention of the M/S. The M/S at this time, will ensure that appropriate measures are taken to repair the system as soon as possible.

4.3.3 TPDES Monitoring

The M/S will ensure that monitoring is conducted in accordance with the regulations for the Texas Pollutant Discharge Elimination System (TPDES) Multi Sector General Operating Permits for this site.

4.3.4 Final Cover Maintenance

Final cover in waste areas will be placed as described in the Final Closure Plan. Once final cover has been placed, it will be the responsibility of the M/S to ensure that vegetation is established and maintained and that erosion is minimized. If significant erosion of the final cover does occur, additional topsoil, or on-site soil capable of sustaining vegetation, will be placed and graded. After erosion is repaired, appropriate seeding and irrigation will be provided in that area to ensure revegetation.

4.4 FIRE PROTECTION PLAN §330.129

This plan has been prepared in accordance with §330.129 to include fire protection procedures to protect the safety of employees, protect the environment, and minimize damage to the integrity of the site and structures. The Fire Protection Plan also includes site personnel training requirements for all on-site activities.

4.4.1 Fire Protection Standards

The facility will be protected from fire by taking precautions to minimize the potential for accidental fires and by providing the training, equipment, resources, and procedures to suppress a fire should one start.

4.4.1.1 Minimizing Fire Potential

Measures to minimize the potential for accidental fires include the general prohibition of burning of solid waste at the landfill site and the implementation of operating practices to limit the potential for accidental fires.

4.4.1.1.1 Open Burning of Solid Waste

The open burning of solid waste, except for the infrequent burning of waste generated by on-site land clearing operations, agricultural waste, silvicultural waste, diseased trees, or emergency clean up operations as authorized by the TCEQ, is prohibited at this site. The operation of any type of air-curtain destructor (trench burner), other than for the exceptions noted in the previous sentence, is prohibited. Any open burning will be conducted a minimum of 100 feet from any combustion source, including uncovered solid waste; fuel supplies; trees, brush, or unmaintained grasses; vehicles; buildings; brush collection areas; stored used tires;

stored used oil; or other sources. The site water truck will be operable, loaded with water, and standing by during any open burning.

4.4.1.1.2 Accidental Fires

Accidental fires will be minimized by not allowing burning waste to be dumped in the active area of the landfill; the use of proper compaction; the use of specified cover materials; the removal of trees, brush, or vegetation immediately adjacent to the landfill; the mowing of grass and weeds around the landfill perimeter; and the prohibition of smoking near flammable materials.

Burning waste will not be unloaded at the active area of the landfill. Gate attendants and equipment operators will be alert for signs of burning waste such as smoke, steam, or heat being released from incoming waste loads. Such loads will be prevented from being disposed of at the active face. The load will be directed by landfill personnel to a location away from any combustion source. The load will be dumped and the fire extinguished in accordance with Section 4.4.1.2 Fire Suppression.

The potential for accidental fires will be further minimized by the use of proper compaction as described in Section 4.21, Compaction §330.163, and by the use of earthen material cover as described in Section 4.22 Landfill Cover §330.165.

Fuel spills will be contained and cleaned up immediately. Dead trees, brush, or vegetation will be moved at least 100 feet from the limit of waste and grass and weeds around the limit of waste will be mowed so that forest, grass, or brush fires cannot spread to the landfill.

Smoking is not allowed on the working face, in fueling areas, or near brush, used tires, used oil, or other combustion sources. This prohibition will apply to the facility employees as well as public users of the landfill. Smoking may only be allowed in designated smoking areas such as the gatehouse, office, shop, and break room. Signs will be placed at the entrance of the facility indicating that smoking is prohibited except at designated areas.

4.4.1.2 Fire Suppression

Fire suppression measures include the training of facility personnel, coordination with the local fire department, the provision and use of fire fighting equipment, and procedures for extinguishing different categories of fires.

4.4.1.2.1 Fire Protection Training

All employees will receive fire protection training regarding the provisions of this Fire Protection Plan. Training of employees will be the responsibility of the M/S and will be provided to each new employee upon hire. A review of fire control measures for all landfill personnel will be conducted on an annual basis. Records of this training should be included in the operating record of the facility. At a minimum, each landfill employee will receive training regarding the following:

- Fire prevention;

- Procedures to follow to respond to fires;
- Fire fighting techniques including:
    - The use and limitation of fire extinguishers or other equipment;
    - When and who to contact in case of emergency situations; and
- Other fire protection aspects of the SOP.

4.4.1.2.2 Coordination with Local Fire Department

The M/S will determine the personnel from the local fire department or volunteer fire department most likely to respond in case of fire at the facility. The M/S will contact the local fire department on an annual basis to coordinate an on-site tour and orientation of the facility. The orientation will include a description of on-site combustible materials, the location of the combustible materials, the on-site road network, and the location of fire fighting fire hydrants and/or water ponds or other on-site water sources.

4.4.1.2.3 Fire Fighting Equipment

Facility equipment will include fire extinguishers, a water truck with powered spray capabilities, earth moving heavy equipment, and a water pump.

A fire extinguisher should be located in/at every building (including the gatehouse), piece of machinery, and fuel station, excluding the working face of the landfill (fires at the working face will be addressed with water or soil material). Each extinguisher will be inspected at least annually and recharged as necessary. A qualified service company should perform these inspections, and all fire extinguishers will display a current inspection tag. Inspection and recharging will be performed following each use.

The site will have a bulldozer and earth moving equipment, either a scraper and/or excavator and dump truck, water truck, and water pump available for fire fighting purposes. The bulldozer will be available for spreading dirt over burning waste and for dispersing any incoming load that is on fire. The scraper or excavator and dump truck will provide cover soils for covering burning waste and for transferring extinguished loads to the landfill for disposal. The water truck may be used for dumping or spraying water on fires. The water pump may be used for loading water in the water truck or pumping water directly onto a fire.

4.4.1.2.4 Procedures for Extinguishing Fires

The following procedures will be implemented in the event of a fire:

- Contact the Local Fire or Volunteer Fire Department by dialing 911;
- Alert other facility personnel;
- Assess the extent of the fire, the possibilities for the fire to spread, and alternatives for extinguishing the fire;
    - If it appears that the fire can be safely fought with available fire fighting devices until arrival of the Local Fire Department then attempt to contain or extinguish the fire as described in sections 4.4.1.2.4.1 through 4.4.1.2.4.4;

- NOTE:
  - Do not attempt to fight the fire alone and
  - Be familiar with the use and limitations of fire fighting equipment available on-site.

- Upon the arrival of the Local Fire Department, direct them to the fire and provide assistance as necessary;
- In the event that additional fire protection/fighting measures are warranted by the M/S, expert fire fighting services will be contacted for emergency assistance.

There are several categories of fires and each may have a different way of being managed. However, a source of earthen material will be maintained in such a manner that it is available at all times to extinguish any fires.

4.4.1.2.4.1 Small Fires

If detected soon enough, a small fire may be fought with a hand-held fire extinguisher. The fire area may be watered down or smothered with 6 inches of soil, as appropriate, to ensure that the fire is out.

4.4.1.2.4.2 Equipment Fires

If a fire occurs on a vehicle or piece of equipment, the equipment operator should bring the vehicle or equipment to a safe stop. If safety of personnel will allow, the vehicle must be parked away from fuel supplies, uncovered solid waste, other combustion sources, and other vehicles. The engine should be shut off and the brake engaged to prevent movement of the vehicle or piece of equipment. The fire should then be extinguished by using fire extinguishers, water spray from the water truck, or by the Local Fire Department.

4.4.1.2.4.3 Hot Loads

Burning waste will not be unloaded in the active area of the landfill. After the gate attendant, equipment operator, or other site personnel have identified signs of a possible load of burning waste, or a hot load, the truck will be directed to a portion of the disposal area away from the working face, fuel areas, and other combustion sources where the load can be unloaded without danger of spreading the fire. The water truck will water down the waste. The bulldozer will then spread the waste for additional water. The bulldozer may smother the fire with soil if the water does not sufficiently extinguish the fire.

The waste will be inspected for signs of fire or hot spots. When the fire has been extinguished and the waste has cooled, the waste will be transferred to the working face and disposed of.

4.4.1.2.4.4 Used Oil and Battery Storage Areas

Landfill personnel, including equipment operators, will watch for signs of fire at the used oil and battery storage areas. Landfill personnel will watch for fire, smoke, steam, or signs of heat. If signs of fire are detected at the used oil and battery storage areas, all vehicles

and equipment will be immediately moved away from the fire. The unloading of materials will either be relocated to a safe location away from the fire and a collection areas established there or halted all together until the fire is extinguished.

If detected soon enough, a small fire may be fought with a hand-held fire extinguisher. The fire area may be watered down or smothered with 6 inches of soil, as appropriate, to ensure that the fire is out.

If the fire cannot be quickly extinguished with the fire extinguisher, the bulldozer, earth moving equipment, and water truck will immediately mobilize to the site of the fire. All available landfill personnel will assist with fire protection measures unless otherwise directed by the M/S.

Fire fighting methods for used oil or batteries include smothering with soil, separating burning material from other waste, spraying with water from an on-site water truck, or pumping with water from an on-site pond. The burning material should be isolated or pushed away immediately before the fire can spread, or fire breaks should be cut around the fire before it can spread. If moving the material is not possible, or if it is unsafe, efforts should be made to cover the burning area with earth immediately to smother the fire.

4.4.1.2.4.5 Brush Collection, Mulching Areas, and Shredding Areas

Landfill personnel, including equipment operators, will watch for signs of fire on the brush collection, mulching and shredding areas. Shredding may include brush or woody materials. Landfill personnel will watch for fire, smoke, steam, or signs of heat. If signs of fire are detected at the brush collection, mulching and shredding areas, all vehicles and equipment will be immediately moved away from the fire. The unloading of materials will either be relocated to a safe location away from the fire and a collection areas established there or halted all together until the fire is extinguished.

The bulldozer, earth moving equipment, and water truck will immediately mobilize to the site of the fire.

All available landfill personnel will assist with fire protection measures unless otherwise directed by the M/S.

Fire fighting methods for burning brush, mulch and shredded material include smothering with soil, separating burning material from other waste, spraying with water from an on-site water truck, or pumping with water from an on-site pond. Small fires might be controlled with hand-held fire extinguishers. If the fire is at an active processing area, if possible, the burning waste should be isolated or pushed away immediately before the fire can spread, or fire breaks should be cut around the fire before it can spread. If moving the material is not possible, or if it is unsafe, efforts should be made to cover the burning area with earth immediately to smother the fire. The faster that soil can be placed over the fire, the more effective this method will be in controlling and extinguishing the fire. The

stormwater diversion and containment berms and stockpiled earthen material may be used for fire fighting purposes.

4.4.1.2.4.6 Working Face/Landfill Fires

Landfill personnel, including equipment operators, will watch for signs of fire on the working face and landfill waste mass in general. Landfill personnel will watch for fire, smoke, steam, or signs of heat.

If signs of fire are detected at the working face or on the landfill, all vehicles and equipment will be immediately moved away from the fire. The unloading of incoming waste will either be relocated to a safe location away from the fire and a working face established there or halted all together until the fire is extinguished.

The bulldozer, earth moving equipment, and the water truck will immediately mobilize to the site of the fire. All available landfill personnel will assist with fire protection measures unless otherwise directed by the M/S.

Fire fighting methods for burning solid waste include smothering with soil, separating burning material from other waste, spraying with water from an on-site water truck, or pumping with water from an on-site pond. Small fires might be controlled with hand-held fire extinguishers. If the fire is at an active disposal area, if possible, the burning waste should be isolated or pushed away immediately before the fire can spread, or fire breaks should be cut around the fire before it can spread. If moving the waste is not possible, or if it is unsafe, efforts should be made to cover the working face with earth immediately to smother the fire. The faster that soil can be placed over the fire, the more effective this method will be in controlling and extinguishing the fire. The working face diversion and containment berms and stockpiled earthen material may be used for firefighting purposes.

A sufficient volume of earthen material will be available at all times to cover a potential fire area equivalent to the size of the working face with six inches of earthen material within one hour. This source of earthen material may be on-site soil stockpiles, working face diversion and/or containment berms, areas of future excavation, or some combination thereof.

The volume of earthen material required is calculated as:

Volume (cubic yards) = $[(L \times W \times 0.5 \text{ feet}) \div 27] \times 1.2$

Where: L = Length of the working face (feet)
W = Width of the working face (feet)
1.2 = A 20% Factor of Safety

Examples of required earthen material volumes are included in the following table.

TABLE 6: REQUIRED EARTHEN MATERIAL FOR FIRE CONTROL

LENGTH OF WORKING FACE (Feet)	WIDTH OF WORKING FACE (Feet)	VOLUME NEEDED TO COVER WORKING FACE (Cubic Yards)
100	50	111
200	50	222
100	100	222
200	100	444
300	100	667

Sufficient on-site equipment must be provided to place a six inch layer of earthen material over any waste not already covered with daily cover in one (1) hour, 30 TAC §330.129.

The following assumptions and calculations demonstrate the personnel's ability to place the required six inch layer of earthen material over the working face of the landfill within one (1) hour:

FOR 100' x 50' WORKING FACE
Volume of Daily Cover = 111 CY
Size of Scraper = 22 CY
Number of Scrapers = 1
Number of Loads = 111 CY/(22 CY /scraper x 1 scraper) = 5.05 use 6 trips
Average Scraper Speed = 10 mph = 52,800 feet per hour
Distance to working face = 2,500 feet
Time for 1 Scraper to Make 6 Trips = (2,500 feet x 6 x 2)/52,800 feet per hour = 0.57 hours = 34.2 minutes which is less than the required 60 minutes.

Therefore, for a 100' x 50' working face, a single scraper can be used with a 111 CY *earthen material source located within 2,500 feet of the working face.*

FOR 300' x 100' WORKING FACE

Volume of Daily Cover = 667 CY
Size of Scraper = 22 CY
Number of Scrapers = 1
Number of Loads = 667 CY / (22 CY /scraper x 1 scraper) = 30.3 use 31 trips
Average Scraper Speed= 10 mph = 52,800 feet per hour
Distance to working face = 800 feet
Time for 1 Scraper to Make 31 Trips = (800 feet x 31 x 2) / 52,800 feet per hour = 0.94 hours = 56.4 minutes which is less than the required 60 minutes

Therefore, for a 300' x 100' working face, a single scraper can be used with a 667 CY *earthen material source located within 800 feet of the working face.*

When a fire is discovered the M/S will be notified, soil from the earthen material source will be loaded and carried to the area with the earth moving equipment and spread to a minimum thickness of 6-inches using a bulldozer or other appropriate equipment. All available landfill personnel will assist with fire management measures, unless otherwise directed by the M/S.

4.4.2 Notifications

Following any fire associated with waste management activity that cannot be extinguished within 10 minutes of detection, contact the TCEQ Region 14 office in Corpus Christi. This notification to Region 14 will include:

1. Contact by telephone at 361-825-3100, as soon as possible, but no later than 4 hours following fire discovery, and
2. Provide a written description of the cause and extent of the fire and the resulting fire response within 14 days of fire detection to:

   TCEQ Region 14
   NRC Bldg., Ste. 1200
   6300 Ocean Dr., Unit 5839
   Corpus Christi, TX 78412-5839

4.4.3 Record Keeping Requirements

Reports on all fires, including causes, durations, responses, and notifications will be completed and placed in the Site Operating Record.

4.4.4 Modifications

Following any fire occurrence that required TCEQ notification per Section 4.4.2, the M/S will review the Fire Protection Plan and determine if any modifications are warranted. Any modification will be submitted to the TCEQ for approval.

4.5 ACCESS CONTROL §330.131

4.5.1 Access Routes

The main local public roadways providing access to the facility are County Road 2130 (CR 2130), Farm to Market Road 2619 (FM 2619) and Farm to Market Road 1717 (FM 1717). Primary access to this the landfill site will be County Road 2130 (CR 2130) to one main site entrance road. The entrance road to the site is a 24-foot wide, all-weather roadway.

4.5.2 Site Security

Public access will be controlled to prevent unauthorized waste disposal, protect the facility and its equipment from potential damage caused by trespassers, prevent disruption of facility operations caused by unauthorized site entry, and to minimize public exposure to hazards associated with landfills.

Unauthorized entry, as well as entry of livestock into the landfill site will be minimized by providing a perimeter fence, an entrance gate and natural barriers. Perimeter fencing consisting of chain-link and/or barbed wire and a gate constructed of suitable fencing materials will be provided.

Entrance to the landfill will be monitored by the gate attendant during operating hours. The gate system will be closed when the waste facility is not open to receive waste, as well as when no personnel are present.

Entry to the active portion of the site will be restricted to designated personnel, approved waste haulers, and properly identified individuals whose entry is authorized by site management.

4.5.3 Traffic Control

All landfill users will be required to stop at the scale house and conduct appropriate business transactions prior to proceeding to the disposal area(s). Site personnel, signs, and barricades will be used to direct the traffic to the corresponding disposal area(s), control traffic flow, and to expedite safe movement of vehicles. Unauthorized vehicles will not be allowed to proceed past the gate house. At this point, the vehicles will be initially monitored for waste type, as necessary. If a load is identified as containing any unauthorized hazardous, special, or industrial waste, the load will be rejected.

4.5.4 Inspection and Maintenance

The entrance fence and gates will be inspected for damage or problems on a daily basis while the perimeter fence will be inspected weekly. The fence, gates, and signs will be repaired, maintained, or replaced on an as needed basis to ensure proper site security. Should a breach be

detected during inspection or at any other time, every effort will be made to make repairs within 8 hours of detection. If a permanent repair can be made within 8 hours of detection, no notices to the TCEQ's regional office are required. When a loss of access control occurs that cannot be repaired within 8 hours, the TCEQ's regional office will be notified within 24 hours of detection of the breach, including when the breach will be permanently repaired. The breach will be temporarily repaired within 24 hours of detection and will be permanently repaired by the time specified to the commission's regional office when it is reported. The TCEQ's regional office will be notified when the permanent repair is complete.

The site will maintain a log of the weekly inspections including date of inspection, name of inspector, and inspection findings, as well as copies of TCEQ notices in the Site Operating Record.

4.6 UNLOADING OF WASTE §330.133

The landfill is authorized to receive municipal solid waste and some special wastes allowable under 30 TAC §330.171. The categories of wastes that are prohibited at this site are discussed in Section 4.2.2. Special wastes will be handled in accordance with TCEQ regulations and with Section 4.24.

Trained personnel will be available to monitor each load at the gate house and at the unloading area(s). The unloading areas at the facility may include the following:

1. **The active working face(s):** Municipal solid waste will be unloaded at the active working face(s). Unloading of municipal solid waste at the active working face will be confined to as small an area as practical and will not exceed 30,000 square feet, or about 300 feet by 100 feet. The size of the working face will be directly impacted by the amount of waste being received and may vary accordingly. There may be one, two or three working faces open at any given time. Typically, there will be one general purpose waste unloading area. The M/S may designate up to three waste unloading areas; one for commercial customers, one for light commercial/residential customers, and one for other wastes requiring special attention or while moving a working face (i.e., establishing a working face in a new location, while covering, or during periods of emergency clean up operations (i.e., hurricane, hailstorm, flood, etc.).
2. **Large item salvage area:** The large items/white goods unloading and storage area will not be larger than 20,000 square feet (100 feet by 200 feet). Large items/white goods may include ovens, dishwashers, freezers, air conditioners, and other items. These items will not be stored in excess of 180 days.
3. **Tire collection and processing area:** Tires will be managed in a manner that minimizes possible ponding of water in order to eliminate potential conditions that would promote disease vectors. The quantity of tires stored on-site will not exceed 500 tires on the ground (maximum storage area of 25 feet by 25 feet), or 2,000 tires in enclosed containers

(maximum storage area of one standard 40 to 52 foot trailer). The tires will be processed/reduced in size to the extent practical for disposal. Tires will not be stored in excess of 180 days.

4. **Liquid waste solidification area:** Liquid waste will be unloaded into one (1) of four (4) approximately eight (8) feet by 20 feet liquid tight mixing containers and will be located within a lined landfill sector. The maximum size of the liquid waste solidification area will be 30 feet by 50 feet. Bulking agents such as on-site soil, sawdust, kiln dust, coal combustion residuals, auto-fluff or other inert material with absorptive capacity will be mixed with the liquids until the resulting mixture passes the paint filter test and any other requirements outlined for the specific material. Once the liquids have been solidified, the solidified waste material will be transported and disposed of in the working face. Liquid waste will be unloaded directly into the mixing containers and solidification will begin upon receipt.

5. **Brush storage and processing area:** Vegetative material not mixed with other wastes will be diverted to a location outside of the active disposal area and drainage ways so that they do not interfere with on-site drainage or wash off-site. The maximum size of the unloading area for brush and yard waste is 200 feet by 400 feet. Brush will be processed for mulch. Brush will not be stored in excess of 180 days.

The unloading of waste in unauthorized areas will be prohibited. Any waste deposited in an unauthorized area will be promptly removed and disposed of properly. The gate attendant will be present at the entrance at all times during operating hours to monitor all incoming loads of waste, and will direct traffic to the appropriate unloading area. Trained landfill personnel will be on duty during regular operating hours at the working face to direct and monitor unloading of solid waste. These employees will have training, authority, and responsibility to reject unauthorized loads, have unauthorized material removed by the transporter and/or assess appropriate surcharges. Gate attendants and equipment operators will monitor the incoming waste. These personnel will be familiar with the rules and regulations governing the various types of waste that can or cannot be accepted in to the facility, including knowledge of §330.171. The personnel will also have a basic understanding of both industrial and hazardous waste and their transportation and disposal requirements.

The facility is not required to accept any solid waste which the M/S determines will cause or may cause problems in maintaining full and continuous compliance with the permit. Prohibited waste will be returned promptly to the transporter or generator of the waste. The driver will be advised and will be responsible for the proper disposal of this rejected waste. In the event the unauthorized waste is not discovered until after the vehicle that delivered it is gone, the waste will be segregated and controlled as necessary. An effort will first be made to identify the entity that deposited the prohibited waste and have them return to the site and properly dispose of the waste. In the event that identification is not possible, the M/S will notify the TCEQ and seek guidance on how to

dispose of the waste as soon as practical. A record of unauthorized material removal will be maintained in the operating record.

Only those persons operating vehicles that comply with the following requirements will be authorized by the landfill M/S to dispose of waste at this site:

1. Vehicles and equipment used for the collection and transportation of waste maintained in good working order to prevent loss of waste material and to limit health and safety hazards to landfill personnel and the public;
2. Collection vehicles and equipment maintained in a sanitary condition to preclude odors and fly breeding; and
3. Collection vehicles not equipped with an enclosed transport body should use other devices such as nets or tarpaulins to preclude accidental spillage.

Signs with directional arrows and/or portable traffic barricades will help to restrict traffic to designated disposal locations. Signs will be placed along the access route to the current disposal area or other designated disposal areas that may be established, such as the commercial disposal area, light commercial/residential disposal area, and brush area. In addition, rules for waste disposal and prohibited waste will be prominently displayed on signs at the site entrance.

4.7 HOURS OF OPERATION §330.135

Authorized Waste Acceptance Hours are Monday through Friday 7:00 a.m. to 7:00 p.m. and Saturday, 8:00 a.m. to 4:30 p.m. The actual waste acceptance hours will fall within the authorized hours. These hours are posted on the site entrance sign. Waste may not be accepted at the gatehouse before or after these hours.

Other site operations may be conducted at any time from 6:00 a.m. to 9:00 p.m. seven (7) days a week. These operations include construction, earthmoving, monitoring, transportation of construction materials, heavy equipment operation, and other non-waste acceptance operations. The facility may operate within these hours at the discretion of site management.

Any change that increases the hours of operation will be preceded by written notification of the change to TCEQ. In the event of an emergency, such as a hurricane, or other circumstances, the M/S may modify the hours of operation with notification by telephone, following with written notification as soon as practical.

4.8 SITE SIGN §330.137

A conspicuous sign measuring a minimum four feet by four feet will be maintained at the public entrance to the site. The sign will state, in letters at least three inches high, the type of site, the hours and days of operation, an emergency 24-hour contact phone number(s) that reaches an individual with the authority to obligate the facility at all times that the facility is closed, the local emergency fire department phone number (City of Kingsville Fire Department can be reached at 911 or (361) 592-6445), and the permit number. A sign prohibiting receipt of hazardous waste,

closed drums and smoking will be posted near the facility entrance or gatehouse. A sign must be prominently displayed at the facility entrances stating that all loads will be properly covered or otherwise secured. The facility sign will be readable from the facility entrance.

4.9 CONTROL OF WINDBLOWN SOLID WASTE AND LITTER §330.139

The working face will be maintained and operated in a manner to control windblown solid waste. Windblown material and litter will be collected and properly managed to control unhealthy, unsafe, or unsightly conditions by the following methods:

- Waste transportation vehicles using the facility will be required to use adequate covers or other means of containment. The adequacy of covers or containment of incoming wastes will be checked at the facility entrance. A sign will be prominently displayed at the gatehouse stating that all loads will be properly covered.
- The active working face will be limited to as small an area as practical for the safe operation of compaction equipment, as well as delivery and placement of daily cover soils, and alternate daily cover.
- The working face will be covered daily to avoid prolonged exposure of waste. A minimum of six inches of "daily" cover soil, alternate daily cover, or approved equivalent will be placed over all exposed waste at the end of each working day or at least once every 24 hours.
- Litter fences may be utilized in the immediate vicinity of the working face to help control windblown material. The M/S or his designee will be responsible for determining the need, type and placement of litter screens and fences. Litter fences will either be portable, free-standing screens which can be easily moved, as necessary, with equipment, and/or temporary fences which consist of poles driven into the ground surface with fencing between them. Numbers and sizes of portable wind fences are included in Section 3.0. Typically, the litter fences will be placed downwind and extend the full width of the working face.
- Litter scattered throughout the site, along fences and access roads, in the adjacent drainage channels and internal access roads and at the gate due to wind or as a result of waste falling from vehicles will be picked up once a day by landfill personnel and returned to the active working face of the disposal area(s). The M/S will ensure that on-site litter clean up efforts are recorded on a daily log which will be maintained in the SOR.
- Screening barriers such as temporary berms and piles of brush may be used in conjunction with portable and temporary wind screens.

4.10 EASEMENTS AND BUFFER ZONES §330.141

4.10.1 Easements

In accordance with §330.141**,** solid waste unloading, storage, disposal, or processing operations will not occur within any easement, or right-of-way that crosses the site. No solid waste disposal will occur within 25 feet of the centerline of any utility line or pipeline easement, unless otherwise authorized by TCEQ. All pipeline and utility easements will be clearly marked with posts which extend at least six feet above ground level, spaced at intervals no greater than 300 feet (see Section 4.11).

The City of Kingsville Landfill has one (1) aerial electrical powerline easement but has no other pipeline, utility, or other easements or rights-of-way within the existing and/or proposed permit boundary.

4.10.2 Buffer Zones

The buffer zone is defined as the area located between the permit boundary and the waste footprint. No solid waste unloading, storage, disposal, or solid waste processing and disposal operations will occur within any buffer zone. The buffer zones will provide safe passage for fire fighting and other emergency vehicles.

The buffer zone for the site varies around the site. The authorized separating distance will be maintained between the permit boundary and the waste footprint in previously permitted airspace, and 125 feet in all vertical and horizontal expansion areas submitted as part of this permit amendment. Buffer zones are shown on Part III, Attachment 1, Figure III.1-2.

4.11 LANDFILL MARKERS AND BENCHMARKS §330.143

Landfill markers consisting of steel, wood, plastic, fiberglass or other appropriate materials of construction will be installed to clearly identify significant landfill features. The markers will extend at least 6 feet above ground level, will not be obscured by vegetation, and will be placed in sufficient numbers to clearly show the required boundaries. In the event that a marker falls in a roadway, waterway or any other area incapable of sustaining an above ground marker, a steel post embedded in concrete may be buried in the appropriate place, or the marker may be placed in an alternate location with its true location noted on the marker.

Landfill markers will be inspected on a monthly basis to ensure that they are installed and maintained in compliance with the site operating plan. Markers that are removed, destroyed or do not meet regulatory requirements will be repaired or replaced within 15 days of removal, destruction or discovering that a marker does not meet regulatory requirements. Records of all inspections, repairs and replacements will be maintained in the SOR.

All markers will be color coded as indicated below.

TABLE 7: COLOR CODES FOR LANDFILL MARKERS AND BENCHMARKS

MARKER	COLOR
Site Boundary	Black
Buffer Zone	Yellow
Easements	Green
Grid System	White
SLER/GLER	Red
Floodplain	Blue

Guidelines for the types, placements and color coding of markers are outlined below.

4.11.1 Easement and R.O.W. Markers §330.143(b)(4)

Easement and right-of-way markers (Green) will be placed along the centerline of an easement, along the boundary of a right-of-way, at each comer within the site, and at the intersection of the site boundary. If a utility line has been constructed down the centerline, the marker may be off-set on the easement or R.O.W. This off-set will be noted on the site grid system drawing and the marker. There are currently no easements or rights-of-way within the permit boundaries.

4.11.2 Site Grid System Markers §330.143(b)(5)

Site grid system markers (White) will be installed at the facility. The grid system will encompass at least the area expected to be filled within the next 3 year period. Grid markers will be maintained during the active life of the site: post-closure maintenance of the grid system is recommended but not required. The grid system will consist of lettered markers along one (1) side and numbered markers along the other perpendicular side. Markers will be spaced no greater than 100 feet apart measured along perpendicular lines. Where markers cannot be seen from opposite boundaries, intermediate markers will be installed, where feasible.

4.11.3 SLER or GLER Area Markers §330.143(b)(6)

SLER or GLER area markers (Red) will be placed so that all areas for which a SLER or GLER has been submitted and approved by TCEQ are readily determinable. Such markers are to provide site workers immediate knowledge of the extent of approved disposal areas. These markers will be located so that they are not destroyed during operations until operations extend into the next SLER or GLER. The location of these markers will be tied into the site grid system and will be reported on each SLER/GLER submitted. SLER and GLER markers will not be placed inside the constructed/evaluated areas.

4.11.4 100 Year Flood Limit Protection Markers §330.143(b)(7)

Flood protection markers (Blue) must be installed in any area within a solid waste disposal facility that is subject to flooding prior to the construction of flood protection levee. The area subject to flooding will be clearly marked by means of permanent posts spaced not more than

300 feet apart or closer if necessary to retain visual continuity. City of Kingsville Landfill is NOT located within a 100 year floodplain.

4.11.5 Site Boundary Markers §330.143(b)(2)

Site boundary markers (Black) will be placed at each corner of the site and along each boundary line at intervals no greater than 300 feet. Fencing may be placed within these markers as required.

4.11.6 Buffer Zone Markers §330.143(b)(3)

Markers (Yellow) identifying the buffer zone will be placed along each buffer zone boundary at all corners and between corners at intervals no greater than 300 feet. Placement of the landfill grid markers may be made along a buffer zone boundary.

4.11.7 Permanent Benchmark §330.143(b)(8)

A permanent monument has been established at the site. The monument is established at the site in an area that is readily accessible and will not be used for disposal. The monument elevation was surveyed from a known United States Coast and Geodetic Survey benchmark. The location and elevation of the reference benchmark monument are provided in Part III, Attachment 1, Figure III.1-2, Facility Layout Plan. The monument is a brass-capped survey marker, set in concrete, stamped with the date and elevation.

4.12 MATERIALS ALONG ROUTE TO SITE §330.145

Necessary steps will be taken to encourage waste disposal vehicles to carry their load in enclosed containers or to provide a tarpaulin, net, or other means to properly secure the load in order to prevent the escape of any part of the load by blowing or spilling. These steps will include;

- Posting a sign at the site entrance stating that all loads must be enclosed or covered,
- Reporting offenders to the City of Kingsville Police or the Kleberg County Sheriff's office as necessary, and
- Adding litter control surcharges or other means to encourage compliance.

On days when the facility is operating, the landfill entrance, and other public roads will be inspected for spilled and wind-blown waste materials for a distance of two miles in either direction from the site entrance. Clean up of spilled and wind-blown materials will be performed at least once per day. All clean up efforts will be recorded on a daily log which will be maintained in the SOR. The M/S or his designee will consult with the Texas Department of Transportation (TXDOT), county, and/or local governments concerning the clean up of public access roads and right-of-ways.

4.13 DISPOSAL OF LARGE ITEMS §330.147

Items classified as large, heavy or bulky can include, but are not limited to, white goods (household appliances), air conditioner units, metal tanks, large metal pieces, large pieces of brush, whole tires, and automobiles. Large items may be disposed of at the working face, or recycled if they cannot be incorporated in the regular spreading, compaction, and covering operations at the

working face. A special area may be designated as a large item salvage area, should these items be accepted. These items will not be stored in excess of 180 days to prevent them from becoming a nuisance and to preclude discharge.

If disposed, bulky items may be reduced in size at the working face to the extent practical. Care should be taken during disposal to ensure that:

- Large items are excluded from the initial 5 feet of waste placed above the protective cover of a liner or sidewalls so that they do not damage the liner.
- Large items are placed in such a way that they do not interfere with continued waste filling.
- The maximum practical compaction is achieved. Smaller municipal solid waste may be placed and compacted around the large items.

Refrigerators, freezers, air conditioners, and any other items containing CFC will not be accepted for disposal at the working face unless the CFC's contained in the item have been removed completely by a licensed contractor in accordance with 40 CFR §82.156(f). No items containing chlorinated fluorocarbons (CFC) will be knowingly disposed of without having the CFC removed.

4.14 ODOR MANAGEMENT PLAN §330.149

This odor management plan addresses the identification of potential sources of odors at the City of Kingsville Landfill and includes methods to control odors or sources of odors.

4.14.1 Sources of Odor

Sources of landfill odor can vary considerably and may include the wastes being delivered to the landfill, the open working face, the leachate collection system, ponded water and landfill gas. Many of the wastes received at a landfill are a source of odor upon receipt, such as sludges 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, liquid that has passed through or emerged from solid waste, may also be a source of odor if not properly handled or managed in a timely manner. Ponded water and landfill gas could become sources of odor as well.

4.14.2 Odor Control

Among the measures that may be employed to reduce potential odors are the following:

- Minimize the size of the working face area.
- Place daily cover (a minimum of six inches of soil, or an alternate daily cover material such as tarps or foam material) over the fill area at the end of the working day. If necessary, increase the thickness of daily cover applied to the working face.
- Inspect daily, intermediate, and final cover areas to confirm that no trash is exposed and no erosion of cover material has occurred. Damaged and/or eroded cover areas will be promptly repaired. If odors result during the use of alternate daily cover material, re-

evaluate the use of that particular ADC. The ADC may be replaced with a different ADC or earthen material.

- Identify any waste stream that requires special attention to control odor.
    - Dead animals will be isolated within the active working face and immediately covered with three feet of waste or two feet of soil upon receipt. Additional daily cover soil may be placed if needed.
    - If the gate attendant or operator notes a load with significant odors, the load will be promptly covered with soil or solid waste when it arrives at the working face.
    - Sludges, septage, and grease trap waste that pass the paint filter test may be mixed with other absorptive wastes to minimize odors.
    - Known sources of odorous waste may be allocated a time of day for these wastes to be received so that they can be given special attention.
- Inspect the leachate collection and storage system to confirm that it is functioning as designed.
- Inspect and evaluate leachate recirculation procedures.
- Ensure that leachate removal from the site is done under appropriate weather conditions.
- Control water ponded over waste disposal areas to avoid it becoming an odor nuisance.
- Manage spills of odorous material in a timely manner.
  Promptly remove and dispose of odorous items from the recycling area.

4.14.3 Odor Response Procedures

If an odor that may be associated with landfill operation is detected within the site boundary, landfill personnel will attempt to determine the source of the odor. Areas to assess include the active working face, the leachate collection sumps, the leachate evaporation pond, the composting area, and/or the gas extraction system (if installed). If an identifiable odor is determined to be originating at these or any other area of the facility, the M/S will be notified and remedial actions will be initiated.

Remedial actions may include any or all of the following:

- Increasing the amount of daily cover for certain waste streams;
- Suspending the use of ADC or making sure certain wastes are covered with soil prior to application of ADC;
- Discontinuing certain waste streams;
- Aerating the leachate evaporation ponds;
- Controlling head levels in the leachate collection system;
- Checking the composting area for any potential sources of odor; and
- Making adjustments to the gas extraction system.

The investigation and remediation of odors will be documented and placed in the site operating record.

4.15 DISEASE VECTOR CONTROL §330.151

The City of Kingsville personnel will control all conditions favorable to the production or harboring of disease vectors such as rodents, flies, mosquitoes, and other insects or animals capable of transmitting diseases to humans. The primary means of control will be to prevent vectors from coming into contact with deposited waste through proper waste compaction and daily cover application. The working face will be confined to as small an area as practical and waste deposited at the working face will be promptly compacted. Daily cover and/or alternate daily cover will be applied at the end of each operating day. Landfill cover procedures are described in Section 4.22 of this SOP. Ponded water will be controlled as detailed in Section 4.23 of this SOP.

Site personnel should be observant for insects and rodents and will report problems to the M/S. Professional exterminators will be contacted, if necessary, to provide additional control of rodents or other pests that may appear at the site. If chemicals are needed for disease vector control, a professional will apply the appropriate chemical at the industry recommended rate, and use the appropriate health and safety practices to minimize any potential adverse effects.

4.16 SITE ACCESS ROADS §330.153

The site entrance road is a 24-foot wide, above-grade, all-weather roadway that extends from CR 2130 to the gate house. Other internal landfill roadways are constructed of crushed stone or similar material surface provide to provide for all-weather access from the scale house to the landfill unloading area(s). The site entrance and access roads will be maintained in a clean and safe condition. This includes the maintenance and grading of the roadway sections, mud control, litter and debris control, and dust control. Records of roadway inspections, as well as litter, dust and mud control efforts will be kept in the SOR to demonstrate compliance with the requirements of this section.

4.16.1 Re-grading of Site Access Roads

The site access roads will be inspected monthly for signs of depressions, pot holes, and rutting. The site will re-grade any depressions or rutting as necessary to provide a smooth, firm surface for all weather operations and to ensure uninterrupted access to the unloading area(s). Pot holes will be filled with road building material and graded to conform to the surrounding surface. At a minimum, site access roads will be re-graded twice a year.

4.16.2 Control and Minimization of Mud

Tracking of mud onto public roads will be controlled by minimizing the amount of mud on site entrance and access roads and on vehicles leaving the site. Vehicles leaving the site will traverse all weather site access roads and paved site entrance roads allowing for mud to be removed from the vehicle. Mud on the site entrance and access roads will be removed as necessary to prevent tracking of mud onto public access roads. Mud and debris tracked onto public roadways will be removed at least once per day on days when mud can be reasonably considered to be associated

with landfill operations. The M/S or his designee may implement further measures such as a temporary wheel wash when deemed necessary.

4.16.3 Control and Minimization of Dust

The landfill access roads will be maintained in a reasonably dust free condition by periodic spraying from a water truck. The M/S or his designee will routinely inspect the site during dry weather conditions and establish a frequency, if necessary, to spray the access roads with water to prevent dust from blowing off-site. The water used for dust control may be from a municipal water line, from on-site excavations, from on-site detention ponds, or from the adjacent drainage ditches.

4.16.4 Control and Minimization of Litter

Litter and debris that are tracked onto public roadways will be picked up at least once per day and returned to the working face of the landfill. Litter on CR 2130 and FM 2619 will picked up in accordance with Section 4.12, Materials Along Route to Site. Litter along the site entrance and access roads will picked up in accordance with Section 4.9, Control of Windblown Solid Waste and Litter.

4.17 SALVAGING AND SCAVENGING §330.155

4.17.1 Salvaging Operations

Salvaging is the controlled removal of waste materials for utilization, recycling or sale. Salvaging or recycling of materials such as metals and white goods will be allowed with specific authorization from the M/S if the activity is supervised by landfill personnel. However, salvaging should not be allowed to interfere with prompt sanitary disposal of solid waste or to create public health nuisances. Such items will be removed on an as needed basis to prevent creation of nuisance conditions, to preclude the discharge of pollutants from the recycling area, and to prevent an excessive accumulation of the material at the facility. Special wastes received at the disposal site will not be salvaged. Pesticide, fungicide, rodenticide, and herbicide containers will not be salvaged unless being salvaged through a state supported recycling program.

4.17.2 Scavenging Operations

Scavenging is the uncontrolled and unauthorized removal of materials at any point in the solid waste management system. No scavenging will be allowed at this site. This rule will be strictly enforced through site access controls and monitoring by facility personnel. Scavenging will be minimized by the following measures:

- Controlling access to the facility during operating and non-operating hours (as described in Section 4.5),
- Proper use of cover material (as described in Section 4.22),
- Regular observation of the working face and any area at which waste or recyclable materials may be stored by facility personnel (as described in Section 4.6), and
- Proper vector control (as described in Section 4.15).

4.18 ENDANGERED SPECIES PROTECTION §330.157

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, or cause or contribute to the taking of any endangered or threatened species. If endangered or threatened species are encountered during site operations, Texas Parks and Wildlife and U.S Fish and Wildlife Department will be notified. Information regarding endangered species is provided in Parts I/II of the site permit application.

4.19 LANDFILL GAS CONTROL §330.159

Landfill gas control is addressed in detail in Part III, Attachment 14 - Landfill Gas Management Plan, in accordance with 30 TAC §330.63(g). Refer to Part III, Attachment 14 for specific requirements and procedures. The required reports and other submittals will be included in the SOR of the facility and submitted to the executive director.

4.20 OIL, GAS AND WATER WELLS §330.161

4.20.1 Water Wells

There are no known (existing or abandoned) water wells on the project site. The executive director may approve any water well used for supply at the facility may remain in use as long as it is located outside the waste footprint, it is not impacted by landfill operations, it can be demonstrated that well design and installation will prevent any cross-contamination from the waste management unit to the water well production zone and between any water bearing zones, and an approved sampling plan to include frequency and parameters is in place. If a water well is proposed in the future, a permit modification will be submitted to the TCEQ. Should any unknown wells be discovered during the facility development, the M/S must, within 30 days provide written notification to the TCEQ's executive director of their location. Within 30 days of finding any water wells, the M/S will provide written 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. A copy of the well plugging report will be provided to the executive director of the TCEQ along with written certification.

4.20.2 Oil and Gas Wells

There are no known active crude oil wells, natural gas wells, or other wells associated with mineral recovery within the City of Kingsville Landfill permit boundary. There are however two inactive crude oil wells, and one inactive natural gas well within the permit boundary that have been properly capped, closed, and plugged in accordance with Railroad Commission of Texas (RRC) regulations. The RRC GIS Online Database identifies two (2) dry holes within the permit boundary. According to the available records for the dry holes have been plugged but there are no plugging reports. Should the dry holes or any unknown wells be discovered during the facility

development, the M/S must provide the executive director of the TCEQ a 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 will be submitted to the appropriate state agency and 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 changes to the liner installation plan, a permit modification will be submitted to the TCEQ executive director.

4.21 COMPACTION §330.163

Compaction of incoming waste facilitates efficient use of available space, minimizes settlement and consolidation, and promotes proper application of daily, intermediate and final cover. The waste will be spread in lifts that are approximately 2 feet thick and will be compacted using landfill compactors or similar equipment. The compaction equipment will pass over the waste a sufficient number of times to achieve thorough compaction. The number of passes required may be increased depending upon the nature of waste that is being compacted.

When waste is used as ballast, as described in Part III, Attachment 10, Liner Quality Control Plan (LQCP), the first five feet or the total thickness of ballast, whichever is greater, placed on the liner system will be free of brush and large bulky items, which may damage the underlying parts of the liner system or which cannot be compacted to required density. When waste is used as ballast, a wheeled trash compactor having a minimum weight of 40,000 pounds, or similar equipment, will be properly utilized to reach a compaction density of at least 1,000 pounds per cubic yard. For additional information see Part III, Attachment 10, LQCP.

To prevent the formation of potentially unstable interim slope conditions, the sequence of fill will be developed in a manner that solid waste will be compacted in horizontal lifts. The filling operation will start at the bottom of the landfill and continue vertically in horizontal lifts. Under no condition will the maximum allowable interim slope or slope lengths be exceeded without prior TCEQ authorization.

4.22 LANDFILL COVER §330.165

4.22.1 Soil Management

Management of soil for use in and around the landfill area will be an ongoing process. Soil for use as daily cover, intermediate cover, final cover and other uses will be obtained from on-site and off-site soil borrow sources. Soil from on-site sources will be obtained from excavation that is ongoing as part of the development of future landfill cells or from other suitable areas.

The earthen material will consist of soil that has not previously come into contact with waste and will be of sufficient volume to meet the required six inches of daily cover over the working face. The soil may also be used in emergency situations for fire control as specified in Section 4.4.1.2.4.6 of this SOP.

Stockpiles at the working face and in other areas of the landfill will be managed so as to not interfere with vehicular traffic or impede drainage and will be maintained in conformance with the Erosion Control Plan. Stockpiles will be oriented generally parallel to the direction of surface drainage in any given area and will not alter drainage patterns.

4.22.2 Daily Cover

Daily cover will be applied at the end of each work day to control disease vectors, windblown debris and odors, contaminated stormwater runoff, reduce the possibility of fire, prevent scavenging, and improve the operation of the site. At least once every 24 hours, the exposed solid waste fill areas will be covered by a minimum of 6 inches of earthen material that has not been previously mixed with garbage, rubbish or other solid waste. An approved alternative daily cover (ADC) material may also be used.

To ensure that the daily cover will be adequate (i.e., minimize vectors, contaminated storm water runoff, odors, etc.), the following procedures will be followed:

- The daily cover will be sloped to drain.
- The daily cover will be spread and compacted with a minimum of two passes with the bulldozer tracks or compactor to minimize infiltration of storm water, provide proper drainage, and to ensure that no waste is visibly protruding through the cover.
- The M/S or his designee will document where daily cover has been placed and visually inspect during placement that a minimum of 6 inches (compacted thickness) of soil daily cover or appropriate thickness of ADC has been placed and that no waste is exposed through it. The M/S or his designee will document on a daily basis the daily cover completion and placement area and indicate that he has visually verified the type (soil or ADC), thickness, and condition in the Cover Application Record.
- After each rainfall event resulting in runoff, the M/S will inspect all daily cover areas for erosion resulting in exposed waste and those areas will be repaired as necessary. Runoff from such areas will be handled as contaminated water until repairs are completed.
- The M/S will inspect for seeps from daily cover. Any leachate from waste below the daily cover will be controlled by placing soil berms and diverting the leachate to the contaminated water collection area. Contaminated water will be treated as outlined in Part III, Attachment 15 - Leachate and Contaminated Water Plan.

4.22.3 Alternate Daily Cover

Alternative material daily cover (ADC) materials may be utilized at this facility with the approval of the Executive Director. These materials may include the use of synthetic material tarps, commercial foam or sprayer products, or petroleum contaminated soils. Information regarding the specific ADC materials currently authorized by the TCEQ for use at the City of Kingsville Landfill is provided in Part IV, Attachment 2 – Alternative Daily Cover Operating Plan. The use of ADC is limited to a 24-hour period after which either waste or daily cover, as defined in

§330.165(a) and applied as described in Part IV, Attachment 2 – Alternative Daily Cover Operating Plan, must be placed.

In accordance with 30 TAC §330.165(d), the use of an ADC material not previously authorized, may be allowed by a temporary authorization under 30 TAC §305.70(m) followed by a permit amendment or a modification in accordance with 30 TAC§ 305.70(k)(1). If the TCEQ grants temporary authorization for the use of additional ADC, status reports of the ADC will be submitted to TCEQ on a two month basis that describes the effectiveness of the alternative material, any problems that may have occurred, and corrective actions required and implemented as a result of such problems. If no unresolved problems have occurred within the temporary authorization period, the status reports may no longer be required.

4.22.4 Intermediate Cover

All areas that have received waste but will be inactive for more than 180 days will be provided with intermediate cover. The daily cover will be covered with an additional 6 inches of well-compacted earthen material, for a total cover thickness of at least 12 inches. The additional 6 inches of earthen material will be capable of sustaining native plant growth and will be seeded or sodded following its application in order to reduce erosion. Seeding will occur during a standard growing season when it is feasible to establish vegetation. In addition to vegetation, other erosion control features will be maintained. Runoff from areas that have intermediate cover is considered to not have come in contact with the working face or leachate and is therefore not contaminated.

4.22.5 Final Cover

Final cover placement will occur in areas of the site that are filled to the design top-of-waste grades. Final cover placement will be in accordance with Part III, Attachment 12 - Final Closure Plan and will permit ongoing landfilling operations to continue until the time of final closure. Surface water will be managed throughout the active life of the site to minimize infiltration into the filled areas and to minimize contact with solid waste.

Closure of completed portions of the site will consist of the following steps:

- Survey controls will be implemented to control the filling of solid waste to the lower level of the final cover.
- A surveyed grid system or other suitable surveying measures will be used to control placement of the final infiltration layer.
- Testing of the various components of the final cover system will be performed in accordance with the Liner Quality Control Plan (Part III, Attachment 10).
- A final cover certification report with an as built survey will be prepared by a registered professional engineer and submitted to the TCEQ for approval.

- The TCEQ-approved final cover certification report will be maintained in the SOR. The final cover inspection record, as described in Section 4.22.7 will be updated to reflect the area where final cover placement has occurred at the site.
- During the first growing season following application of the final cover system, the area will be vegetated with appropriate grasses to minimize erosion.

4.22.6 Erosion of Cover

The final cover system including the erosion control structures (such as drainage swales and chutes) will be maintained during and after construction. The M/S will inspect the intermediate and final cover at the site on a weekly basis and after a rain event in which runoff occurs. Eroded or washed out areas of the intermediate or final cover that are deep enough (more than 4 inches in depth) to jeopardize the integrity of the cover will be repaired within five days of detection as weather permits. Repair of final cover includes restoring the cover material, grading, compacting, and seeding. If conditions warrant, and the commission's regional office approves otherwise, based on the extent of the damage, time to repair or weather conditions, the five day requirement may be extended. The date of detection of erosion and date of completion of repairs, including reasons for any delays, will be documented in the cover inspection record.

4.22.7 Cover Inspection

A cover application record will be maintained at the site and readily available for inspection by TCEQ and authorized agents or employees of local governments having jurisdiction. The record will specify the date that cover (no exposed wastes) was accomplished, how it was accomplished, and the last area covered. This applies to daily, intermediate, alternative material daily, and final cover. For final cover, the record should show the area receiving final cover and reference a final cover certification report for each area. Each entry will be certified by signature of the landfill M/S.

The cover inspection record will be maintained that documents inspections of daily, intermediate and final cover, the findings, and corrections action taken when necessary. This cover inspection record will be maintained in the SOR.

4.23 PONDED WATER §330.167

The City of Kingsville will prevent and control the ponding of water over waste and within the site. Site grading and maintenance activities will be performed on an as needed basis to help minimize the ponding of water over waste areas. Should ponded water occur, the ponded water will be eliminated and depressions will be filled as soon as practical within seven days of the occurrence. If the ponded water has come into contact with waste, leachate or contaminated soils, it will be treated as contaminated water and handled in accordance with Part III, Attachment 15 - Leachate and Contaminated Water Management Plan (LCWMP).

Active portions of the landfill, including final covered areas not in post closure care, intermediate cover areas, daily cover areas, and ADC areas, will be inspected at least weekly for signs of

ponding water or depressions that could potentially pond water. Additional inspections may be conducted after rainfall events that might cause ponding, typically 1 inch or more rain in a 24 hour period. Ponded water in areas not over waste, such as excavations, and detention ponds is not prohibited as long as it does not cause or contribute to nuisance conditions. Refer to Part IV, Attachment 4 - Ponded Water Prevention Plan for more details on techniques used to prevent the ponding of water over waste, inspection schedule, corrective actions to remove ponded water, and general instructions to manage water that has been in contact with waste.

4.24 DISPOSAL OF SPECIAL WASTE §330.171

Special wastes, as defined in §330.3, may be accepted at the facility in accordance with §330.171(b) and (c) and Part IV, Attachment 3 - Special Waste Acceptance Plan (SWAP). The special wastes that will be accepted at the site, as well as the identification, acceptance and handling procedures are discussed in Part IV, Attachment 3 - SWAP.

4.25 DISPOSAL OF INDUSTRIAL WASTE §330.173

This facility will not accept any Class 1, Class 2, or Class 3 industrial solid waste. Industrial (nonhazardous) waste is defined by §330.3 as solid waste resulting from or incidental to any process of industry or manufacturing, or mining or agricultural operations, classified as follows:

- Class 1 - 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 defined in §335.505 (relating to Class 1 Waste Determination).
- Class 2 - 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 - any inert and essentially insoluble industrial solid waste, including materials such as rock, brick, glass, dirt, and certain plastics and rubber, etc. that are not readily decomposable as defined in §335.507 (relating to Class 3 Waste Determination).

4.26 VISUAL SCREENING OF DEPOSITED WASTE §330.175

The landfill will be operated in a manner that will provide the maximum screening possible within the requirements of the design. All disposal operations will be conducted in accordance with the following sections of this SOP to minimize the visual impact of waste disposal operations;

- Section 4.22 : Landfill Cover
- Section 4.21 : Compaction
- Section 4.17 : Salvaging and Scavenging

- Section 4.15 : Disease Vector Control
- Section 4.9 : Control of Windblown Solid Waste and Litter
- Section 4.6 : Unloading of Waste

The visual effect of the disposal activities will also be minimized through the use of fencing, planted vegetation, and natural vegetation within the buffer zone.

4.27 LEACHATE AND GAS CONDENSATE RECIRCULATION §330.177

Consistent with §330.177, recirculation of leachate and gas condensate will only occur in landfill units that are designed and constructed with a leachate collection system and a composite liner. The Kingsville Landfill will not recirculate leachate and gas condensate.

5.0 OTHER SITE ACTIVITIES

Other site activities may arise that are not discussed in this plan. The M/S has full responsibility for on the job training of those activities and ensuring that they are conducted as required by the site permit, TCEQ regulations, or any other local, state or federal regulation. Some of these activities are briefly discussed below.

5.1 POND AND DITCH MAINTENANCE

Periodically, as directed by the M/S, site drainage ditches and storm water ponds may require maintenance and/or cleaning to ensure that they function as intended. The required maintenance may be conducted by site personnel or by a contractor. The maintenance may consist of a little as cleaning up litter and/or small brush/limbs to as much as excavating and removing excessive silt deposits. The amount of maintenance will be predetermined by the M/S. If landfill personnel conduct the activities, on-site equipment will be used if possible. Otherwise, appropriate equipment may require rental. In any case, if excavation is required, the work will be conducted so as not to change elevations documented within the site permit.

5.2 LEACHATE SYSTEM MAINTENANCE

It will be the responsibility of the M/S to ensure that the leachate collection system remains in good working order. As leachate systems are installed for new cell constructions, landfill personnel will be trained on the operation and maintenance procedures associated with the equipment. The leachate system at each cell location will be inspected at least weekly to ensure that it is operating properly. Any system found to not be operating properly will be brought to the immediate attention of the M/S. The M/S, at this time, will ensure that appropriate measures are taken to repair the system as soon as possible.

5.3 TPDES MONITORING

The M/S will ensure that proper monitoring is conducted according to regulations for the Texas Pollutant Discharge Elimination System (TPDES) for this site.

5.4 FINAL COVER MAINTENANCE

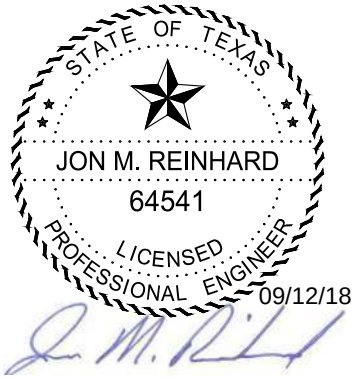
Final cover in waste areas will be placed as described in Part III, Attachment 12, Closure Plan. Once final cover has been established, it will be the responsibility of the M/S to ensure that vegetation is maintained through irrigation and reseeding, if necessary, and that erosion is minimized. If erosion of the final cover does occur, additional topsoil, or on site soil capable of sustaining vegetation, will be placed and graded according to the final contours as detailed in Part III, Attachment 7, Final Contour Map. After erosion is repaired, appropriate seeding and irrigation will be provided in that area to ensure revegetation.

CITY OF KINGSVILLE LANDFILL

ATTACHMENT 1

FORMS

CONTENTS



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WASTE PROFILE FORM

Generator's Name:_____

Generators Address: _____

Generator Contact:_____

Phone: _____ Fax: _____

Description of Waste: _____

_____

Description of Process Generating Waste: _____

_____

Volume of Waste: _____

Supplemental Information Attached: _____

(i.e., Analytical Data, MSDS, Process Knowledge, etc.)

Physical characteristic of waste: ☐ Solid ☐ Liquid ☐ Powder ☐ Semi-Solid

Free Liquid: ☐ Yes ☐ No

Flash Point: _____ pH:_____

Chemical Composition:	_____	_____
(Total must add to 100 %)	_____	_____
	_____	_____
	_____	_____
	_____	_____
	Total =	100%

Generator Certification

I certify that the above information is correct and complete to the best of my knowledge, and the Waste is not hazardous as per 40 CFR Part 261. I, _____ (Name) , am employed by_____ (Company Name) , and am authorized to sign this request for:

_____ (Company Name) , _____ (Signature) _____ (Date)

WASTE INSPECTION/SCREENING FORM

Inspection No.: _____

Date: _____

Name of Inspector: _____

Type of Inspection: ☐ Initial Screening ☐ Random Screening

☐ Suspected Unauthorized Waste

Other: _____

Transporter/Generator Information:

Name: _____

Address: _____

Contact Person: _____

Phone: _____ Fax: _____

Type of Vehicle: _____

Source of Load: _____

Size of Load: _____

Contents of Load: _____

_____

_____

Indicators of Prohibited Waste: _____

_____

_____

Unusual Odors:	☐ Yes	☐ No
Unusual Colors:	☐ Yes	☐ No
Heat/Excessive Smoke:	☐ Yes	☐ No

Inspection Comments: _____

_____

_____

_____

_____

SPECIAL WASTE INSPECTION FORM

Inspection No.: _____

Date: _____

Name of Inspector: _____

Type of Inspection: ☐ Initial Screening ☐ Random Screening
☐ Suspected Unauthorized Waste

Other: _____

Transporter/Generator Information:

Name: _____

Address: _____

Contact Person: _____

Phone: _____ Fax: _____

Type of Vehicle: _____

Source of Load: _____

Size of Load: _____

Physical Screening

Indicate Yes or No for each of the following tests. Note any Discrepancies. Do the characteristics of the waste match the provided information on the special waste profile?

Characteristics Profile		Yes	No	Comments and/or Observations
Color	_____	☐	☐	_____
Odor	_____	☐	☐	_____
Physical State	_____	☐	☐	_____
Free Liquids	_____	☐	☐	_____

Waste Accepted:

_____ _____
(Inspector Signature) (Date)

Inspection No.: _____

Date: _____

Name of Inspector: _____

Waste Rejected:
Reasons for rejection

☐ Extraneous and/or Unauthorized Material ☐ Suspected Hazardous Waste

☐ Suspected PCB Waste ☐ Does not match profile

Other:_____

Comments:_____

_____

_____

_____ _____
(Inspector Signature) (Date)

_____ _____
(M/S or Designee Signature) (Date)

WASTE DISCREPANCY REPORT FORM

Date:_____

Name of Inspector: _____

Transporter/Generator Information:_____

Name:_____

Address:_____

Contact Person:_____

Phone:_____ Fax:_____

Waste Description:_____

_____

_____

_____

_____

Comments:_____

_____

_____

_____

_____

CITY OF KINGSVILLE LANDFILL

ATTACHMENT 2

ALTERNATE DAILY COVER (ADC) OPERATING PLAN

TABLE OF CONTENTS

ALTERNATE DAILY COVER (ADC) OPERATING PLAN

A. Background

Purpose

This alternate daily cover (ADC) operating plan has been developed for the City of Kingsville Landfill to describe the materials and procedures regarding the use of ADC at the facility. The use of ADC must otherwise comply with the Site Operating Plan (SOP).

B. Description of the ADC Material

Tarps

Tarps from a variety of manufacturers may be used as ADC to cover the working face at the end of the operational day. The tarps will be removed prior to the placement of additional waste, so the use of these products will conserve landfill space and prolong the potential landfill life.

C. Effects of ADC on vectors, fires, odors, windblown litter or waste, and scavenging

The alternate daily covers described in Section B will control vectors, fires, odors, windblown litter or waste, and scavenging by creating a barrier between the waste and vectors, gas, oxygen, odors, wind, scavengers, and other elements.

D. Application and Operation Methods

Tarps

The following procedures shall be utilized for the application of the tarps:

- Tarps will be deployed and removed using automatic tarp deployment equipment, standard landfill equipment, and/or site personnel. To minimize tears, the tarps will not be forcibly dragged over the working face.
- Tarp panels shall be placed over the entire working face and extend at least one (1) foot past the limits of the working face.
- If the required coverage cannot be achieved utilizing one tarp panel, additional tarp panels shall be utilized to achieve the required coverage, with a minimum one (1) foot overlap where the tarp panels join.

- The edges and all overlapped joints panels shall be anchored utilizing used tires or sandbags.
- The entire working face shall be inspected to ensure that the application has met the requirements of the SOP and inspections documented in the Daily Cover log required by the SOP.
- Once the application is verified, the tarp panels may remain in-place for up to twenty four (24) hours, past which time the material shall either be removed and additional waste placed or standard soil cover applied as outlined in the SOP.
- Waste may not be placed directly on top of the tarps that are to be re-used.

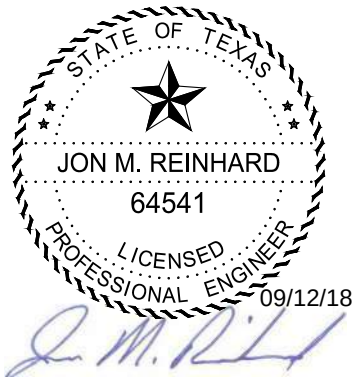
CITY OF KINGSVILLE LANDFILL

ATTACHMENT 3

SPECIAL WASTE ACCEPTANCE PLAN

CONTENTS

TABLES



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1.0 INTRODUCTION

This Waste Acceptance Plan (WAP) outlines the procedures for the identification, acceptance and management of special waste. The objectives of the WAP are as follows:

- Define procedures which will be followed to determine whether or not the facility is permitted to accept a specific waste for disposal.
- Outline the procedures for identifying and preventing the disposal of unacceptable wastes that are delivered to the facility.
- Establish the necessary conditions to ensure the safe and environmentally sound management (including collection, storage, transportation, and disposal) of the waste.

Special waste is 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. Special wastes as defined in 30 TAC §330.3, 30 TAC §330.171, and 30 TAC §330.173 include the following:

a) Hazardous waste from conditionally exempt small-quantity generators that may be exempt from full controls under Chapter 335, Subchapter N (relating to Household Materials Which Could Be Classified as Hazardous Wastes);
b) Class 1 industrial nonhazardous waste;
c) Untreated medical waste;
d) Municipal wastewater treatment plant sludges, other types of domestic sewage treatment plant sludges, and water-supply treatment plant sludges;
e) Septic tank pumpings;
f) Grease and grit trap wastes;
g) Wastes from commercial or industrial wastewater treatment plants; air pollution control facilities; and tanks, drums, or containers used for shipping or storing any material that has been listed as a hazardous constituent in 40 Code of Federal Regulations (CFR) Part 261, Appendix VIII but has not been listed as a commercial chemical product in 40 CFR §261.33(e) or (f);
h) Slaughterhouse wastes;
i) Dead animals;
j) Drugs, contaminated foods, or contaminated beverages, other than those contained in normal household waste;
k) Pesticide (insecticide, herbicide, fungicide, or rodenticide) containers;
l) Discarded materials containing asbestos;
m) Incinerator ash;

n) Soil contaminated by petroleum products, crude oils, or chemicals in concentrations of greater than 1,500 milligrams per kilogram total petroleum hydrocarbons; or contaminated by constituents of concern that exceed the concentrations listed in Table 1 of §335.521(a)(1);

o) Used oil;

p) Waste from oil, gas, and geothermal activities subject to regulation by the Railroad Commission of Texas when those wastes are to be processed, treated, or disposed of at a solid waste management facility;

q) Waste generated outside the boundaries of Texas that contains:

   i. any industrial waste;

   ii. any waste associated with oil, gas, and geothermal exploration, production, or development activities; or

   iii. any item listed as a special waste in this paragraph;

r) Lead acid storage batteries;

s) Used-oil filters from internal combustion engines;

t) Regulated asbestos-containing material (RACM) as defined in 40 CFR Part 61;

u) Nonregulated asbestos-containing material (non-RACM);

2.0 DISPOSAL OF SPECIAL WASTES

The City of Kingsville is required to handle special wastes in a manner that is consistent with TCEQ regulations. The facility will handle special waste according to the following guidelines.

2.0.1 SPECIAL WASTES THAT DO NOT REQUIRE SPECIAL WASTE DISPOSAL AUTHORIZATION FROM TCEQ

The following special wastes may be accepted for disposal at the City of Kingsville Landfill without prior written authorization from the TCEQ provided the waste is handled in accordance with the procedures listed below:

1. **Special Wastes from Health Care Related Facilities**
   Special wastes from health care related facilities must be treated in accordance with the procedures specified in 30 TAC §330, Subchapter Y (relating to Medical Waste Management).

2. **Dead Animals and/or Slaughterhouse Waste**
   Dead animals and/or slaughterhouse waste may be accepted without further approval provided the carcasses and/or slaughterhouse waste are covered by 3 feet of other solid waste or at least 2 feet of soil immediately upon receipt. Dead animals may also be composted in accordance with 30 TAC Chapter 332.

3. **Non-Regulated Asbestos-Containing Materials (non-RACM)**
   Non-regulated asbestos-containing materials (non-RACM) may be accepted for disposal provided the wastes are placed on the active working face and covered in accordance with 30 TAC §330 (relating to Municipal Solid Wastes). Under no circumstances may any material containing non-RACM be placed on any surface or roadway which is subject to vehicular traffic or disposed of by any other means by which the material could be crumbled into a friable state.

4. **Empty Containers which have been used for Pesticides, Herbicides, Fungicides, or Rodenticides** Empty containers which have been used for pesticides, herbicides, fungicides, or rodenticides must be disposed of in accordance with subparagraphs (a) and (b) of this paragraph.

   a) These containers may be disposed of at the disposal facility provided that:
      i. The containers are triple-rinsed prior to receipt at the landfill;
      ii. The containers are rendered unusable prior to or upon receipt at the landfill; and
      iii. The containers are covered by the end of the same working day they are received.

   b) Those containers for which triple-rinsing is not feasible or practical (e.g. paper bags, cardboard containers) may be disposed of under the provisions of subparagraph (5) of this section or in accordance with 30 TAC §330.173;

5. **Municipal Hazardous Waste from a Conditionally Exempt Small Quantity Generator (CESQG)** Municipal hazardous waste from a conditionally exempt small quantity generator (CESQG) may be accepted provided the amount of waste does not exceed 220 pounds (1 00 kilograms) per month per generator, and provided the facility owner/operator authorizes acceptance of the waste.

6. **Sludge, Grease Trap Waste, or Grit Trap Waste from Municipal Sources**
   Sludge, grease trap waste, or grit trap waste from municipal sources can be accepted for disposal only if the material has been treated or processed and the treated/processed material has been tested, in accordance with Test Method 9095 (Paint Filter Liquids Test), as described in "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods: (EPA Publication Number SW -846), as amended, and is certified to contain no free liquids. Dry sludge, from the Kingsville Wastewater treatment plants may be placed, one-time, over the final cover at a rate not to exceed 8 tons per acre for vegetation growth enhancement. The dry sludge shall be required to pass the Paint Filter Test and no application shall exceed 8 tons per acre.

7. **Soil Contaminated by Petroleum Products, Crude Oils, or Chemicals**
   Soil contaminated by petroleum products, crude oils, or chemicals (also referred to as petroleum contaminated soils) may be accepted for disposal without specific TCEQ approval only if they are tested as being under the limits specified in the following table.

TABLE 1: MAXIMUM CONTAMINANT LEVEL *§335.521(a)(1)*

CONTAMINANT	CONSTITUENTS OF CONCERN	MAXIMUM CONTAMINANT LEVEL MUST BE LESS THAN
Automotive Gasoline	Benzene TPH Lead	0.5 mg/l 1500 mg/kg 1.5 mg/l
All Other Fuels (i.e., Diesel, Kerosene, Aviation, Fuel Oil, etc.)	Benzene TPH Lead	0.5 mg/l 1500 mg/kg 1.5 mg/l
Used Motor Oil from an Internal Combustion Engine.	Benzene TPH Lead	0.5 mg/l 1500 mg/kg 1.5 mg/l

Other soils contaminated by petroleum products, crude oils, or chemicals (not addressed in the table) will require specific authorization on a case-by-case basis prior to disposal. Requests for authorization to dispose of contaminated soils will be accompanied by analytical data (including signed laboratory reports, chain-of custody information, Quality Control Data, and a sampling plan) or data as required by the TCEQ.

2.0.2 SPECIAL WASTES THAT REQUIRE SPECIAL WASTE DISPOSAL AUTHORIZATION FROM TCEQ

Special wastes that are not listed for acceptance per Section 2.0.1, Items 1 through 7, will require prior written authorization from the TCEQ. A Request for Authorization for Disposal of a Special Waste will be submitted, by either the landfill or customer/ generator to the TCEQ for review and approval. Once the waste has been approved for receipt and disposal at the facility, the customer/generator will be notified of the waste's approval and the delivery and disposal will be coordinated. The waste handling procedures will be specific to the approved waste stream.

2.0.3 SPECIAL WASTE PROHIBITED FROM DISPOSAL

The following wastes are prohibited and will not be accepted for disposal at this facility:

1. Class 1, Class 2, and Class 3 Industrial waste.
2. Regulated asbestos-containing materials (RACM).
3. Lead acid storage batteries.

3.0 SPECIAL WASTE EVALUATION GUIDELINES

Before accepting any special waste for disposal at this facility, the waste must be evaluated to assure that the waste is non-hazardous and to determine the acceptability of the waste pursuant to facility permit conditions, applicable regulations, and operating capabilities.

3.0.1 WASTE PROFILING

The customer/generator must provide sufficient documentation that their wastes meet all of the requirements. This type of documentation, when necessary, should include information such as the generator's information, description of the waste, description of the process generating the waste, volume of waste, waste/chemical composition, physical characteristics, and any other information the M/S deems necessary. This documentation may be included on a Waste Profile Form (WPF) such as the one included in Part IV, Attachment 1.

3.0.2 ANALYTICAL REQUIREMENTS

The waste generator may also be required to provide analytical data depending on the type of waste stream to be deposited. Any analytical data submitted to the City of Kingsville Landfill for use in the waste evaluation process must meet the following criteria:

- Analytical sampling, analysis, and interpretations must be in strict accordance with current local, state and federal regulatory requirements;
- Analytical data must be less than 12 months old; and
- The analytical information provided must be legible, signed by the laboratory, and must include:
    - A description of the waste material analyzed;
    - The analytical methods used;
    - The concentration of the observed value in appropriate units; and
    - The detection limit of the analytical method if chemical constituents are not detected.

Should there be any changes in the process from which the waste is produced, the generator will be required to provide notification and additional process and/or chemical analysis data. If the waste received at the landfill differs from that of the approved waste stream, disposal will be temporarily stopped until the generator can provide additional process and/or chemical analysis data in order to determine the cause of the change in waste characteristics and any associated disposal requirements.

3.0.3 SPECIAL WASTE ACCEPTANCE CRITERIA

Authorized landfill personnel (Special Waste Analysts) responsible for reviewing special waste documentation will utilize waste-specific chemical and characteristic information submitted by the generator on the Waste Profile Form (WPF) to determine the acceptability of a waste for disposal at the City of Kingsville Landfill. These individuals will be familiar with the application of relevant regulations and guidance documents pertaining to waste classification, waste characterization, and hazardous waste determination. Applicable regulations and guidance documents include: 40 CFR Part 261 - Identification and Listing of Hazardous Waste; 30 TAC §335, Subchapter R - Waste Classification; and TCEQ Regulatory Guide RG-22, Guidelines for the Classification and Coding of Industrial and Hazardous Wastes.

Special waste review procedures will include:

1. Review of Waste Profiling Documents- The provided Waste Profile Form(s) must be completed in full by the waste generator and must include sufficient information to provide a clear understanding of the waste's type, origin, content, shipping method, anticipated frequency of disposal, and physical characteristics (including chemical and physical properties).
2. Discrepancy Resolution – In the event that there are any discrepancies (i.e., missing documentation, incomplete documents or questionable waste characteristics), the Special Waste Analyst may request additional information in the form of analytical test results and/or other documentation (e.g., MSDS) from the generator before rendering a decision. If the discrepancies cannot be resolved, the waste load will be rejected.
3. Determination of the Acceptability of a Waste for Disposal at the Site – The analysts will determine if the special waste falls in the categories of special wastes that **do not** require further disposal authorization from TCEQ, special wastes that **do** require special disposal authorization from TCEQ, or special wastes that are prohibited for disposal at the facility. Refer to Section 2.0 of this WAP – Disposal of Special Wastes.

   If the special waste falls in the category of special wastes that **do not** require special disposal authorization from TCEQ, then the special waste will be further evaluated using the criteria established in Section 2.0.1 of this WAP.

   If the special waste falls in the category of special wastes that **do** require special disposal authorization from TCEQ, then the landfill or the customer/generator will need to obtain special waste disposal authorization from TCEQ if they have not already done so. The waste will be further evaluated using the criteria established in the TCEQ approved special waste disposal documentation.

   It will be confirmed that all special waste acceptance is in accordance with the Landfill Permits, as well as TCEQ, Local and Federal regulations.

4.0 DOCUMENTATION AND RECORD KEEPING

The landfill must keep all TCEQ approved special waste authorization forms, Waste Profile Forms approved by landfill personnel, and all other paperwork relating to the acceptance of special waste on file in the Site Operating Record (SOR).

5.0 TRAINING OF PERSONNEL

Key site personnel will receive initial and refresher training on special waste identification, screening, and management procedures. This training will allow for the monitoring and proper

handling of waste streams as they enter the facility, as well as during disposal. Training will be conducted by either in-house staff or outside specialists familiar with proper special waste management procedures and the requirements of this Waste Acceptance Plan (WAP). Documentation and a record of all training provided will be maintained in the SOR and will be available for inspection.

6.0 PERSONAL PROTECTIVE EQUIPMENT

The required protective equipment for operating personnel assisting in the disposal of special waste includes:

- Hard hat,
- Steel toed boots,
- Safety vest,
- Safety glasses or goggles, and
- Leather gloves.

On-site emergency equipment includes:

- Fire extinguisher,
- Shower,
- Eye wash,
- Bulldozer, and
- Water truck.

7.0 CONTINGENCY PROCEDURES

Special waste that is spilled during the delivery and/or disposal operations will be immediately cleaned up, transported to the appropriate disposal area, and properly disposed.

The area around the special waste spill will be immediately cordoned off and traffic safely diverted around the spill. Spilled special waste will be loaded back onto the transport truck or other appropriate vehicle for transport to the disposal area. Small amounts of spilled waste may be loaded by handheld tools while larger amounts of spilled waste may be loaded with an excavator, front end loader, or other similarly qualified equipment.

The location of the special waste spill will be inspected after the clean-up is completed and any remaining special waste will be removed and properly disposed of. Soils observed to be potentially impacted will be excavated and disposed of with the collected material.

CITY OF KINGSVILLE LANDFILL

ATTACHMENT 4

PONDED WATER PREVENTION PLAN

(30 TAC §330.167)

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1.0 INTRODUCTION

This Ponded Water Prevention Plan identifies techniques to be used at the landfill to control the ponding of water over waste, an inspection schedule to identify potential ponding sites, corrective actions to remove ponded water, and general instructions to manage water that has been in contact with waste.

2.0 TECHNIQUES TO PREVENT PONDING OF WATER OVER WASTE

The ponding of water over waste, over active portions of the landfill or closed portions of the landfill, will be controlled by grading the landfill to provide positive flow at all locations that contain waste and combining that with routine grading and maintenance of the cover soils.

Closed areas, with final cover, will be graded, inspected, and maintained in accordance with the requirements of Part III, Attachment 12, Final Closure Plan and Part III, Attachment 13, Post Closure Care Plan.

Water that may pond at the working face of the landfill will be removed using landfill equipment. Water that comes in contact with waste will be treated as contaminated water and disposed of in accordance with Part III, Attachment 15, Leachate and Contaminated Water Management Plan.

Water directed into future cell excavations from intermediate cover areas will be pumped into the perimeter drainage system. Water from the closed portions of the landfill will be directed to the perimeter drainage system and discharged off-site as shown in Part III, Attachment 6, Groundwater and Surface Water Protection Plan and Drainage Plan.

3.0 ROUTINE INSPECTIONS AND CORRECTIVE ACTIONS

Active portions of the landfill including final covered areas not in post closure care, intermediate cover areas, daily cover areas, and ADC areas, will be inspected at least weekly for signs of ponding water or depressions that could potentially pond water. Additional inspections to identify areas of potential or actual ponding may be conducted after heavy rainfall events, typically 1 inch or more rain in a 24 hour period.

During the post closure period of closed portions of the landfill, the final cover will be inspected and maintained annually, at a minimum, in accordance with Part III, Attachment 13, Post Closure Care Plan.

Directives to fill and re-grade potential ponding locations will be undertaken as soon as practical after they have been identified. Ponded water that occurs in the active portion of the landfill will be eliminated and the area in which the ponding occurred will be filled in and re-graded within seven days of detection. However, during periods of extended rainfall, the site may not be able to

operate on the cover materials without further compromising the cover with the tracking of equipment. During these periods, the site may allow for a period of drying prior to accessing the ponded water with landfill equipment.

After the ponded water has been removed the site will be re-graded and/or filled with additional cover soil to eliminate the potential for ponded water and promote positive drainage.

4.0 GENERAL INSTRUCTIONS TO MANAGE WATER THAT HAS BEEN IN CONTACT WITH WASTE (CONTAMINATED WATER)

Water that has been in contact with waste will be removed and handled as contaminated water in accordance with Part III, Attachment 15, Leachate and Contaminated Water Management Plan and Part III, Attachment 6, Groundwater and Surface Water Protection Plan and Drainage Plan.

In general, contaminated water will be contained in the area of the working face behind the containment berm. This water will be handled as leachate and will be disposed of in a manner that will not cause surface water or groundwater pollution. Contaminated water will not be discharged without specific written authorization. As such, the contaminated water will be pumped directly into a tanker truck, or pumped through a force main system, or directly, to the evaporation pond(s) or future on-site storage or treatment facilities. Contaminated water pumped directly to a tanker truck may be disposed of at the evaporation pond or off-site at a TCEQ approved treatment facility. Any of the aforementioned transmission systems may be utilized.

The contaminated water evaporation pond is constructed and managed in accordance with Part III, Attachment 15, Leachate and Contaminated Water Management Plan.

On-site wastewater treatment systems will comply with 30 TAC 285 relating to On-site Sewage Facilities. The owner or operator will obtain any permit or other approval required by state or local code for the system installed.

Off-site discharge of contaminated waters will be made only after approval under the Texas Pollutant Discharge Elimination System authority.

Wastewaters discharged to a treatment facility permitted under Texas Water Code, Chapter 26 must not:

1. Interfere with or pass-through the treatment facility processes or operations;
2. Interfere with or pass-through its sludge processes, use, or disposal; or
3. Otherwise be inconsistent with the prohibited discharge standards, including 40 Code of Federal Regulations Part 403, General Pretreatment Regulations for Existing and New Source Pollution.

The daily effluent design standard for oil and grease concentration leaving the facility and entering a public sewer system will not exceed 200 milligrams per liter, the concentration

established in the wastewater discharge permit pretreatment limit or the concentration established by the treatment facility permitted under the Texas Water Code, Chapter 26, the National Pollutant Discharge Elimination System, or the following liquid effluent limits, if the discharge points do not require compliance with locally set limits.

TABLE 1: LIQUID EFFLUENT LIMITS

EFFLUENT CHARACTERISTICS	**EFFLUENT LIMITATIONS**	
	Maximum for one day:	**Average daily values for 30 consecutive days shall not exceed:**
	Metric Units (kg)/1,000 kg of raw material	
Oil and grease	0.10	0.05
Total Petroleum Hydrocarbons (TPH)	0.01	0.01
pH	5.5 – 10.5	5.5 – 10.5
	English Units (lbs.)/1,000 lb. of raw material	
Oil and grease	0.10	0.05
Total Petroleum Hydrocarbons (TPH)	0.01	0.01
pH	5.5 – 10.5	5.5 – 10.5