THE CITY OF KINGSVILLE LANDFILL TCEQ PERMIT MSW 235-C

PERMIT AMENDMENT APPLICATION Volume 4 of 6



CITY OF KINGSVILLE, TEXAS

September 2018 Revision 0

Prepared by





HANSON PROJECT NO. 16L0438-0003

CITY OF KINGSVILLE LANDFILL PART III ATTACHMENT 5

ALTERNATIVE LINER AND OVERLINER
POINT OF COMPLIANCE DEMONSTRATIONS

Revision: 0

ATTACHMENT 5 ALTERNATIVE LINER AND OVERLINER DESIGN AND POINT OF COMPLIANCE DEMONSTRATIONS



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1 INTRODUCTION

1.1 Purpose and Scope

This attachment is submitted to allow the use of a geosynthetic clay liner (GCL) as an alternative to the Subtitle D two-foot thick soil liner component of the liner system and demonstrate that the proposed alternative liner and overliner will meet the point of compliance (POC) requirements specified in Title 30 Texas Administrative Code (TAC) §330.331 (a).

This Alternate Liner Design Demonstration (ALD) was performed in accordance with the procedures presented in the *Texas Water Commission Alternate Liner Design Handbook, A Performance Standard As Authorized by 31 Texas Administrative Code (TAC)* §330.202 (Version 1, August 1993), using the Hydrologic Evaluation of Landfill Performance (HELP) and Mutimed Exposure Assessment (MULTIMED) computer models. This is achieved by demonstrating that the predicted concentrations of selected leachate chemical constituents do not exceed maximum contaminant levels (as listed in Table 1 in §330.331(a)(1)) in the uppermost aquifer at the POC. The concentration of various constituents at the POC is determined by calculating a dilution attenuation factor (DAF), which is determined by the following equation.

DAF = Co, Initial Constituent Concentration of Leachate Within the Landfill Cp, Constituent Concentration at the POC

The DAF represents the factor by which the constituent concentration is expected to decrease between the landfill and the POC. When the constituent's concentration in leachate is divided by the model predicted DAF, the resulting concentration must be less than the allowable maximum contaminant levels (MCLs) in groundwater for the chemical parameters listed in Table 1 included in Title 30 TAC §330.331(a)(1).

The scope of this attachment includes both an alternative liner for future sectors and the proposed alternative liner and overliner for the pre-Subtitle D areas.

1.2 Proposed Alternative Liner

The layout of the proposed alternative liner is shown in Appendix A-Point of Compliance Figures, A.1 Permit Amendment Application MSW-235C Landfill Completion Site Plan. The proposed alternative liner system consists of a 60-mil high density polyethylene (HDPE) geomembrane placed over a GCL overlain by a geocomposite leachate collection

layer covered with a 2-foot-thick layer of protective soil cover. The components of the proposed alternative liner are shown in Appendix B.1 HELP Model/MULTIMED Model-Summary of Cases 1-8 for both interim and closed conditions. Details of the alternate liner are in Appendix D.1 and Appendix D.2.

1.3 Proposed Overliner System

The layout of the proposed overliner system is shown in Appendix A Point of Compliance Figures, A.1 Permit Amendment Application MSW-235C Landfill Completion Site Plan. The proposed alternative overliner system consists of a 60-mil high density polyethylene (HDPE) geomembrane placed over GCL overlain by a geocomposite leachate collection layer covered with a 2-foot thick layer of protective soil cover. The overliner will be placed over pre-Subtitle D areas to separate the existing waste and the vertical expansion area. The overliner system areas include Sectors 8A and 8B. The components of the proposed overliner system are shown in Appendix B.11 Help Model/MULTIMED Model-Summary of Cases 10L-8OL for both interim and closed conditions. Details of the overliner system are in Appendix D.3 and Appendix D.4.

1.4 Site Geology and Hydrogeology

A geologic and hydrogeologic site exploration program was conducted for the proposed City of Kingsville Landfill. Details of these investigations are included in Attachment 4 Geology Report.

2 ALTERNATE LINER DEMONSTRATION METHODS

2.1 HELP Model

The HELP Model Version 3.07 was used to estimate the amount of leachate generated by the landfill and the percolation through the proposed alternative liner system and overliner system. The HELP model is a water-balance model developed by the U.S. Army Corps of Engineers Waterways Experiment Station for the Environmental Protection Agency (EPA). The model uses climate, soil, and landfill design data to perform a solution technique that accounts for the effects of surface storage, run-off, infiltration, percolation, soil moisture storage, evapotranspiration, and lateral drainage.

2.2 MULTIMED MODEL

The MULTIMED Model Version 1.01 was used to assess contaminant fate and transport between the landfill base and the Point of Compliance (POC). MULTIMED was developed by the Athens Environmental Research Laboratory for the EPA. MULTIMED estimates the capacity of the hydrogeologic system modeled to dilute and attenuate contaminate concentrations. The model can be used to simulate fate and transport processes in both unsaturated and saturated subsurface environments. In this application, only the saturated environment was modeled to provide a conservative analysis.

2.3 LANDFILL CONFIGURATIONS

Sixteen HELP Model simulations were completed to estimate percolation rates through the alternate liner and overliner system. Both interim and closed landfill conditions were modeled in accordance with the Texas Water Commission Alternate Liner Design Handbook. The landfill configurations modeled for the alternative liner are summarized in Appendix B.1. HELP Model/MULTIMED Model-Summary of Cases 1-8 and in Appendix B.2 HELP Model Case Summary. The landfill configurations modeled for the overliner system are summarized in Appendix B.11 HELP Model/MULTIMED Model-Summary of Cases 10L-80L and B.12 HELP Mode Case Summary. The resulting percolation rate for each HELP Model simulation was then used to estimate the DAF using MULTIMED for each of the 16 cases. MULTIMED model analysis is in Appendix C. Calculations of the DAF are in Appendix D. The locations used for the POC demonstrations were chosen to represent the shortest distance to the POC. The analysis locations were selected to model the scenario at the toe of the landfill, midway up the slope, at the slope transition, and peak in order to consider the effect of the waste column thickness on the calculated DAF. Point of Compliance Figures are in Appendix A. DAFs were also computed at the four locations for each landfill configuration to show a direct relationship with the distance from the POC to the analysis point. Leachate Data is in Appendix E. MULTIMED Model output is in Appendix F. Aquifer Specific Data, geology, and hydrogeology are in

> Hanson Professional Services Inc. Submittal Date: September 2018

Appendices C.7.1 through C.7.11. The upper clay (light olive green clay) is ubiquitous under the site with a minimum proven thickness of 38 feet thick, the Chicot Aquifer is approximately 220 feet below ground surface, and the Evangeline Aquifer is approximately 500 feet below ground surface. The light olive green clay layer serves as aquiclude between the uppermost acquifer below the landfill site and the Chicot acquifer. To provide a conservative assumption given the bottom of the landfill and the groundwater, the percolation through the alternate liner and overliner system was assumed to be conveyed directly to the upper strata and therefore travel time, dilution, and attenuation are not accounted for in this analysis for upper soils.

2.4 SLOPE STABILITY ANALYSIS

The alternative liner and overliner system were analyzed for slope stability by performing two dimensional, effective stress slope stability analyses for the final, closed geometry, using the computer program SLIDE. The slope stability calculations are presented in Part III Attachment 4, Appendix 2-Section 7 WASTE MASS STABILITY and Appendix F: Graphical Representation of Mass Stability Analyses Results.

3 MODEL INPUT PARAMETERS

Detailed HELP and MULTIMED information is presented in Appendices A through F. HELP Model input parameters and results are summarized in Appendices B.1, B.2, B.11, and B.12 for both the analysis of the alternative liner (interim and closed conditions) and overliner system (interim and closed conditions). In general, conservative assumptions were made in determining the percolation rate and dilution attenuation factor (DAF). A list of major assumptions used in the MULTIMED demonstrations are presented in Table 3-1. The table also compares the actual site conditions to the assumptions used for modeling. The criteria used to develop the percolation rate for each landfill case were selected to maximize the percolation rate. As discussed in Section 2.3, a major conservative assumption is not accounting for the approximately 38 feet of low permeability light olive green clay separating the bottom of the landfill and the uppermost groundwater zone. The estimated percolation through the alternative liner and overliner system is modeled to be conveyed directly to the strata below the bottom of the landfill at each evaluation section location; and the water table is assumed to be at the bottom of the liner as a conservative approach. If less conservative assumptions were used, the DAF calculated using MULTIMED for each landfill case would be significantly larger.

The MULTIMED model input parameters are detailed in Appendix C. By making the assumptions listed in Table 3-1, a single MULTIMED simulation accounts for all 24 constituents identified by the EPA as requiring landfill design protection criteria. The required minimum DAFs for the 24 EPA constituents are given in Table 2-Leachate Evaluation, page 24 of the Texas Water Commission Alternate Liner Design Handbook; the same table of constituents listed in Table 1 in Title 30 TAC §330.331(a)(1). The largest DAF listed in the table is 260. Therefore, if MULTIMED results in a DAF higher than 260 for a generic chemical that is conservatively modeled with no carbon absorption, no biodegradation, and no decay, it is concluded that the proposed alternative liner and overliner system design is acceptable. The actual DAF for a specific chemical would be higher than the result calculated by MULTIMED under these circumstances since actual physical processes of absorption, biodegradation, and decay would act to reduce chemical concentrations at the POC to less than those predicted by MULTIMED. The model result is then expressed in terms of the DAF, which is defined as the ratio of the input concentration to the concentration at the POC. MULTIMED can be used to find the DAF by using an input concentration of 1.0 mg/L. The DAF is the reciprocal of the resulting concentration of POC. The POCs for this demonstration are sin Appendix F.

Table 3-1
Major Assumption Used to Determine MULTIMED Model Input Parameters

Input Parameters	Assumption	Actual Site Conditions
Model Source Type	Steady state	Assumed amount of
		leachate percolation is
		released continuously.
		This is a very conservative
		assumption.
Biodegradation	No biodegradation	Biodegradation is active in
		hydrogeologic
		environments
Chemical Decay	No chemical deay	Chemical decay will occur
		with most contaminants in
		hydrogeologic
		environments

4 POINT OF COMPLIANCE DEMONSTRATION RESULTS

The HELP and MULTIMED models were used to evaluate the proposed design of the alternative liner and overliner system by estimating constituent concentrations at the POC for the landfill cases discussed in Section 2.3. The percolation rates obtained from the HELP Model cases included in Appendix C.3 and Appendix C.4 were used as input for the MULTIMED model to determine the DAF. Conservatively, the constituent concentrations at the base of the landfill liner and at the POC were used to calculate the DAF.

A summary of the calculated DAF is presented below and in Appendix D.

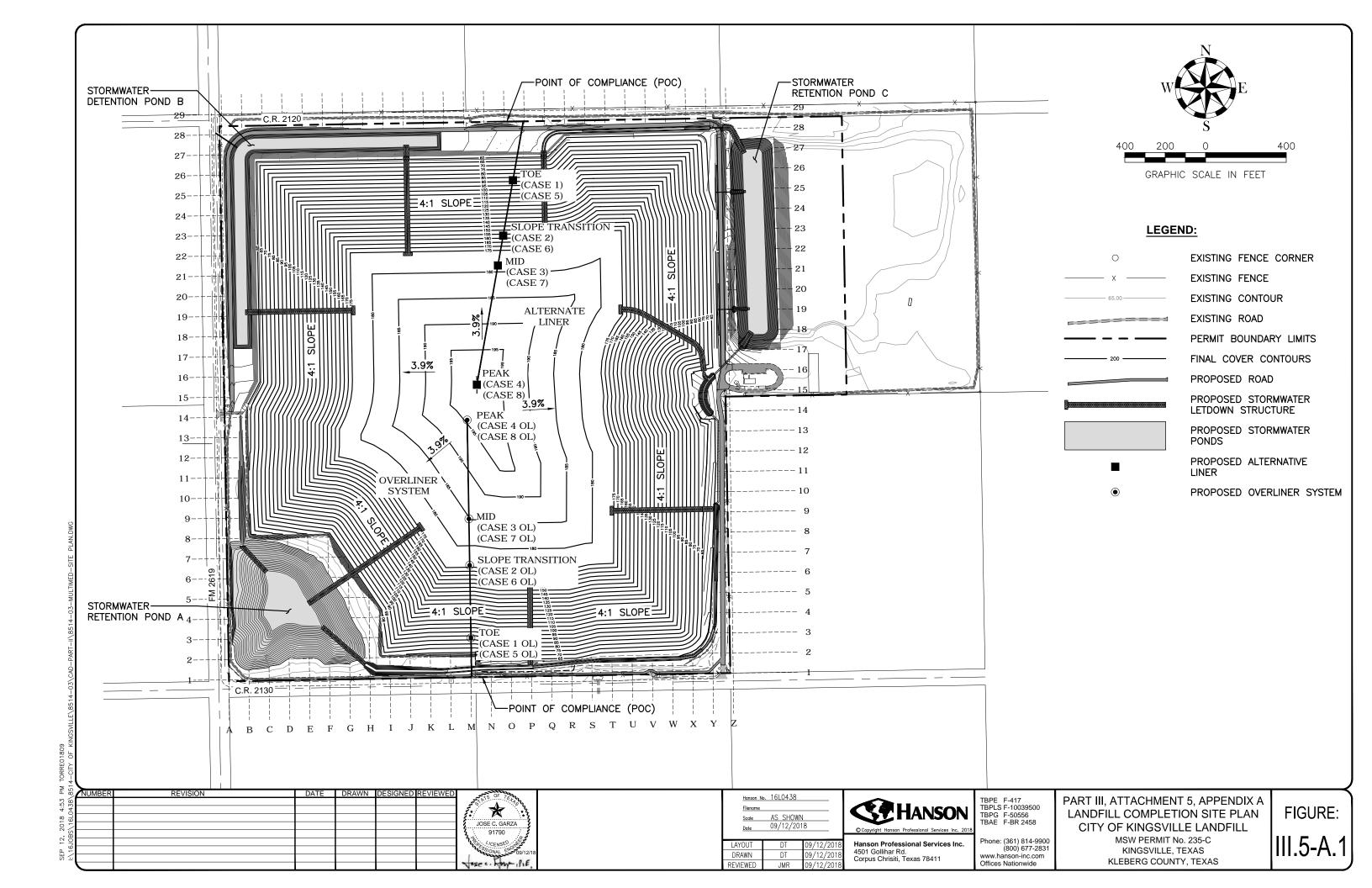
	Interim Case	
Location	DAF	Closed Case DAF
Alternative Liner Location 1	33,979	85,106
Alternative Liner Location 2	57,471	201,288
Alternative Liner Location 3	80,645	282,566
Alternative Liner Location 4	286,533	1,003,814

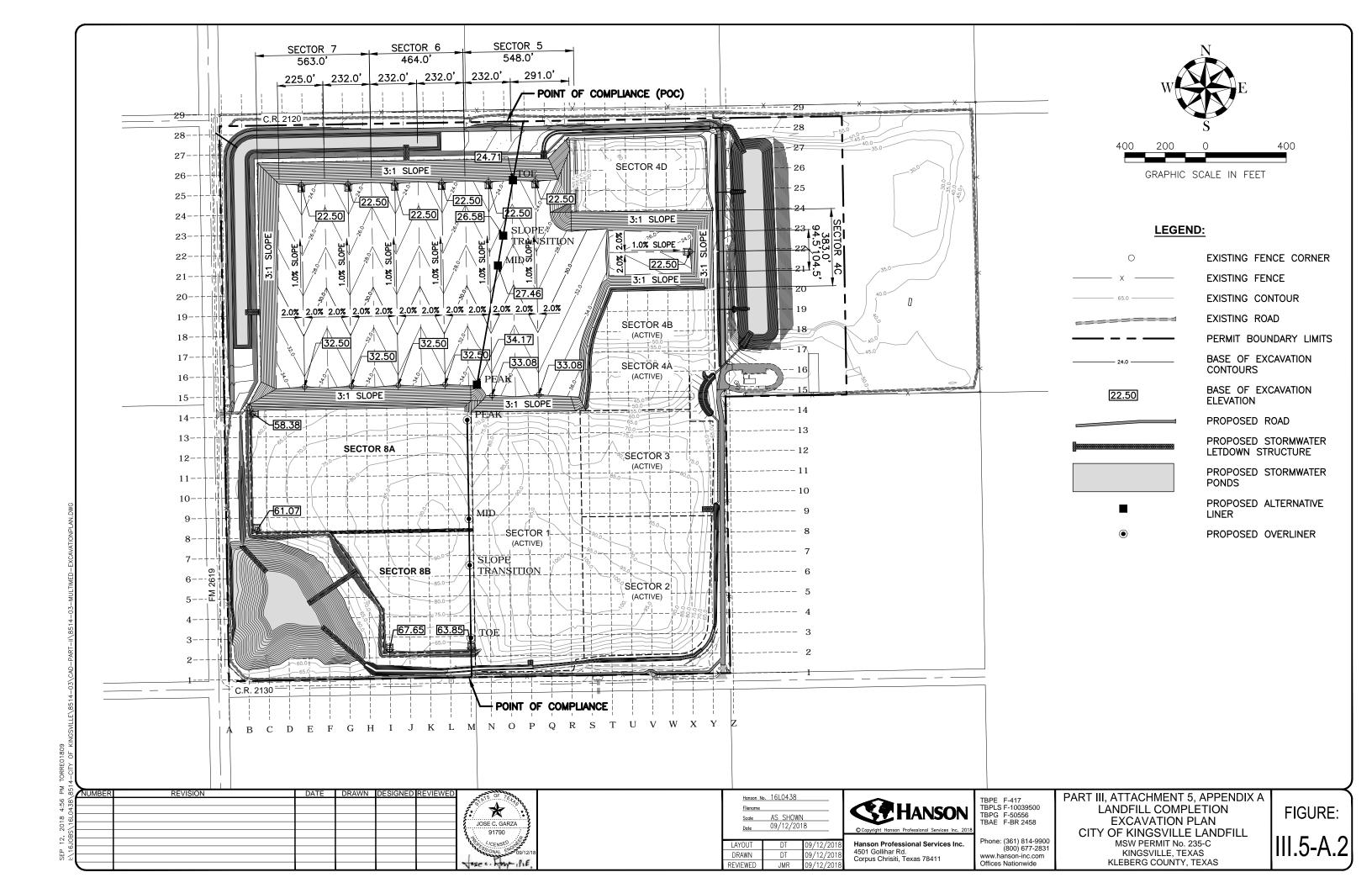
Location	Interim Case DAF	Closed Case DAF
Overliner Location 1	18,797	65,833
Overliner Location 2	77,640	232,450
Overliner Location 3	158,253	473,934
Overliner Location 4	615,385	1,842,639

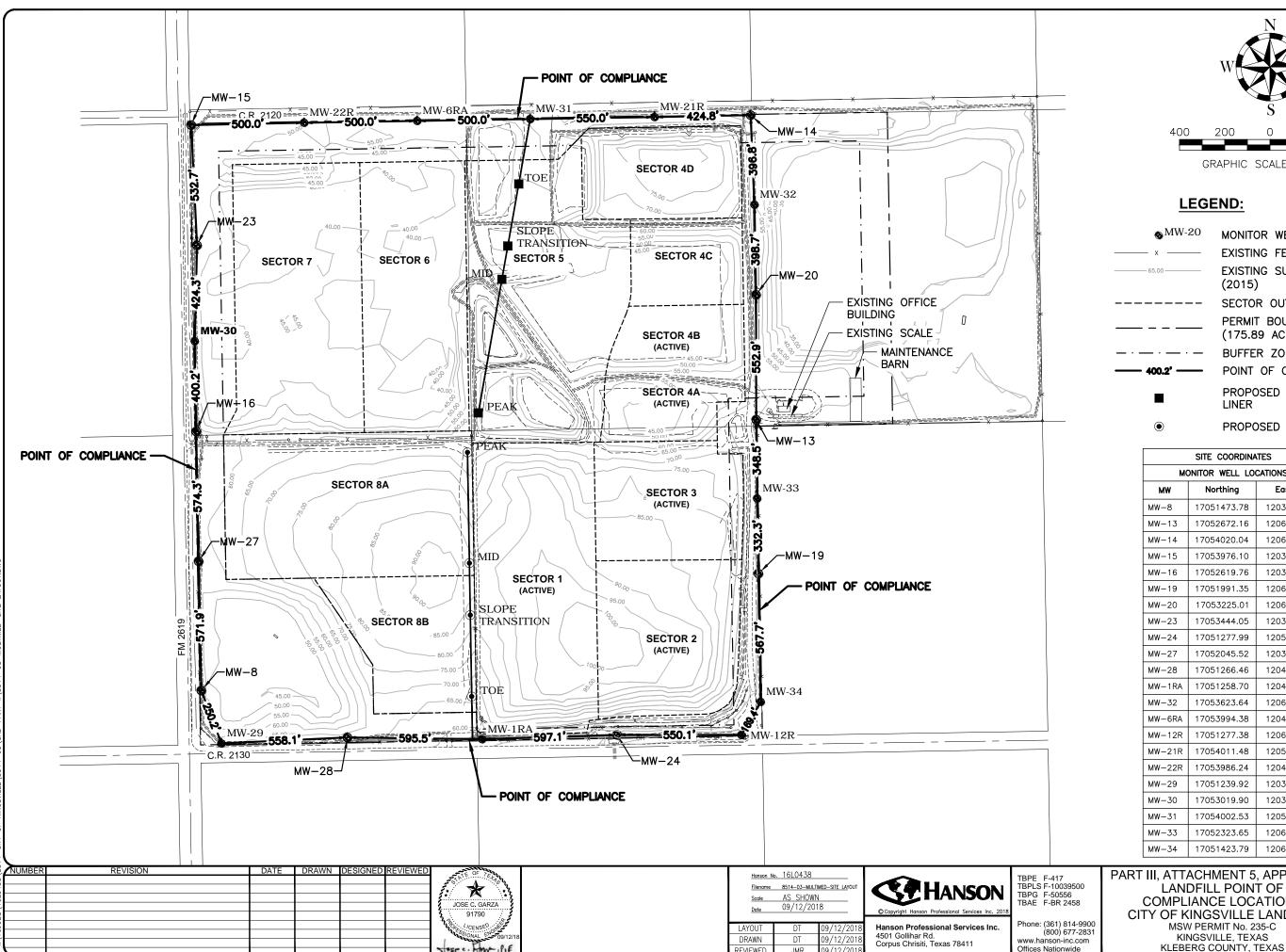
The results demonstrate that the proposed alternative liner design and overliner design meets or exceeds the requirements of Title 30 TAC §330.331(a)(1). The DAF calculated by the use of HELP and MULTIMED are well in excess of the 260 minimum criterion. The actual DAFs are expected to be substantially higher than the DAFs predicted by this modeling demonstration because the model input was conservatively estimated as discussed in previous sections of this report.

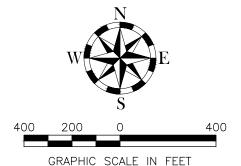
APPENDIX A POINT OF COMPLIANCE FIGURES











LEGEND:

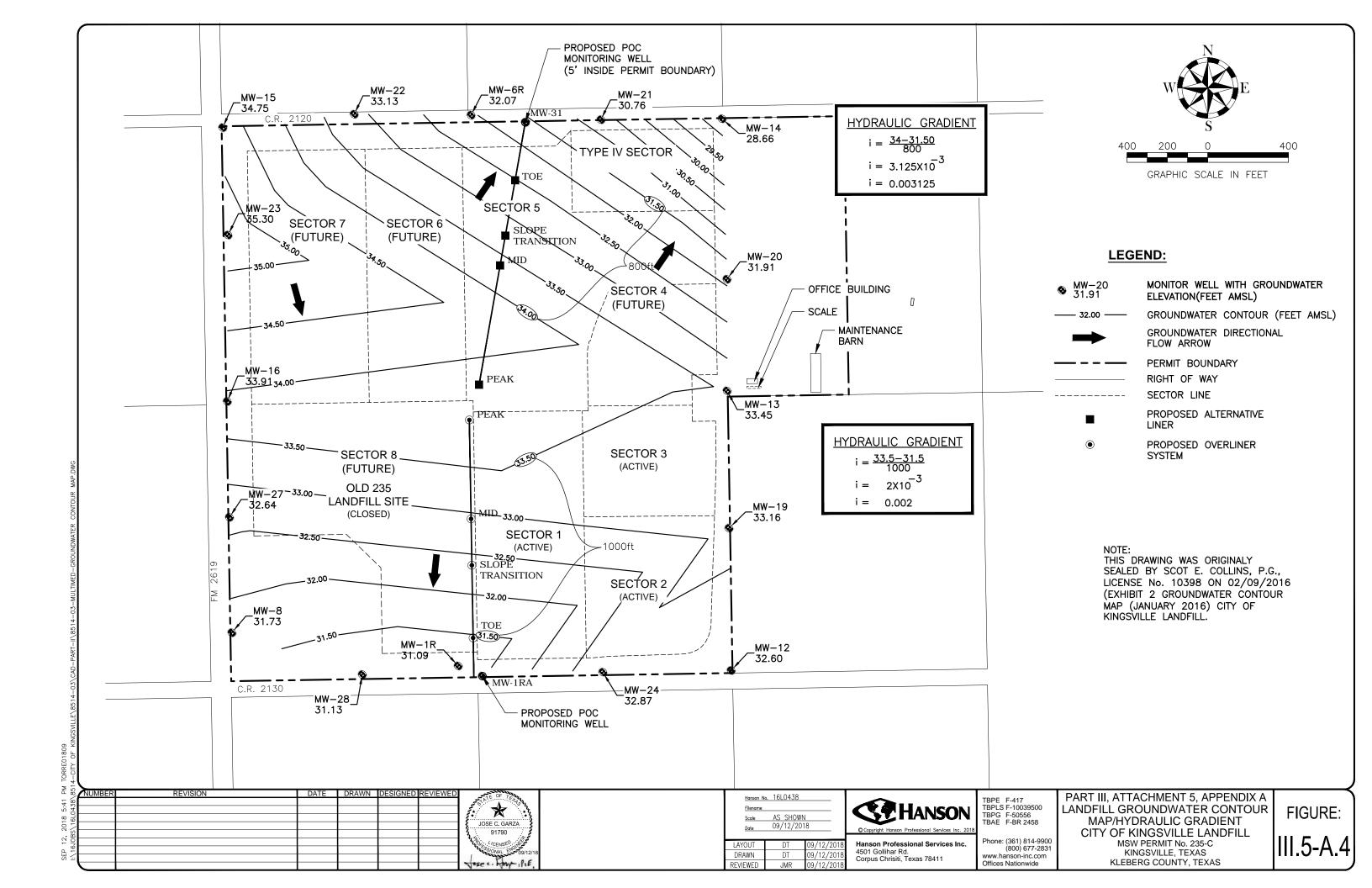
MONITOR WELL LOCATION EXISTING FENCE EXISTING SURFACE CONTOUR (2015)SECTOR OUTLINE PERMIT BOUNDARY (175.89 ACRES) BUFFER ZONE POINT OF COMPLIANCE PROPOSED ALTERNATIVE LINER PROPOSED OVERLINER

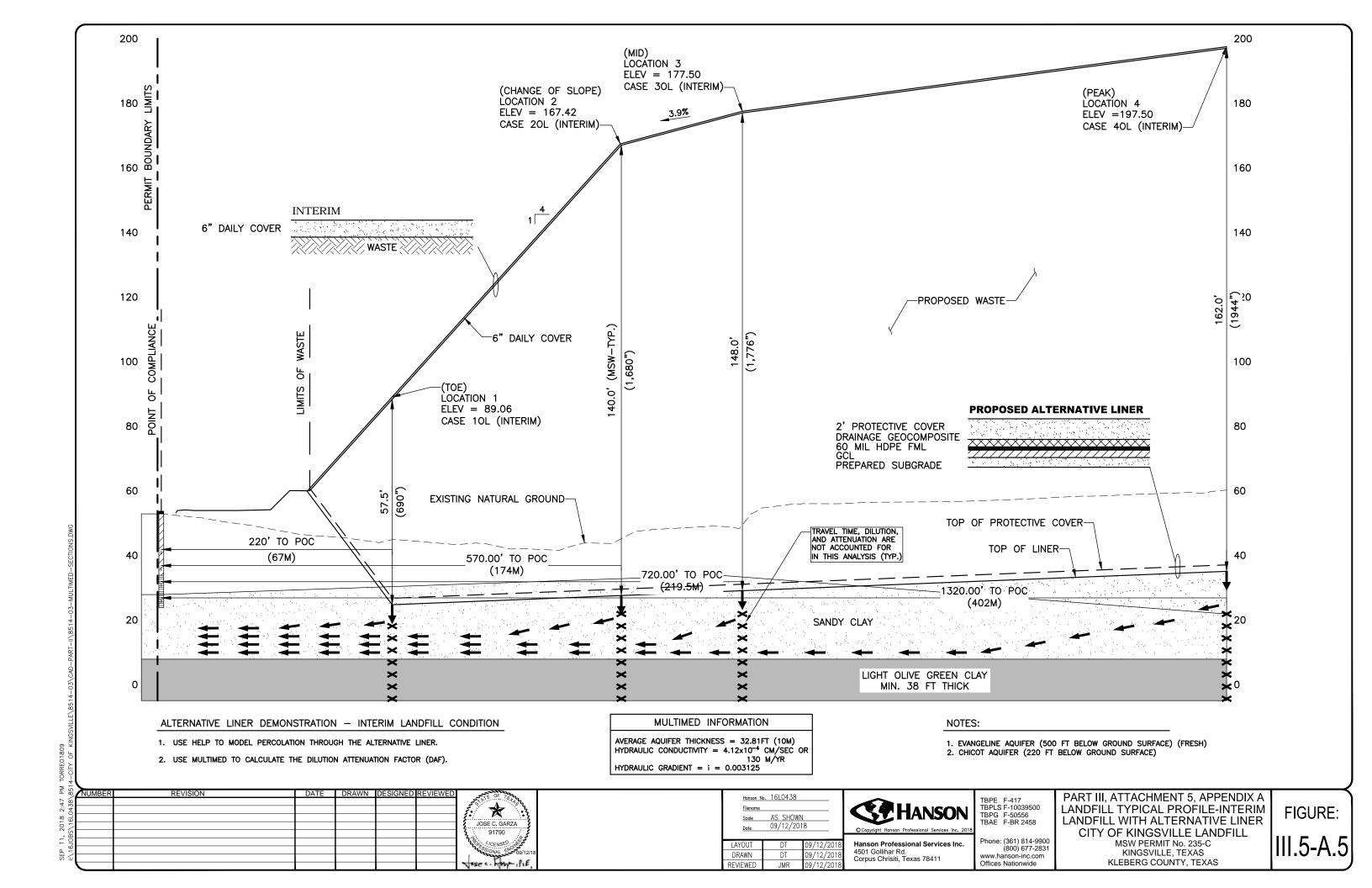
	SITE COORDINA	ITES			
MONITOR WELL LOCATIONS					
MW	Northing	Easting			
MW-8	17051473.78	1203673.74			
MW-13	17052672.16	1206127.95			
MW-14	17054020.04	1206103.02			
MW-15	17053976.10	1203628.61			
MW-16	17052619.76	1203651.21			
MW-19	17051991.35	1206137.50			
MW-20	17053225.01	1206127.20			
MW-23	17053444.05	1203654.88			
MW-24	17051277.99	1205512.42			
MW-27	17052045.52	1203661.75			
MW-28	17051266.46	1204320.24			
MW-1RA	17051258.70	1204915.66			
MW-32	17053623.64	1206120.29			
MW-6RA	17053994.38	1204628.44			
MW-12R	17051277.38	1206062.51			
MW-21R	17054011.48	1205678.30			
MW-22R	17053986.24	1204128.51			
MW-29	17051239.92	1203762.81			
MW-30	17053019.90	1203644.60			
MW-31	17054002.53	1205128.38			
MW-33	17052323.65	1206132.04			
MW-34	17051423.79	1206147.64			

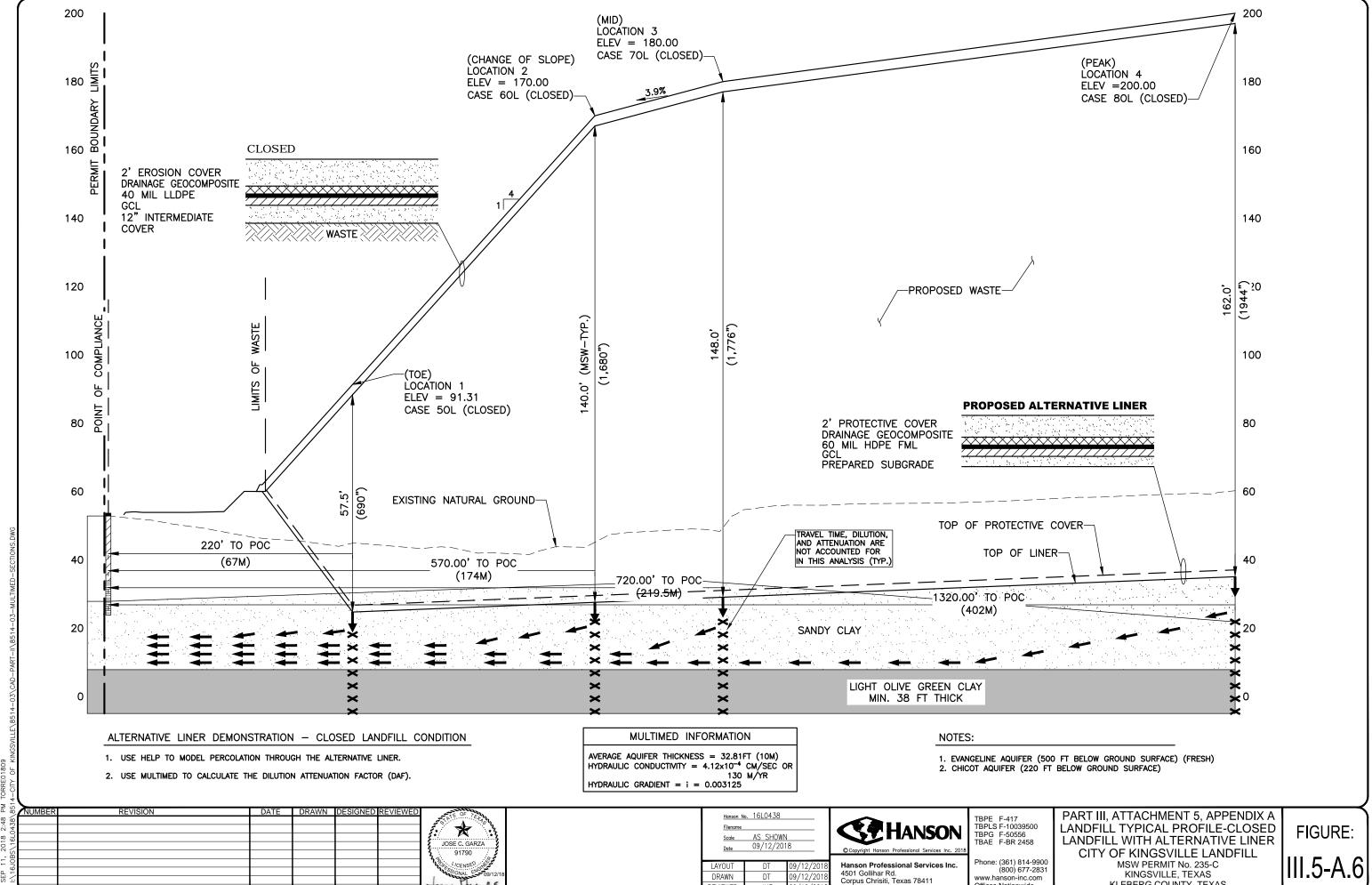
PART III, ATTACHMENT 5, APPENDIX A LANDFILL POINT OF **COMPLIANCE LOCATIONS** CITY OF KINGSVILLE LANDFILL MSW PERMIT No. 235-C KINGSVILLE, TEXAS

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FIGURE:

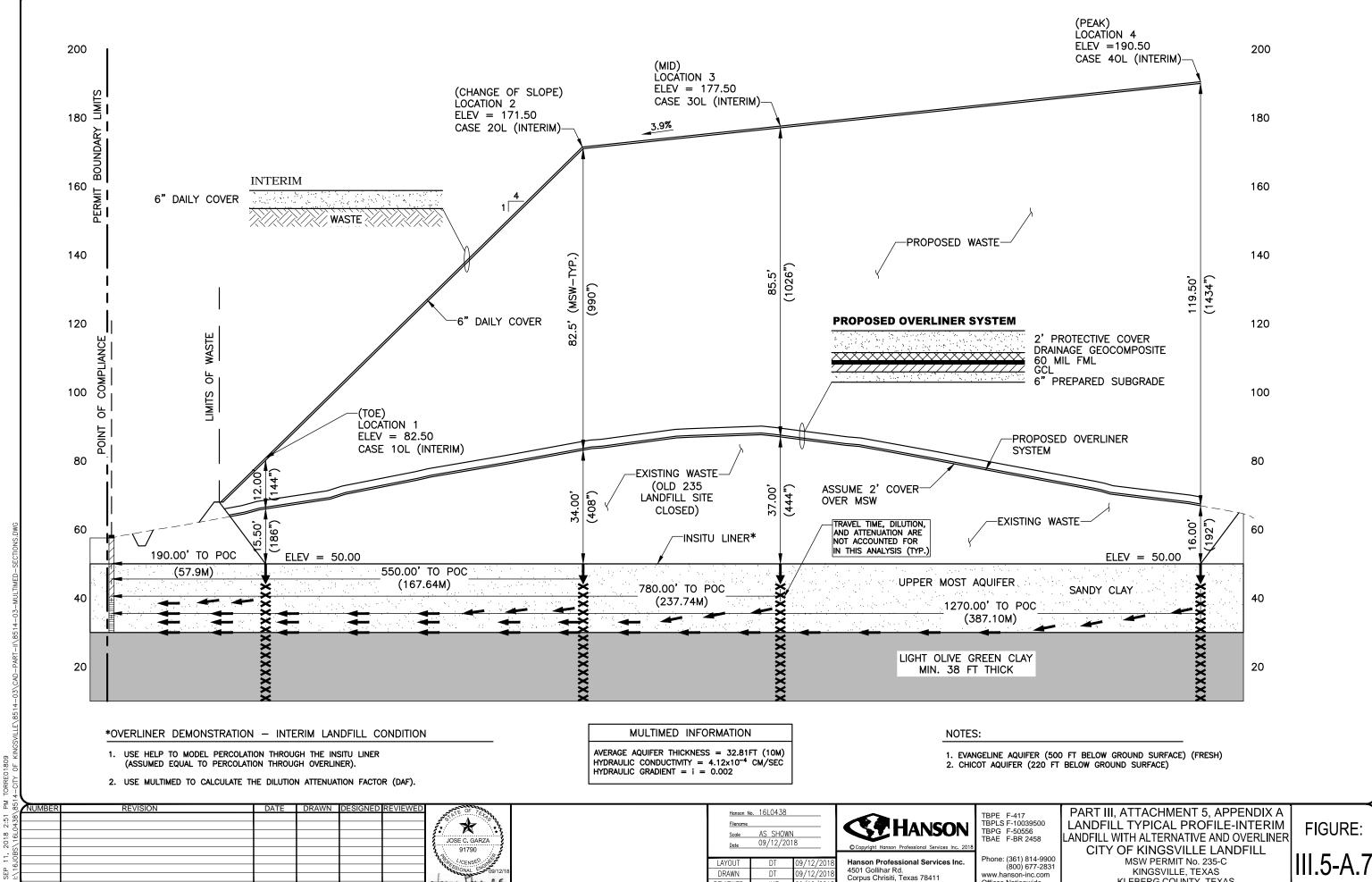






KLEBERG COUNTY, TEXAS

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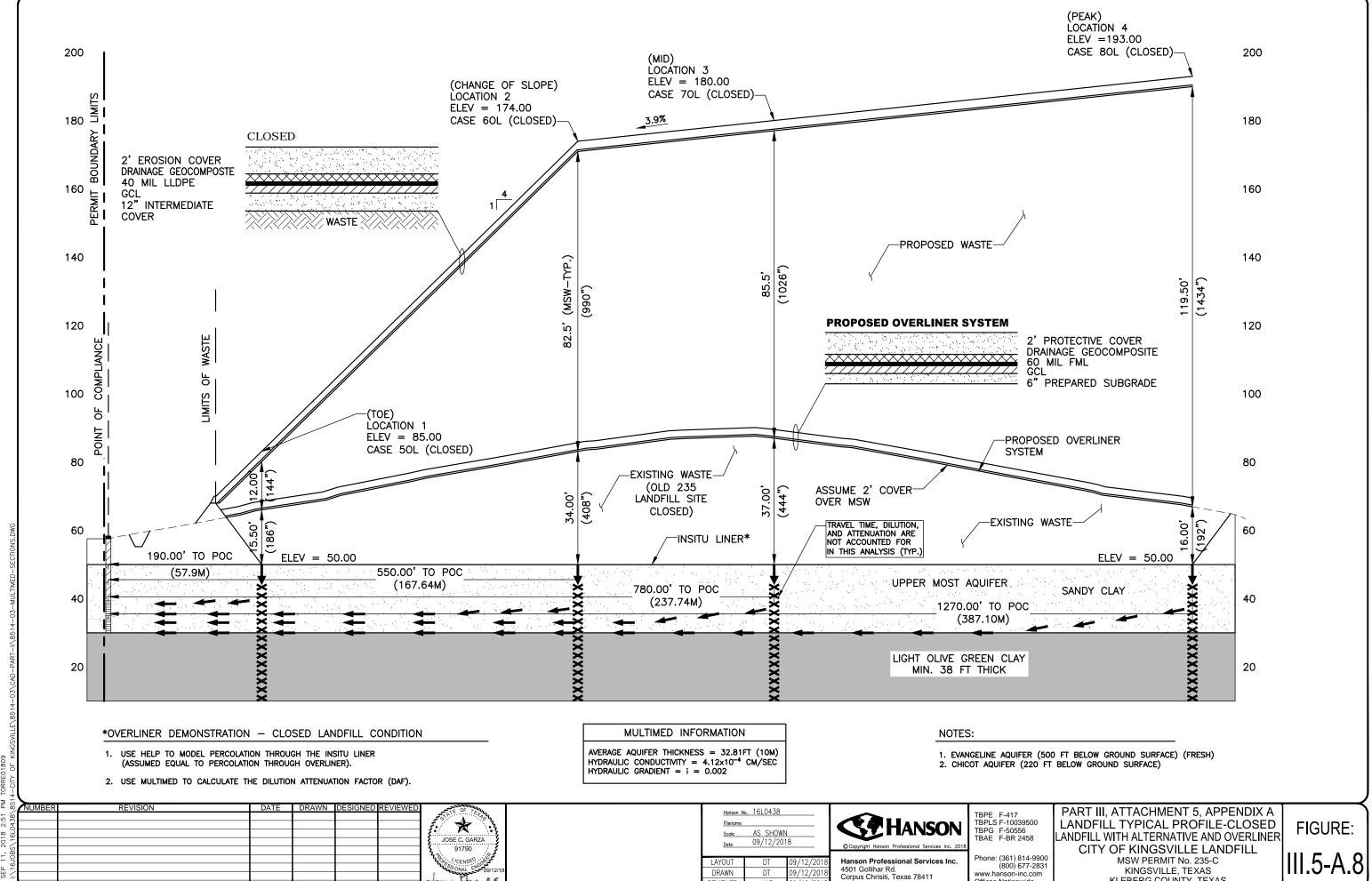


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APPENDIX B HELP MODEL ANALYSIS ALTERNATIVE LINER



APPENDIX B.1 HELP MODEL/MULTIMED MODEL-SUMMARY OF CASES 1-8



Project No. 8514-3 Permit Amendment

Description: HELP Model/MULTIMED Model-Summary of Cases 1-8

Date: 3/01/17

By: JCG

<u>Case 1-Interim Landfill (Location 1)</u>- An open landfill with a Geosynthetic Clay Liner (GCL), a 60 mil HDPE Flexible Membrane Liner (FML), a Geocomposite drainage layer (Geonet), a 24 inch protective soil layer (Protective Cover),57.5 feet of waste with 250 foot drain length at 2%, and 6 inches of daily soil cover.

<u>Case 2-Interim Landfill (Location 2)</u>- An open landfill with a Geosynthetic Clay Liner (GCL), a 60 mil HDPE Flexible Membrane Liner (FML), a Geocomposite drainage layer (Geonet), a 24 inch protective soil layer (Protective Cover), 140 feet of waste with 500 foot drain length at 2%, and 6 inches of daily soil cover.

<u>Case 3-Interim Landfill (Location 3)</u>- An open landfill with a Geosynthetic Clay Liner (GCL), a 60 mil HDPE Flexible Membrane Liner (FML), a Geocomposite drainage layer (Geonet), a 24 inch protective soil layer (Protective Cover), 148 feet of waste with 500 foot drain length at 2%, and 6 inches of daily soil cover.

<u>Case 4-Interim Landfill (Location 4)</u>- An open landfill with a Geosynthetic Clay Liner (GCL), a 60 mil HDPE Flexible Membrane Liner (FML), a Geocomposite drainage layer (Geonet), a 24 inch protective soil layer (Protective Cover), 162 feet of waste with 500 foot drain length at 2%, and 6 inches of daily soil cover.

<u>Case 5-Closed Landfill (Location 1)</u> - A closed landfill with a Geosynthetic Clay Liner (GCL), a 60 mil HDPE Flexible Membrane Liner (FML), a Geocomposite drainage layer (Geonet), a 24 inch protective soil layer (Protective Cover), 57.5 feet of waste with 250 foot drain length at 2%, and 12 inches of intermediate cover, a GCL, a 40 mil LLDPE membrane, a Geocomposite drainage layer, and 24 inch erosion cover.

<u>Case 6-Closed Landfill (Location 2)</u>- A closed landfill with a Geosynthetic Clay Liner (GCL), a 60 mil HDPE Flexible Membrane Liner (FML), a Geocomposite drainage layer (Geonet), a 24 inch protective soil layer (Protective Cover), 140 feet of waste with 500 foot drain length at 2%, and 12 inches of intermediate cover, a GCL, a 40 mil LLDPE membrane, a Geocomposite drainage layer, and 24 inch erosion cover.

<u>Case7-Closed Landfill (Location 3)</u>- A closed landfill with a Geosynthetic Clay Liner (GCL), a 60 mil HDPE Flexible Membrane Liner (FML), a Geocomposite drainage layer (Geonet), a 12 inch protective soil layer (Protective Cover), 148 feet of waste with 500 foot drain length at 2%, and 12 inches of intermediate cover, a GCL, a 40 mil LLDPE membrane, a Geocomposite drainage layer, and 24 inch erosion cover.

<u>Case 8-Closed Landfill (Location 4)</u>- A closed landfill with a Geosynthetic Clay Liner (GCL), a 60 mil HDPE Flexible Membrane Liner (FML), a Geocomposite drainage layer (Geonet), a 24 inch protective soil layer (Protective Cover), 162 feet of waste with 500 foot drain length at 2%, and 12 inches of intermediate cover, a GCL, a 40 mil LLDPE membrane, a Geocomposite drainage layer, and 24 inch erosion cover.

APPENDIX B.2 HELP MODEL CASE SUMMARY



HELP MODEL CASE SUMMARY

Case Alternative Liner	Average Precipitation (IN/YR)	Average Runoff (IN/YR)	Average Evapotranspiration (IN/YR)	Average Percolation Through Liner (CF/YR)	Peak Percolation Through Liner (CF/DAY)	*Peak Percolation Through Liner (M/YR)
Interim Landfill HELP Information						
Location 1						Relicio de Companyo
• 57.5 feet of waste (Case 1)	1					V
20 yr	25.74	2.391	21.632	0.004	0.000050	1.28E-07
Location 2 • 140 feet of waste (Case 2)	3					
20 yr	25.74	2.135	21.716	0.004	0.00007	1.79E-07
Location 3 • 148 feet of waste (Case 3)						
20 yr	25.74	2.197	21.691	0.004	0.00007	1.79E-07
Location 4 • 162 feet of waste (Case 4)	1	70 g	5			
20 yr	25.74	1.907	21.787	0.005	0.00007	1.79E-07
Closed Landfill HELP Information					is:	
Location 1			a [1 1	
• 57.5 feet of waste (Case 5)						E 44E 00
30 yr	27.20	1.880	21.749	0.001	0.00002	5.11E-08
Location 2 • 140 feet of waste (Case 6)	7	2	7 1			
30 yr	27.20	1.680	21.481	0.004	0.00002	5.11E-08
Location 3 • 148 feet of waste (Case 7)	a a Fi					
30 yr	27.20	1.711	21.470	0.004	0.00002	5.11E-08
Location 4 • 162 feet of waste (Case 8)		10				
30 yr	27.20	1.533	21.495	0.004	0.00002	5.11E-08
55 /.						700000000000000000000000000000000000000

^{*} Determined Using Peak Daily Percolation/Leakage Rate Through GCL and Converted to (M/YR) Example: $((.00005 \text{ FT}^3/\text{Day-Acre})x(1 \text{ Acre}/43,560 \text{ FT}^2)/(1 \text{ Meter}/3.28 \text{ FT})) \times (365 \text{ Days}/1 \text{ YR}) = 1.28 \times 10^{-7} \text{ M/YR}$

APPENDIX B.3 HELP OUTPUT FOR ALTERNATIVE LINER INTERIM CASE 1LOCATION 1



******	*******************	******
*****	******************	******
**		**
**		**
**	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: TEMPERATURE DATA FILE: EVAPOTRANSPIRATION DATA: SOIL AND DESIGN DATA FILE: C:\HELP3\MDATA\CASE1.D10

C:\HELP3\MDATA\KGVPR20Y.D4 C:\HELP3\MDATA\KGVTE20Y.D7 SOLAR RADIATION DATA FILE: C:\HELP3\MDATA\KGVSO20Y.D13 C:\HELP3\MDATA\KGVEV20Y.D11 C:\HELP3\MDATA\CASE120Y.OUT

OUTPUT DATA FILE:

TIME: 16:43

DATE: 3/13/2017

TITLE: CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE 1 (Location 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

6.00 INCHES **THICKNESS** 0.4300 VOL/VOL POROSITY FIELD CAPACITY 0.3210 VOL/VOL WILTING POINT 0.2210 VOL/VOL INITIAL SOIL WATER CONTENT = 0.2393 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

690.00 INCHES

POROSITY = 0.6710 VOL/VOL FIELD CAPACITY = 0.2920 VOL/VOL WILTING POINT = 0.0770 VOL/VOL INITIAL SOIL WATER CONTENT = 0.2905 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 = 0.3244 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.330000003000E-04 CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 20

0.20 INCHES THICKNESS = POROSITY 0.8500 VOL/VOL = 0.0100 VOL/VOL FIELD CAPACITY WILTING POINT 0.0050 VOL/VOL INITIAL SOIL WATER CONTENT = 0.0152 VOL/VOL EFFECTIVE SAT. HYD. COND. = 10.0000000000 CM/SEC 2.00 PERCENT SLOPE

DRAINAGE LENGTH = 250.0 FEET

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER

MATERIAL TEXTURE NUMBER 35

THICKNESS = 0.06 INCHES
POROSITY = 0.0000 VOL/VOL
FIELD CAPACITY = 0.0000 VOL/VOL
WILTING POINT = 0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.19999996000E-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 25.% AND A SLOPE LENGTH OF 100. FEET.

SCS RUNOFF CURVE NUMBER	=	89.50	
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	=	2.124	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6.606	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.788	INCHES
INITIAL SNOW WATER	E	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	209.820	INCHES
TOTAL INITIAL WATER	=	209.820	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 KINGSVILLE 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)

				CASE120Y.OU	T
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 MONTHI	Y VALUES I	N INCHES	FOR YEARS	1 THR	OUGH 20	
	COMPONENT SERVICE	TECHNICASIN NAMED IN	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION		(
TOTALS	1.15	2.02	1.05	1.42	2.41	2.71
	2.43	2.37	5.38	2.30	1.33	1.18
STD. DEVIATIONS	0.63	1.18	0.55	1.20	1.88	2.04
	2.55	1.63	3.12	1.75	1.17	0.85
RUNOFF						
TOTALS	0.015	0.067	0.006	0.104	0.281	0.288
	0.380	0.193	0.784	0.181	0.073	0.020
STD. DEVIATIONS	0.043	0.081	0.009	0.237	0.504	0.348
	0.817	0.198	0.914	0.274	0.212	0.076
EVAPOTRANSPIRATION						
TOTALS	0.939	2.086	1.297	1.241	1.988	2.114
A 8/4 NOTES	2.037	1.875	3.620	2.256	1.089	1.091
STD. DEVIATIONS	0.543	0.911	0.701	0.915	1.322	1.388
	1.606	1.312	1.225	1.220	0.757	0.583
LATERAL DRAINAGE COL	LECTED FROM	LAYER 4				
TOTALS	0.0660	0.0208	0.0717	0.0580	0.0362	0.053
	0.1446	0.1781	0.1018	0.4110	0.4038	0.191
STD. DEVIATIONS	0.0860	0.0317	0.1423	0.1051	0.0619	0.105
	0.2593	0.3508	0.2000	0.5937	0.7436	0.324
PERCOLATION/LEAKAGE	THROUGH LAY	ER 6				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000

AVERAGES	0.0005	0.0002	0.0005	0.0004	0.0003	0.0004
	0.0010	0.0013	0.0007	0.0029	0.0030	0.0014
STD. DEVIATIONS	0.0006	0.0002	0.0010	0.0008	0.0004	0.0008
	0.0018	0.0025	0.0015	0.0042	0.0055	0.0023

	INC	HES		CU. FEET	PERCENT
PRECIPITATION	25.74	(5.706)	93448.9	100.00
RUNOFF	2.391	(1.2854)	8679.79	9.288
EVAPOTRANSPIRATION	21.632	(3.6809)	78522.88	84.028
ATERAL DRAINAGE COLLECTED FROM LAYER 4	1.73689	(1.43677)	6304.902	6.74690
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.004	0.0000
AVERAGE HEAD ON TOP OF LAYER 5	0.001 (0.001)		
CHANGE IN WATER STORAGE	-0.016	(0.5277)	-58.66	-0.063

	(INCHES)	(CU. FT.)
PRECIPITATION	5.07	18404.102
RUNOFF	2.138	7761.3745
DRAINAGE COLLECTED FROM LAYER 4	0.16595	602.40332
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00005
AVERAGE HEAD ON TOP OF LAYER 5	0.037	
MAXIMUM HEAD ON TOP OF LAYER 5	0.072	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	2.4 FEET	
SNOW WATER	0.00	0.0000

MINIMUM VEG. SOIL WATER (VOL/VOL)

0.1490

*** 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.

^			
***************	*****	*****	*****

LAYER	(INCHES)	(VOL/VOL)	
1	1.4211	0.2369	
2	200.1899	0.2901	
3	7.7040	0.3210	
4	0.0020	0.0100	
5	0.0000	0.0000	
6	0.1800	0.7500	
SNOW WATER	0.000		

APPENDIX B.4 HELP OUTPUT FOR ALTERNATIVE LINER INTERIM CASE 2LOCATION 2



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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: TEMPERATURE DATA FILE: EVAPOTRANSPIRATION DATA: SOIL AND DESIGN DATA FILE: C:\HELP3\MDATA\CASE2.D10 OUTPUT DATA FILE:

C:\HELP3\MDATA\KGVPR20Y.D4 C:\HELP3\MDATA\KGVTE20Y.D7 SOLAR RADIATION DATA FILE: C:\HELP3\MDATA\KGVSO20Y.D13 C:\HELP3\MDATA\KGVEV20Y.D11 C:\HELP3\MDATA\CASE220Y.OUT

TIME: 16:53 DATE: 3/13/2017

********************************* TITLE: CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE 2 (LOCATION 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 6.00 INCHES THICKNESS

POROSITY 0.4300 VOL/VOL FIELD CAPACITY 0.3210 VOL/VOL WILTING POINT 0.2210 VOL/VOL INITIAL SOIL WATER CONTENT = 0.2391 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

1680.00 INCHES

POROSITY = 0.6710 VOL/VOL FIELD CAPACITY = 0.2920 VOL/VOL WILTING POINT = 0.0770 VOL/VOL INITIAL SOIL WATER CONTENT = 0.2914 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 = 0.3245 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.330000003000E-04 CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 20

THICKNESS = 0.20 INCHES
POROSITY = 0.8500 VOL/VOL
FIELD CAPACITY = 0.0100 VOL/VOL
WILTING POINT = 0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0205 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 = 0.06 INCHES

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 25.% AND A SLOPE LENGTH OF 350. FEET.

SCS RUNOFF CURVE NUMBER	8	88.80	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.124	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	=	498.905	INCHES
TOTAL INITIAL WATER	=	498.905	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 3RD QUARTER RELATIVE HUMIDITY = 76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR KINGSVILLE 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)

Page 3

Revision: 0

				CASE220Y.OU	T
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 MONTHL	Y VALUES II	N INCHES	FOR YEARS	1 THR	OUGH 20	
	JAN/JUL		MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.15	2.02	1.05	1.42	2.41	2.71
	2.43	2.37	5.38	2.30	1.33	1.18
STD. DEVIATIONS	0.63	1.18	0.55	1.20	1.88	2.04
	2.55	1.63	3.12	1.75	1.17	0.85
RUNOFF						
TOTALS	0.012	0.055	0.003	0.092	0.254	0.252
	0.350	0.170	0.716	0.149	0.066	0.016
STD. DEVIATIONS	0.037	0.071	0.006	0.216	0.479	0.31
eie, eeremeene	0.770	0.181	0.864	0.234	0.199	0.05
EVAPOTRANSPIRATION						
TOTALS	0.932	2.093	1.304	1.251	1.993	2.12
	2.048	1.899	3.628	2.264	1.098	1.07
STD. DEVIATIONS	0.540	0.899	0.714	0.930	1.317	1.38
	1.634	1.319	1.222	1.208	0.786	0.59
ATERAL DRAINAGE COLL	ECTED FROM	LAYER 4				
TOTALS	0.0714	0.0325	0.0735	0.0598	0.0433	0.06
	0.1629	0.1994	0.1144	0.4250	0.4282	0.22
STD. DEVIATIONS	0.0918	0.0521	0.1373	0.1034	0.0700	0.14
	0.3040	0.4252	0.2386	0.5913	0.7365	0.41
PERCOLATION/LEAKAGE T	HROUGH LAY	ER 6				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.00
	0.0000	0.0000	0.0000	0.0000	0.0000	0.00
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.00
	0.0000	0.0000	0.0000	0.0000	0.0000	0.00

AVERAGES	0.0010	0.0005	0.0010	0.0009	0.0006	0.0010
	0.0023	0.0028	0.0017	0.0060	0.0063	0.0033
STD. DEVIATIONS	0.0013	0.0008	0.0020	0.0015	0.0010	0.0021
	0.0043	0.0061	0.0035	0.0084	0.0108	0.0059

	INC	HES	71	CU. FEET	PERCENT
PRECIPITATION	25.74	(5.706)	93448.9	100.00
RUNOFF	2.135	(1.1936)	7751.57	8.295
EVAPOTRANSPIRATION	21.716	(3.6903)	78829.24	84.355
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1.90751	(1.54789)	6924,269	7.40968
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.004	0.0000
AVERAGE HEAD ON TOP OF LAYER 5	0.002 (0.002)		
CHANGE IN WATER STORAGE	-0.015	(0.5511)	-56.19	-0.060

	(INCHES)	(CU. FT.)
PRECIPITATION	5.07	18404.102
RUNOFF	2.088	7578.4883
DRAINAGE COLLECTED FROM LAYER 4	0.16062	583.03455
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	0.141	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	1.7 FEET	
SNOW WATER	0.00	0.0000

MINIMUM VEG. SOIL WATER (VOL/VOL)

0.1490

*** 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 EN	ID OF YEAR 20	
 LAYER	(INCHES)	(VOL/VOL)	
	(INCIES)		
1	1.4393	0.2399	
2	489.2699	0.2912	
3	7.7040	0.3210	
4	0.0020	0.0100	
5	0.0000	0.0000	
6	0.1800	0.7500	
SNOW WATER	0.000	1.39	

APPENDIX B.5 HELP OUTPUT FOR ALTERNATIVE LINER INTERIM CASE 3LOCATION 3



*******	*******************	******
*******	******************	******
**		**
**		**
**	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\MDATA\KGVPR20Y.D4
TEMPERATURE DATA FILE: C:\HELP3\MDATA\KGVPR20Y.D7
SOLAR RADIATION DATA FILE: C:\HELP3\MDATA\KGVS020Y.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\MDATA\KGVEV20Y.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\MDATA\CASE3.D10
OUTPUT DATA FILE: C:\HELP3\MDATA\CASE320Y.OUT

TIME: 9:42 DATE: 3/3/2017

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 = 0.2391 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 = 1776.00

1776.00 INCHES

Part III

CASE320Y, OUT

POROSITY = 0.6710 VOL/VOL FIELD CAPACITY = 0.2920 VOL/VOL WILTING POINT = 0.0770 VOL/VOL INITIAL SOIL WATER CONTENT = 0.2914 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 = 0.3245 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.330000003000E-04 CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 20

THICKNESS = 0.20 INCHES
POROSITY = 0.8500 VOL/VOL
FIELD CAPACITY = 0.0100 VOL/VOL
WILTING POINT = 0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0205 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

0.06 INCHES THICKNESS = POROSITY 0.0000 VOL/VOL 0.0000 VOL/VOL FIELD CAPACITY WILTING POINT 0.0000 VOL/VOL INITIAL SOIL WATER CONTENT = 0.0000 VOL/VOL EFFECTIVE SAT. HYD. COND. = 0.199999996000E-12 CM/SEC 1.00 FML PINHOLE DENSITY **100** HOLES/ACRE FML INSTALLATION DEFECTS = 2.00 HOLES/ACRE = 3 - GOOD FML PLACEMENT QUALITY

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 12.% AND A SLOPE LENGTH OF 200. FEET.

SCS RONOTT CORVE HOUSER	=	89.00	
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	=	2.124	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	=	526.937	INCHES
TOTAL INITIAL WATER	=	526.937	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 = 12.00 INCHES
AVERAGE ANNUAL WIND SPEED = 12.00 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 76.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 76.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR KINGSVILLE TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

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

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

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

			CASE320Y.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 MONTH	LY VALUES IN		FOR YEARS			
	0.000		MAR/SEP		MAY/NOV	JUN/DEC
PRECIPITATION						
	4 4 5	2.02	1 05	1 12	2.41	2.71
TOTALS	2.43	2.02	1.05 5.38	2.30	1.33	1.18
STD. DEVIATIONS	0.63	1.18	0.55	1.20	1.88	2.04
11	2.55	1.63	3.12	1.75		0.85
RUNOFF						
TOTALS	0.013	0.058	0.004	0.095	0.261	0.260
	0.358	0.176	0.733	0.155	0.067	0.017
STD. DEVIATIONS	0.038	0.074	0.007	0.221	0.486	0.324
	0.783	0.186	0.879	0.241	0.202	0.058
EVAPOTRANSPIRATION						
TOTALS	0.931	2.093			1.993	2.121
	2.045	1.896	3.629	2.258	1.099	1.074
STD. DEVIATIONS	0.537	0.898	0.710	0.928	1.312	
	1.629	1.315	1.227	1.202	0.786	0.593
LATERAL DRAINAGE COL		LAYER 4				
TOTALS		0.0357		0.0581		
	0.1587	0.1953	0.1104	0.4160	0.4200	0.227
STD. DEVIATIONS			0.1437			
	0.2950	0.4190	0.2386	0.5831	0.7316	0.415
PERCOLATION/LEAKAGE	THROUGH LAY	ER 6				
TOTALS	0.0000		0.0000			
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000		0.0000			
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000

AVERAGES	0.0010	0.0006	0.0011	0.0009	0.0006	0.0009
	0.0023	0.0028	0.0016	0.0059	0.0062	0.0032
STD. DEVIATIONS	0.0013	0.0009	0.0020	0.0015	0.0010	0.0021
	0.0042	0.0060	0.0035	0.0083	0.0108	0.0059

	INC	HES		CU. FEET	PERCENT
PRECIPITATION	25.74	(5.706)	93448.9	100.00
RUNOFF	2.197	(1.2161)	7975.32	8.534
EVAPOTRANSPIRATION	21.691	(3.6830)	78736.87	84.257
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1.87134	(1.53436)	6792.955	7.26917
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.004	0.0000
AVERAGE HEAD ON TOP OF LAYER 5	0.002 (0.002)		
CHANGE IN WATER STORAGE	-0.015	(0.5521)	-56.24	-0.060

PEAK DAILY VALUES FOR YEARS	1 THROUGH	20
	(INCHES)	(CU. FT.)
PRECIPITATION	5.07	18404.102
RUNOFF	2.106	7646.4312
DRAINAGE COLLECTED FROM LAYER 4	0.16174	587.13318
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	0.142	
OCATION 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.	3893
1.E.C	Page	5

MINIMUM VEG. SOIL WATER (VOL/VOL)

0.1490

*** 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 ENI	O OF YEAR 20	
LAYER	(INCHES)	(VOL/VOL)	
1	1.4394	0.2399	
2	517.3019	0.2913	
3	7.7040	0.3210	
4	0.0020	0.0100	
5	0.0000	0.0000	
6	0.1800	0.7500	
SNOW WATER	0.000		

APPENDIX B.6 HELP OUTPUT FOR ALTERNATIVE LINER INTERIM CASE 4-**LOCATION 4**



CASE420Y, 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\MDATA\KGVPR20Y.D4
TEMPERATURE DATA FILE: C:\HELP3\MDATA\KGVPR20Y.D7
SOLAR RADIATION DATA FILE: C:\HELP3\MDATA\KGVS020Y.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\MDATA\KGVEV20Y.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\MDATA\CASE4.D10
OUTPUT DATA FILE: C:\HELP3\MDATA\CASE420Y.OUT

TIME: 17: 0 DATE: 3/13/2017

TITLE: CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE 4 (LOCATION 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 = 6.00 INCHES

POROSITY = 0.4300 VOL/VOL

FIELD CAPACITY = 0.3210 VOL/VOL

WILTING POINT = 0.2210 VOL/VOL

INITIAL SOIL WATER CONTENT = 0.2210 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 = 1944.00 INCHES

Part III

CASE420Y.OUT

0.6710 VOL/VOL POROSITY FIELD CAPACITY = 0.2920 VOL/VOL WILTING POINT 0.0770 VOL/VOL INITIAL SOIL WATER CONTENT = 0.2914 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 13

24.00 INCHES THICKNESS = POROSITY 0.4300 VOL/VOL = 0.3210 VOL/VOL FIELD CAPACITY WILTING POINT = 0.2210 VOL/VOL WILTING POINT = 0.2210 VOL/VOL INITIAL SOIL WATER CONTENT = 0.3246 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.330000003000E-04 CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 20

THICKNESS 0.20 INCHES 0.8500 VOL/VOL = POROSITY FIELD CAPACITY = 0.0100 VOL/VOL 0.0050 VOL/VOL WILTING POINT INITIAL SOIL WATER CONTENT = 0.0206 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 0.06 INCHES =

POROSITY 0.0000 VOL/VOL = 0.0000 VOL/VOL FIELD CAPACITY WILTING POINT = 0.0000 VOL/VOL INITIAL SOIL WATER CONTENT = 0.0000 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.19999996000E-12 CM/SEC FML PINHOLE DENSITY = 1.00 HOLES/ACRE FML INSTALLATION DEFECTS = 2.00 HOLES/ACRE

= 3 - GOOD FML PLACEMENT QUALITY

THICKNESS

LAYER 6

TYPE 3 - BARRIER SOIL LINER

MATERIAL TEXTURE NUMBER 17

0.24 INCHES THICKNESS = 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 4.% AND A SLOPE LENGTH OF 600. FEET.

SCS RUNOFF CURVE NUMBER	=	88.00	
FRACTION OF AREA ALLOWING R	UNOFF =	80.0	PERCENT
AREA PROJECTED ON HORIZONTA	L PLANE =	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIV	E ZONE =	1.920	INCHES
UPPER LIMIT OF EVAPORATIVE	STORAGE =	6.606	INCHES
LOWER LIMIT OF EVAPORATIVE	STORAGE =	1.788	INCHES
INITIAL SNOW WATER	823	0.000	INCHES
INITIAL WATER IN LAYER MATE	RIALS =	575.790	INCHES
TOTAL INITIAL WATER	=	575.790	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 KINGSVILLE TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JUC/NAC	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)

				CASE420Y.OUT		
JUC/NAC	UL FEB/AUG MAR/S	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 MONTH					OUGH 20	
	JAN/JUL		MAR/SEP	APR/OCT	MAY/NOV	JUN/DE
PRECIPITATION						
TOTALS	1.15			1.42	2.41	2.71
	2.43	2.37	5.38	2.30	1.33	1.18
STD. DEVIATIONS	0.63	1.18	0.55	1.20	1.88	2.04
	2.55	1.63	3.12	1.75	1.17	0.85
RUNOFF						
TOTALS	0.010	0.044	0.002	0.080	0.229	0.22
TOTALS	0.322	0.145	0.650	0.131	0.058	0.01
STD. DEVIATIONS	0.032	0.059	0.004	0.198	0.452	0.28
	0.721	0.160	0.809	0.208	0.182	0.04
EVAPOTRANSPIRATION						
TOTALS	0.926	2.091	1.307	1.259	2.002	2.14
	2.063	1.908	3.649	2.262	1.101	1.08
STD. DEVIATIONS	0.553	0.908	0.722	0.938	1.315	1.39
	1.651	1.324	1.215	1.209	0.795	0.58
LATERAL DRAINAGE COL		LAYER 4				
TOTALS	0.0726	0.0392	0.0796	0.0589	0.0482	0.07
	0.1774	0.2168	0.1255	0.4497	0.4595	0.25
STD. DEVIATIONS	0.0955	0.0557	0.1545	0.1063	0.0799	0.15
	0.3182	0.4582	0.2771	0.6082	0.7549	0.45
PERCOLATION/LEAKAGE						
TOTALS	0.0000		0.0000			
	0.0000	0.0000	0.0000	0.0000	0.0000	0.00
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.00

AVERAGES	0.0010	0.0006	0.0011	0.0009	0.0007	0.001
	0.0025	0.0031	0.0018	0.0064	0.0068	0.003
STD. DEVIATIONS	0.0014	0.0009	0.0022	0.0016	0.0011	0.002
	0.0045	0.0065	0.0041	0.0087	0.0111	0.006

	INC	HES		CU. FEET	PERCENT
PRECIPITATION	25.74	(5.706)	93448.9	100.00
RUNOFF	1.907	(1.1083)	6921.00	7.406
EVAPOTRANSPIRATION	21.787	(3.6980)	79085.98	84.630
LATERAL DRAINAGE COLLECTED FROM LAYER 4	2.05535	(1.61442)	7460.923	7.98396
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.005	0.0000
AVERAGE HEAD ON TOP OF LAYER 5	0.002 (0.002)		
CHANGE IN WATER STORAGE	-0.005	(0.5759)	-18.99	-0.020

	(INCHES)	(CU. FT.)
PRECIPITATION	5.07	18404.102
RUNOFF	2.016	7318.0361
DRAINAGE COLLECTED FROM LAYER 4	0.16131	585.57281
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00007
VERAGE HEAD ON TOP OF LAYER 5	0.071	
MAXIMUM HEAD ON TOP OF LAYER 5	0.142	
OCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	1.4 FEET	
SNOW WATER	0.00	0.0000

MINIMUM VEG. SOIL WATER (VOL/VOL)

0.1490

*** 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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1.4410	0.2402	
566.3580		
	0.2913	
Description		
7.7040	0.3210	
0.0020	0.0100	
0.0000	0.0000	
0.1800	0.7500	

APPENDIX B.7 HELP OUTPUT FOR ALTERNATIVE LINER CLOSED CASE 5LOCATION 1



CASE530Y.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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TEMPERATURE DATA FILE: SOIL AND DESIGN DATA FILE: C:\HELP3\MDATA\CASE5.D10 OUTPUT DATA FILE:

PRECIPITATION DATA FILE: C:\HELP3\MDATA\KGVPR30Y.D4 C:\HELP3\MDATA\KGVTE30Y.D7 SOLAR RADIATION DATA FILE: C:\HELP3\MDATA\KGVSO30Y.D13 EVAPOTRANSPIRATION DATA: C:\HELP3\MDATA\KGVEV30Y.D11 C:\HELP3\MDATA\CASE530Y.OUT

TIME: 8:21 DATE: 3/14/2017

******************************* TITLE: CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE 5 (LOCATION 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

24.00 INCHES THICKNESS = POROSITY 0.4300 VOL/VOL FIELD CAPACITY 0.3210 VOL/VOL = WILTING POINT 0.2210 VOL/VOL INITIAL SOIL WATER CONTENT = 0.2719 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

Part III

CASE530Y.OUT

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

2.00 PERCENT

DRAINAGE LENGTH 250.0 FEET

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER MATERIAL TEXTURE NUMBER 36

= 0.04 INCHES THICKNESS 0.0000 VOL/VOL POROSITY

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

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

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

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 13

= 12.00 INCHES THICKNESS 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 690.00 INCHES = POROSITY = 0.6710 VOL/VOL FIELD CAPACITY 0.2920 VOL/VOL

CASE530Y.OUT

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 0.4300 VOL/VOL POROSITY 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 0.20 INCHES POROSITY 0.8500 VOL/VOL = 0.0100 VOL/VOL FIELD CAPACITY 0.0050 VOL/VOL WILTING POINT INITIAL SOIL WATER CONTENT = 0.0100 VOL/VOL

EFFECTIVE SAT, HYD. COND. = 10.0000000000 CM/SEC

2.00 PERCENT SLOPE DRAINAGE LENGTH 250.0 FEET

LAYER 9

TYPE 4 - FLEXIBLE MEMBRANE LINER

= 3 - GOOD

MATERIAL TEXTURE NUMBER 35

0.06 INCHES THICKNESS 0.0000 VOL/VOL POROSTTY FIELD CAPACITY 0.0000 VOL/VOL WILTING POINT = 0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0000 VOL/VOL 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

LAYER 10

TYPE 3 - BARRIER SOIL LINER MATERIAL TEXTURE NUMBER 17

0.24 INCHES THICKNESS = 0.7500 VOL/VOL POROSITY FIELD CAPACITY 0.7470 VOL/VOL 0.4000 VOL/VOL WILTING POINT 0.7500 VOL/VOL

INITIAL SOIL WATER CONTENT =

FML PLACEMENT QUALITY

CASE530Y.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 A GOOD STAND OF GRASS, A SURFACE SLOPE OF 25.% AND A SLOPE LENGTH OF 100. FEET.

SCS RUNOFF CURVE NUMBER	=	85.60	
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	=	2.674	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	=	219.926	INCHES
TOTAL INITIAL WATER	=	219.926	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 3RD QUARTER RELATIVE HUMIDITY = 76.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR KINGSVILLE 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)

JUC/NAC	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
				Page 4	

				CASE530Y.OU	I
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

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.37		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						
	0 007	0 000	0.005	0.051	0.100	0 17
TOTALS	0.007	0.022		0.051		0.174
	0.342	0.218	0.608	0.191	0.067	0.00
STD. DEVIATIONS	0.022	0.041	0.026	0.171	0.500	0.24
	0.789	0.366	0.822	0.318	0.265	0.02
EVAPOTRANSPIRATION						
TOTALS	1.093	1.768	1.331	1.252	1.966	2.07
**************************************	1.754	2.186	3.474	2.435	1.312	1.10
STD. DEVIATIONS	0.665	0.864	0.621	0.803	1.191	1.22
	1.256	1.504	1.237	1.136	0.899	0.68
LATERAL DRAINAGE COLLE						
TOTALS	0.0698	0.2237		0.0457	0.1805	0.33
TOTALS	0.3318		2 THE STATE OF STATE	8 1 1 1 1 1 1 1 1		
		0.2604	0.1270	0.1234	0.2785	0.46
CTD DEVITATIONS	0 1215				0.2703	0.40
STD. DEVIATIONS		0.5857			0.3203	0.11
PERCOLATION/LEAKAGE TH	0.5455 HROUGH LAYI	0.5857			0.3203	0.11
PERCOLATION/LEAKAGE TH	0.5455 HROUGH LAYI	0.5857 ER 4	0.9977	0.7204		
PERCOLATION/LEAKAGE TH	0.5455 HROUGH LAYI	0.5857 ER 4 	0.9977	0.7204	0.0000	0.00
PERCOLATION/LEAKAGE TH TOTALS	0.5455 HROUGH LAYI 0.0000 0.0000	0.5857 ER 4 0.0000 0.0000	0.9977 0.0000 0.0000	0.7204 0.0000 0.0000	0.0000 0.0000	0.00 0.00
PERCOLATION/LEAKAGE TH	0.5455 HROUGH LAYI 0.0000 0.0000	0.5857 ER 4 0.0000 0.0000	0.9977 0.0000 0.0000 0.0000	0.7204 0.0000 0.0000 0.0000	0.0000 0.0000	0.00 0.00
PERCOLATION/LEAKAGE TH TOTALS	0.5455 HROUGH LAYI 0.0000 0.0000 0.0000	0.5857 ER 4 0.0000 0.0000 0.0000	0.9977 0.0000 0.0000 0.0000 0.0000	0.7204 0.0000 0.0000 0.0000	0.0000 0.0000	0.00 0.00
PERCOLATION/LEAKAGE THE TOTALS STD. DEVIATIONS	0.5455 HROUGH LAYI 0.0000 0.0000 0.0000	0.5857 ER 4 0.0000 0.0000 0.0000 LAYER 8	0.9977 0.0000 0.0000 0.0000 0.0000	0.7204 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.00 0.00 0.00
PERCOLATION/LEAKAGE TH TOTALS STD. DEVIATIONS	0.5455 HROUGH LAYI 0.0000 0.0000 0.0000	0.5857 ER 4 0.0000 0.0000 0.0000 LAYER 8	0.9977 0.0000 0.0000 0.0000	0.7204 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.000 0.000 0.000 0.000
PERCOLATION/LEAKAGE THE TOTALS STD. DEVIATIONS	0.5455 HROUGH LAYI 0.0000 0.0000 0.0000 0.0000	0.5857 ER 4 0.0000 0.0000 0.0000 LAYER 8 0.0000 0.0000	0.9977 0.0000 0.0000 0.0000 0.0000	0.7204 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.000 0.000 0.000 0.000

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
PERCOLATION/LEAKAGE TI	HROUGH LAYE	R 10				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
AVERAGES	OF MONTHLY	AVERAGED	DATLY HE	ADS (TNCH	=51	
AVERAGES	OF MONTHLY	AVERAGED	DAILY HEA	ADS (INCH	ES) 	
AVERAGES	OF MONTHLY	AVERAGED	DAILY HE	ADS (INCHI	ES)	
,			DAILY HEA	ADS (INCHI	ES)	
,			DAILY HEA	ADS (INCHI	ES)	
,			0.0008	0.0003	0.0013	0.013
DAILY AVERAGE HEAD ON	TOP OF LAY	ER 3			90 accepts, 900	0.013 0.000
DAILY AVERAGE HEAD ON	TOP OF LAY!	ER 3 0.0017	0.0008	0.0003	0.0013	
DAILY AVERAGE HEAD ON AVERAGES	TOP OF LAY! 0.0005 0.0206	ER 3 0.0017 0.0177	0.0008 0.1061	0.0003 0.0240	0.0013 0.0018	0.000
DAILY AVERAGE HEAD ON AVERAGES STD. DEVIATIONS	0.0005 0.0206 0.0009 0.1028	ER 3 0.0017 0.0177 0.0020 0.0537	0.0008 0.1061 0.0009	0.0003 0.0240 0.0009	0.0013 0.0018 0.0020	0.000
DAILY AVERAGE HEAD ON AVERAGES STD. DEVIATIONS	0.0005 0.0206 0.0009 0.1028	ER 3 0.0017 0.0177 0.0020 0.0537	0.0008 0.1061 0.0009	0.0003 0.0240 0.0009	0.0013 0.0018 0.0020	0.000 0.041 0.000
DAILY AVERAGE HEAD ON AVERAGES STD. DEVIATIONS DAILY AVERAGE HEAD ON	0.0005 0.0206 0.0009 0.1028	ER 3 0.0017 0.0177 0.0020 0.0537	0.0008 0.1061 0.0009 0.2641	0.0003 0.0240 0.0009 0.0529	0.0013 0.0018 0.0020 0.0024	0.000 0.041 0.000
DAILY AVERAGE HEAD ON AVERAGES STD. DEVIATIONS DAILY AVERAGE HEAD ON	0.0005 0.0206 0.0009 0.1028 TOP OF LAYI	0.0017 0.0177 0.0020 0.0537 ER 9	0.0008 0.1061 0.0009 0.2641	0.0003 0.0240 0.0009 0.0529	0.0013 0.0018 0.0020 0.0024	0.000

	INC	HES		CU. FEET	PERCENT
PRECIPITATION	27.20	(5.704)	98722.7	100.00
RUNOFF	1.880	(1.2157)	6825.49	6.914
EVAPOTRANSPIRATION	21.749	(3.7373)	78947.65	79.969
LATERAL DRAINAGE COLLECTED FROM LAYER 2	3.55912	(1.91851)	12919.604	13,08676
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00001	(0.00001)	0.023	0.00002
AVERAGE HEAD ON TOP OF LAYER 3	0.016 (0.026)		
LATERAL DRAINAGE COLLECTED FROM LAYER 8	0.00001	(0.00001)	0.022	0.00002
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.001	0.0000
AVERAGE HEAD ON TOP OF LAYER 9	0.000 (0.000)		
CHANGE IN WATER STORAGE	0.008	(0.4489)	29.91 Page 6	0.030

CASE530Y.OUT

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PEAK DAILY VALUES FOR YEARS	1 THROUGH	30
	(INCHES)	(CU. FT.)
PRECIPITATION	5.07	18404.102
RUNOFF	2.585	9382.1035
DRAINAGE COLLECTED FROM LAYER 2	0.91251	3312.41650
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000012	0.04380
AVERAGE HEAD ON TOP OF LAYER 3	14.568	
MAXIMUM HEAD ON TOP OF LAYER 3	18.997	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	87.9 FEET	
DRAINAGE COLLECTED FROM LAYER 8	0.00001	0.03665
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)	0.4	4285
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.3	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 30

LAYER (INCHES) (VOL/VOL)

1 6.7730 0.2822

		CASE530Y.OUT
2	0.0020	0.0100
3	0.0000	0.0000
4	0.1800	0.7500
5	3.8520	0.3210
6	201.4800	0.2920
7	7.7040	0.3210
8	0.0020	0.0100
9	0.0000	0.0000
10	0.1800	0.7500
SNOW WATER	0.000	

APPENDIX B.8 HELP OUTPUT FOR ALTERNATIVE LINER CLOSED CASE 6LOCATION 2



CASE630Y.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	**
**		**
**		**
******	******************	******
*******	*******************	k******

PRECIPITATION DATA FILE: C:\HELP3\MDATA\KGVPR30Y.D4 C:\HELP3\MDATA\KGVTE30Y.D7 TEMPERATURE DATA FILE: SOLAR RADIATION DATA FILE: C:\HELP3\MDATA\KGVSO30Y.D13 EVAPOTRANSPIRATION DATA: C:\HELP3\MDATA\KGVEV30Y.D11 SOIL AND DESIGN DATA FILE: C:\HELP3\MDATA\CASE6.D10 OUTPUT DATA FILE: C:\HELP3\MDATA\CASE630Y.OUT

8:29 DATE: 3/14/2017 TIME:

TITLE: CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE 6 (LOCATION 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 24.00 INCHES POROSITY 0.4300 VOL/VOL FIELD CAPACITY 0.3210 VOL/VOL 0.2210 VOL/VOL WILTING POINT INITIAL SOIL WATER CONTENT = 0.2754 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 = 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 = 1680.00 INCHES
POROSITY = 0.6710 VOL/VOL
FIELD CAPACITY = 0.2920 VOL/VOL

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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 = 0.20 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 = 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

CASE630Y.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 A GOOD STAND OF GRASS, A SURFACE SLOPE OF 25.% AND A SLOPE LENGTH OF 350. FEET.

SCS RUNOFF CURVE NUMBER	=	84.60	
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	=	2.757	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	=	509.089	INCHES
TOTAL INITIAL WATER	=	509.089	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	
		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 KINGSVILLE 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	

		CASE630Y.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

	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	0.004	0.047	0.169	0.145
4, 4,	0.325	0.191	0.568	0.161	0.044	0.004
STD. DEVIATIONS	0.016	0.032	0.020	0.171	0.495	0.206
	0.770	0.339	0.843	0.294	0.176	0.018
EVAPOTRANSPIRATION						
TOTALS	1.081	1.760	1.314	1.251	1.928	2.038
	1.728	2.139	3.444	2.384	1.304	1.109
STD. DEVIATIONS	0.675	0.902	0.615	0.801	1.168	1.210
	1.204	1.461	1.229	1.106	0.896	0.689
LATERAL DRAINAGE COL		LAYER 2				
TOTALS	0.0809					
	0.3796	0.4275	0.9447	0.7920	0.2900	0.0857
STD. DEVIATIONS	0.1435	0.2996	0.1230	0.1528	0.3265	0.5469
	0.6067	0.6486	0.9618	0.8406	0.4048	0.1200
PERCOLATION/LEAKAGE						
TOTALS	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 COL	LECTED 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
				Page 5		

	CASE630Y.OUT						
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	
PERCOLATION/LEAKAGE TH	HROUGH LAYER	R 10					
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
AVERAGES	OF MONTHLY	AVERAGED	DAILY HEA	ADS (INCH	ES)		
AVERAGES	OF MONTHLY	AVERAGED	DAILY HEA	ADS (INCHI	ES) 		
AVERAGES			DAILY HEA	ADS (INCH	ES)		
			0.0016	0.0008	0.0104	0.058	
DAILY AVERAGE HEAD ON	TOP OF LAYI	ER 3					
AILY AVERAGE HEAD ON AVERAGES	TOP OF LAY!	ER 3 	0.0016	0.0008	0.0104	0.001	
DAILY AVERAGE HEAD ON	TOP OF LAYI 0.0012 0.0681	ER 3 0.0038 0.0899	0.0016 0.3548	0.0008 0.1774	0.0104 0.0241	0.058 0.001 0.191 0.001	
DAILY AVERAGE HEAD ON AVERAGES	0.0012 0.0681 0.0020 0.2573	ER 3 0.0038 0.0899 0.0047 0.2432	0.0016 0.3548 0.0017	0.0008 0.1774 0.0022	0.0104 0.0241 0.0324	0.001	
AZILY AVERAGE HEAD ON AVERAGES STD. DEVIATIONS DAILY AVERAGE HEAD ON	0.0012 0.0681 0.0020 0.2573	0.0038 0.0899 0.0047 0.2432	0.0016 0.3548 0.0017 0.7287	0.0008 0.1774 0.0022 0.4575	0.0104 0.0241 0.0324 0.1013	0.001 0.191 0.001	
AXILY AVERAGE HEAD ON AVERAGES STD. DEVIATIONS	0.0012 0.0681 0.0020 0.2573	ER 3 0.0038 0.0899 0.0047 0.2432	0.0016 0.3548 0.0017	0.0008 0.1774 0.0022	0.0104 0.0241 0.0324	0.001 0.191 0.001	
AZILY AVERAGE HEAD ON AVERAGES STD. DEVIATIONS DAILY AVERAGE HEAD ON	0.0012 0.0681 0.0020 0.2573 TOP OF LAYI	0.0038 0.0038 0.0899 0.0047 0.2432 ER 9	0.0016 0.3548 0.0017 0.7287	0.0008 0.1774 0.0022 0.4575	0.0104 0.0241 0.0324 0.1013	0.001	

	INCHES			CU. FEET	PERCENT	
PRECIPITATION	27.20	(5.704)	98722.7	100.00	
RUNOFF	1.680	(1.1902)	6099.48	6.178	
EVAPOTRANSPIRATION	21.481	(3.7202)	77976.52	78,985	
LATERAL DRAINAGE COLLECTED FROM LAYER 2	4.02954	(2.05403)	14627.235	14.81649	
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00002	(0.00003)	0.077	0.00008	
AVERAGE HEAD ON TOP OF LAYER 3	0.066 (0.096)			
LATERAL DRAINAGE COLLECTED FROM LAYER 8	0.00002	(0.00003)	0.073	0.00007	
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	0.005	(0.4311)	19.37 Page 6	0.020	

PEAK DAILY VALUES FOR YEARS	1 THROUGH	30
		(CU. FT.)
PRECIPITATION	5.07	
RUNOFF	2.585	9382.0957
DRAINAGE COLLECTED FROM LAYER 2	0.45365	1646.75024
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000023	0.08305
AVERAGE HEAD ON TOP OF LAYER 3	22.812	
MAXIMUM HEAD ON TOP OF LAYER 3	31.119	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	158.8 FEET	
DRAINAGE COLLECTED FROM LAYER 8	0.00002	0.07910
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	6
SNOW WATER	0.02	73.7433

*** 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 30

LAYER (INCHES) (VOL/VOL)

1 6.7691 0.2820

		CASE630Y.OUT
2	0.0020	0.0100
3	0.0000	0.0000
4	0.1800	0.7500
5	3.8520	0.3210
6	490.5600	0.2920
7	7.7040	0.3210
8	0.0020	0.0100
9	0.0000	0.0000
10	0.1800	0.7500
SNOW WATER	0.000	

APPENDIX B.9 HELP OUTPUT FOR ALTERNATIVE LINER CLOSED CASE 7-**LOCATION 3**



•			
*****	****************	*****	*****
*****	**************	******	*****
**			**
**			**
**	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\MDATA\KGVPR30Y.D4
TEMPERATURE DATA FILE: C:\HELP3\MDATA\KGVTE30Y.D7
SOLAR RADIATION DATA FILE: C:\HELP3\MDATA\KGVS030Y.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\MDATA\KGVEV30Y.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\MDATA\CASE7.D10
OUTPUT DATA FILE: C:\HELP3\MDATA\CASE730Y.OUT

TIME: 10:27 DATE: 3/3/2017

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. = 10.000000000 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 = 1776.00 INCHES
POROSITY = 0.6710 VOL/VOL
FIELD CAPACITY = 0.2920 VOL/VOL
Page 2

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 = 0.20 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 = 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

CASE730Y.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 A GOOD STAND OF GRASS, A SURFACE SLOPE OF 12.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	84.80	
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	=	537.073	INCHES
TOTAL INITIAL WATER	=	537.073	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 HUMIDIT	Y =	76.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDIT	Y =	78.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDIT	Y =	76.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDIT	Y =	76.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR KINGSVILLE 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	

				CASE/304.00	1
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

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						HT TOTO TO
			101 312	1000	JT 1923 1222	2 221
TOTALS	1.37 2.36	1.81	1.19 5.39	1.40	2.51 1.49	2.59 1.25
CTD DEVITATIONS	0.01	1.21	0.57	1.05	1.80	1.82
STD. DEVIATIONS	0.81 2.23	2.36	2.96	1.90	1.16	0.84
RUNOFF						
TOTALS	0.005	0.017	0.004	0.048	0.172	0.15
	0.327	0.197	0.576	0.165	0.045	0.00
STD. DEVIATIONS	0.017	0.034	0.021	0.172	0.495	0.21
	0.771	0.344	0.849	0.296	0.177	0.019
EVAPOTRANSPIRATION						
TOTALS	1.078	1.759	1.312	1.250	1.927	2.03
TOTALS	1.733	2.138	3.441	2.378	1.302	1.11
STD. DEVIATIONS	0.678	0.893	0.613	0.800	1.166	1.21
	1.208	1.465	1.222	1.103	0.899	0.69
LATERAL DRAINAGE COLI	LECTED FROM	LAYER 2				
TOTALS	0.0770	0.2413	0.1130	0.0569	0.2266	0.389
	0.3734	0.4229	0.9423	0.7940	0.2864	0.08
STD. DEVIATIONS	0.1384	0.3007	0.1237	0.1480	0.3277	0.534
	0.6049	0.6418	0.9643	0.8378	0.4003	0.12
PERCOLATION/LEAKAGE	THROUGH LAY	ER 4				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.00
	0.0000	0.0000	0.0000	0.0000	0.0000	0.00
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.00
	0.0000	0.0000	0.0000	0.0000	0.0000	0.00
LATERAL DRAINAGE COLI		LAYER 8				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000				0.0000	0.00
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
				Page 5		

			C	ASE730Y.0	UT	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
PERCOLATION/LEAKAGE	THROUGH LAYE	R 10				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.00
	0.0000	0.0000	0.0000	0.0000	0.0000	0.00
AVERAG	ES OF MONTHLY	AVERAGED	DAILY HE	ADS (INCH	ES)	
AVERAG	ES OF MONTHLY	AVERAGED	DAILY HE	ADS (INCH	ES)	
AVERAG	ES OF MONTHLY	AVERAGED	DAILY HE	ADS (INCH	ES)	
2			DAILY HEA	ADS (INCH	ES)	
AVERAGI			DAILY HE	ADS (INCH	ES)	
2			0.0016	0.0008	0.0105	0.05
AILY AVERAGE HEAD (ON TOP OF LAY	ER 3				
AILY AVERAGE HEAD (ON TOP OF LAY	ER 3 0.0038	0.0016	0.0008	0.0105	0.00
AILY AVERAGE HEAD (ON TOP OF LAY 0.0011 0.0675	ER 3 0.0038 0.0853	0.0016 0.3606	0.0008 0.1844	0.0105 0.0215	0.00 0.18
AILY AVERAGE HEAD (0.0011 0.0675 0.0020 0.2555	ER 3 0.0038 0.0853 0.0047 0.2308	0.0016 0.3606 0.0018	0.0008 0.1844 0.0022	0.0105 0.0215 0.0325	0.00 0.18
AVERAGE HEAD (AVERAGES STD. DEVIATIONS WAILY AVERAGE HEAD (0.0011 0.0675 0.0020 0.2555	ER 3 0.0038 0.0853 0.0047 0.2308	0.0016 0.3606 0.0018	0.0008 0.1844 0.0022	0.0105 0.0215 0.0325	0.00 0.18 0.00
AILY AVERAGE HEAD OF AVERAGES STD. DEVIATIONS	0.0011 0.0075 0.0020 0.2555 ON TOP OF LAY	ER 3 0.0038 0.0853 0.0047 0.2308 ER 9	0.0016 0.3606 0.0018 0.7392	0.0008 0.1844 0.0022 0.4599	0.0105 0.0215 0.0325 0.0994	0.00 0.18 0.00
AVERAGE HEAD (AVERAGES STD. DEVIATIONS WAILY AVERAGE HEAD (0.0011 0.0075 0.0020 0.2555 ON TOP OF LAY	ER 3 0.0038 0.0853 0.0047 0.2308 ER 9 0.0000	0.0016 0.3606 0.0018 0.7392	0.0008 0.1844 0.0022 0.4599	0.0105 0.0215 0.0325 0.0994	0.05 0.00 0.18 0.00

	INCHES			CU. FEET	PERCENT	
RECIPITATION	27.20	(5.704)	98722.7	100.00	
UNOFF	1.711	(1.1947)	6210.31	6.291	
VAPOTRANSPIRATION	21.470	(3.7084)	77936.37	78.945	
ATERAL DRAINAGE COLLECTED FROM LAYER 2	4.00840	(2.03256)	14550.508	14.73877	
ERCOLATION/LEAKAGE THROUGH LAYER 4	0.00002	(0.00003)	0.078	0.00008	
VERAGE HEAD ON TOP OF LAYER 3	0.066 (0.097)			
ATERAL DRAINAGE COLLECTED FROM LAYER 8	0.00002	(0.00003)	0.073	0.00007	
ERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.004	0.0000	
VERAGE HEAD ON TOP OF LAYER 9	0.000 (0.000)			
HANGE IN WATER STORAGE	0.007	(0.4345)	25.43	0.026	

^			
***********	*******	*******	*****

	PEAK DAILY VALUES FOR YEARS	1 THROUGH	30
-			(CU. FT.)
	PRECIPITATION	5.07	18404.102
	RUNOFF	2.585	9382.0957
	DRAINAGE COLLECTED FROM LAYER 2	0.45365	1646.75073
	PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000023	0.08307
	AVERAGE HEAD ON TOP OF LAYER 3	22.816	
	MAXIMUM HEAD ON TOP OF LAYER 3	31.124	
	LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	158.8 FEET	
	DRAINAGE COLLECTED FROM LAYER 8	0.00002	0.07912
	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.

FINAL WATER STORAGE AT END OF YEAR 30

LAYER (INCHES) (VOL/VOL)

1 6.7714 0.2821

		CASE730Y.OUT		
2	0.0020	0.0100		
3	0.0000	0.0000		
4	0.1800	0.7500		
5	3.8520	0.3210		
6	518.5920	0.2920		
7	7.7040	0.3210		
8	0.0020	0.0100		
9	0.0000	0.0000		
10	0.1800	0.7500		
SNOW WATER	0.000			

APPENDIX B.10 HELP OUTPUT FOR ALTERNATIVE LINER CLOSED CASE 8LOCATION 4



** ** 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\MDATA\KGVPR30Y.D4
TEMPERATURE DATA FILE: C:\HELP3\MDATA\KGVTE30Y.D7
SOLAR RADIATION DATA FILE: C:\HELP3\MDATA\KGVSO30Y.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\MDATA\KGVEV30Y.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\MDATA\CASE8.D10
OUTPUT DATA FILE: C:\HELP3\MDATA\CASE830Y.OUT

TIME: 8:39 DATE: 3/14/2017

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 = 0.2733 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 0.0100 VOL/VOL FIELD CAPACITY WILTING POINT = 0.0050 VOL/VOL INITIAL SOIL WATER CONTENT = 0.0100 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 10.0000000000 CM/SEC

2.00 PERCENT DRAINAGE LENGTH 500.0 FEET

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER MATERIAL TEXTURE NUMBER 36

THICKNESS 0.04 INCHES 0.0000 VOL/VOL POROSITY = 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

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

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

LAYER 5 -----

TYPE 1 - VERTICAL PERCOLATION LAYER MATERIAL TEXTURE NUMBER 13

= 12.00 INCHES THICKNESS 0.4300 VOL/VOL POROSITY 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

= 1944.00 INCHES **THICKNESS** POROSITY = 0.6710 VOL/VOL FIELD CAPACITY 0.2920 VOL/VOL

0.0770 VOL/VOL WILTING POINT 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 0.4300 VOL/VOL POROSITY = FIELD CAPACITY 0.3210 VOL/VOL 0.2210 VOL/VOL = WILTING POINT 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 0.20 INCHES 0.8500 VOL/VOL POROSITY = 0 0.0100 VOL/VOL FIELD CAPACITY 0.0050 VOL/VOL WILTING POINT = INITIAL SOIL WATER CONTENT = 0.0100 VOL/VOL

CM/SEC EFFECTIVE SAT. HYD. COND. = 10.0000000000

= 2.00 PERCENT SLOPE DRAINAGE LENGTH 500.0 FEET

LAYER 9

TYPE 4 - FLEXIBLE MEMBRANE LINER

MATERIAL TEXTURE NUMBER 35

0.06 INCHES **THICKNESS** POROSITY 0.0000 VOL/VOL = 0.0000 VOL/VOL FIELD CAPACITY 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 0.7500 VOL/VOL POROSITY 0.7470 VOL/VOL FIELD CAPACITY WILTING POINT 0.4000 VOL/VOL

INITIAL SOIL WATER CONTENT = 0.7500 VOL/VOL

CASE830Y.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 A GOOD STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 600. FEET.

SCS RUNOFF CURVE NUMBER	= 1	83.40	
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	=	2.708	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	=	586.128	INCHES
TOTAL INITIAL WATER	=	586.128	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	8	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	Y =	76.00	%
AVERAGE 4TH OUARTER RELATIVE HUMIDITY	/ =	76.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR KINGSVILLE 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)

JUC/NAC	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
				Page 4	

				CASE830Y.OU	T
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

		N INCHES				
	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION			X			
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	0.003	0.011	0.003	0.043	0.154	0.117
LEANIER III	0.320	0.167	0.536	0.138	0.039	0.002
STD. DEVIATIONS	0.012	0.024	0.015	0.167	0.494	0.168
	0.765	0.317	0.853	0.285	0.166	0.012
EVAPOTRANSPIRATION						
TOTALS	1.075	1.755	1.316	1.246	1.943	2.036
	1.740	2.149	3.445	2.375	1.304	1.111
STD. DEVIATIONS	0.680	0.890	0.616	0.799	1.174	1,212
	1.225	1.476	1.225	1.098	0.904	0.695
LATERAL DRAINAGE COL	LECTED FROM	LAYER 2				
TOTALS	0.0871	0.2477	0.1143	0.0601	0.2280	0.425
	0.3740	0.4325	0.9802	0.8286	0.2979	0.084
STD. DEVIATIONS	0.1585	0.3090	0.1186	0.1609	0.3250	
	0.6004	0.6575	0.9888	0.8731	0.4168	0.119
PERCOLATION/LEAKAGE	THROUGH LAY	ER 4				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
LATERAL DRAINAGE COL	LECTED FROM	LAYER 8				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
				Page 5		

			C	ASE830Y.0	UT	
¥0	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
PERCOLATION/LEAKAGE	THROUGH LAYE	R 10				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	S OF MONTHLY			2.0	0.0	
	S OF MONTHLY			2.0	0.0	
				2.0	0.0	
				2.0	0.0	
				2.0	0.0	0.074
DAILY AVERAGE HEAD ON	N TOP OF LAY	ER 3			3-3	
DAILY AVERAGE HEAD ON	N TOP OF LAY	ER 3 0.0039	0.0016	0.0009	0.0104	0.001
DAILY AVERAGE HEAD ON AVERAGES	0.0012 0.0679	ER 3 0.0039 0.0824	0.0016 0.3707	0.0009 0.2120	0.0104 0.0248	0.001 0.232
DAILY AVERAGE HEAD OF AVERAGES STD. DEVIATIONS	0.0012 0.0679 0.0023 0.2719	ER 3 0.0039 0.0824 0.0048 0.2347	0.0016 0.3707 0.0017	0.0009 0.2120 0.0024	0.0104 0.0248 0.0323	0.001 0.232
DAILY AVERAGE HEAD OF AVERAGES STD. DEVIATIONS	0.0012 0.0679 0.0023 0.2719	ER 3 0.0039 0.0824 0.0048 0.2347	0.0016 0.3707 0.0017	0.0009 0.2120 0.0024	0.0104 0.0248 0.0323	0.001 0.232 0.001
AVERAGE HEAD ON AVERAGES STD. DEVIATIONS DAILY AVERAGE HEAD ON	0.0012 0.0679 0.0023 0.2719	ER 3 0.0039 0.0824 0.0048 0.2347	0.0016 0.3707 0.0017 0.7766	0.0009 0.2120 0.0024 0.4906	0.0104 0.0248 0.0323 0.1168	0.001 0.232 0.001
DAILY AVERAGE HEAD ON AVERAGES STD. DEVIATIONS DAILY AVERAGE HEAD ON	0.0012 0.0679 0.0023 0.2719 N TOP OF LAY!	er 3 0.0039 0.0824 0.0048 0.2347 Er 9	0.0016 0.3707 0.0017 0.7766	0.0009 0.2120 0.0024 0.4906	0.0104 0.0248 0.0323 0.1168	0.074 0.001 0.232 0.001 0.000

	INC	HES		CU. FEET	PERCENT
PRECIPITATION	27.20	(5.704)	98722.7	100.00
RUNOFF	1.533	(1.1930)	5565.96	5.638
EVAPOTRANSPIRATION	21.495	(3.7381)	78026.06	79.036
LATERAL DRAINAGE COLLECTED FROM LAYER 2	4.16123	(2.10988)	15105.281	15.30072
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00002	(0.00003)	0.083	0.00008
AVERAGE HEAD ON TOP OF LAYER 3	0.071 (0.104)		
LATERAL DRAINAGE COLLECTED FROM LAYER 8	0.00002	(0.00003)	0.079	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	(0.4342)	25.30	0.026

	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	1646.74548	
	PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000023	0.08285	
	AVERAGE HEAD ON TOP OF LAYER 3	22.774		
	MAXIMUM HEAD ON TOP OF LAYER 3	31.078		
	LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	158.7 FEET		
	DRAINAGE COLLECTED FROM LAYER 8	0.00002	0.07933	
	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.

FINAL WATER STORAGE AT END OF YEAR 30

LAYER (INCHES) (VOL/VOL)

1 6.7694 0.2821

		CASE830Y.OUT
2	0.0020	0.0100
3	0.0000	0.0000
4	0.1800	0.7500
5	3.8520	0.3210
6	567.6481	0.2920
7	7.7040	0.3210
8	0.0020	0.0100
9	0.0000	0.0000
10	0.1800	0.7500
SNOW WATER	0.000	

HELP MODEL ANALYSIS ALTERNATIVE LINER AND OVERLINER



APPENDIX B.11 HELP MODEL/MULTIMED MODEL-SUMMARY OF CASES 10L-80L



Project No. 8514-3 Permit Amendment

Description: HELP Model/MULTIMED Model-Summary of Cases 10L-80L

Date: 3/07/17

By: JCG

<u>Case1OL-Interim Landfill (Location 1)</u>- An open landfill with 15.5 feet of insitu pre-Subtitle D waste and liner, 30 inches of cover, a Geosynthetic Clay Liner (GCL), a 60 mil HDPE Flexible Membrane Liner (FML), a Geocomposite drainage layer (Geonet), a 24 inch protective soil layer (Protective Cover), 12 feet of waste with 400 foot drain length at 2%, and 6 inches of daily soil cover.

<u>Case2OL-Interim Landfill (Location 2)</u>- An open landfill with 34 feet of insitu pre-Subtitle waste and liner, 30 inches of cover, a Geosynthetic Clay Liner (GCL), a 60 mil HDPE Flexible Membrane Liner (FML), a Geocomposite drainage layer (Geonet), a 24 inch protective soil layer (Protective Cover), 82.5 feet of waste with 400 foot drain length at 2%, and 6 inches of daily soil cover.

<u>Case 3OL-Interim Landfill (Location 3)</u>- An open landfill with 37 feet of insitu pre-Subtitle D waste and liner, a Geosynthetic Clay Liner (GCL), a 60 mil HDPE Flexible Membrane Liner (FML), a Geocomposite drainage layer (Geonet), a 24 inch protective soil layer (Protective Cover), 85.5 feet of waste with 400 foot drain length at 2%, and 6 inches of daily soil cover.

<u>Case4OL-Interim Landfill (Location 4)</u>- An open landfill with 16 feet of insitu pre-Subtitle D waste and liner, a Geosynthetic Clay Liner (GCL), a 60 mil HDPE Flexible Membrane Liner (FML), a Geocomposite drainage layer (Geonet), a 24 inch protective soil layer (Protective Cover), 119.5 feet of waste with 400 foot drain length at 2%, and 6 inches of daily soil cover.

<u>Case5OL-Closed Landfill (Location 1)</u> - A closed landfill with 15.5 feet of insitu pre-Subtitle D waste and liner, a Geosynthetic Clay Liner (GCL), a 60 mil HDPE Flexible Membrane Liner (FML), a Geocomposite drainage layer (Geonet), a 24 inch protective soil layer (Protective Cover), 12 feet of waste with 400 foot drain length at 2%, and 12 inches of intermediate cover, a GCL, a 40 mil LLDPE membrane, a Geocomposite drainage layer, and 24 inch erosion cover.

<u>Case6OL-Closed Landfill (Location 2)</u>- A closed landfill with 34 feet of insitu pre-Subtitle D waste and liner, a Geosynthetic Clay Liner (GCL), a 60 mil HDPE Flexible Membrane Liner (FML), a Geocomposite drainage layer (Geonet), a 24 inch protective soil layer (Protective Cover), 82.5 feet of waste with 400 foot drain length at 2%, and 12 inches of intermediate cover, a GCL, a 40 mil LLDPE membrane, a Geocomposite drainage layer, and 24 inch erosion cover.

<u>Case7OL-Closed Landfill (Location 3)</u>- A closed landfill with 37 feet of insitu pre-Subtitle D waste and liner, a Geosynthetic Clay Liner (GCL), a 60 mil HDPE Flexible Membrane Liner (FML), a Geocomposite drainage layer (Geonet), a 12 inch protective soil layer (Protective Cover), 85.5 feet of waste with 400 foot drain length at 2%, and 12 inches of intermediate cover, a GCL, a 40 mil LLDPE membrane, a Geocomposite drainage layer, and 24 inch erosion cover.

<u>Case8OL-Closed Landfill (Location 4)</u>- A closed landfill with 16 feet of insitu pre-Subtitle D waste and liner, a Geosynthetic Clay Liner (GCL), a 60 mil HDPE Flexible Membrane Liner (FML), a Geocomposite drainage layer (Geonet), a 24 inch protective soil layer (Protective Cover), 119.5 feet of waste with 400 foot drain length at 2%, and 12 inches of intermediate cover, a GCL, a 40 mil LLDPE membrane, a Geocomposite drainage layer, and 24 inch erosion cover.

APPENDIX B.12 HELP MODEL CASE SUMMARY



HELP MODEL CASE SUMMARY

Case Alternative Liner/Overliner	Average Precipitation (IN/YR)	Average Runoff (IN/YR)	Average Evapotranspiration	Average Percolation Through Liner (CF/YR)	Peak Percolation Through Liner (CF/DAY)	*Peak Percolation Through Liner (M/YR)
Interim Landfill HELP Information			9 =		1	
Location 1 (Case 1OL) • 12 feet of waste above liner				UII		
15.5 feet of waste below liner		William III				
20 yr	25.74	2.364	21.601	0.004	0.00007	1.79E-07
Location 2 (Case 2OL) • 82.5 feet of waste above liner				2 8	1 . 1	
34 feet of waste below liner						
20 yr	25.74	2.135	21.716	0.004	0.00006	1.53E-07
Location 3 (Case 3OL) • 85.5 feet of waste above liner			- y-			
• 37 feet of waste below liner						
20 yr	25.74	2.043	21.741	0.004	0.00006	1.53E-07
Location 4 (Case 4OL) • 119.5 feet of waste above liner			7 1	e a a	u lk ie	
16 feet of waste below liner						
20 yr	25.74	1.907	21.787	0.004	0.00006	1.53E-07
Closed Landfill HELP Information	8 2 50 8					
Location 1 (Case 5OL) • 12 feet of waste above liner	45	12 - 14 12 - 14			\$1 m."	11
15.5 feet of waste below liner						
30 yr	27.20	1.880	21.749	0.001	0.00002	5.11E-08
Location 2 (Case 6OL) • 82.5 feet of waste above liner	22					
• 34 feet of waste below liner			*		, Y ,	
30 yr	27.20	1.723	21.785	0.002	0.00002	5.11E-08
Location 3 (Case 70L) • 85.5 feet of waste above liner	4		- 8		-	, iii
37 feet of waste below liner				N		
30 yr	27.20	1.657	21.773	0.002	0.00002	5.11E-08
Location 4 (Case 8OL) • 119.5 feet of waste above liner			72	4 2 2	W	v = ' '
• 16 feet of waste below liner		31				
30 yr	27.20	1.562	21.805	0.002	0.00002	5.11E-08

^{*} Determined Using Peak Daily Percolation/Leakage Rate Through GCL and Converted to (M/YR) Example: $((.00007 \, \text{FT}^3/\text{Day-Acre}) \times (1 \, \text{Acre}/43,560 \, \text{FT}^2) / (1 \, \text{Meter}/3.28 \, \text{FT})) \times (365 \, \text{Days}/1 \, \text{YR}) = 1.79 \times 10^{-7} \, \text{M/YR}$

APPENDIX B.13 HELP OUTPUT FOR ALTERNATIVE LINER INTERIM CASE 10L-LOCATION 1



CASE10L.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\MDATA\KGVPR20Y.D4 TEMPERATURE DATA FILE: SOLAR RADIATION DATA FILE: C:\HELP3\MDATA\KGVSO20Y.D13 EVAPOTRANSPIRATION DATA: C:\HELP3\MDATA\KGVEV20Y.D11 SOIL AND DESIGN DATA FILE: C:\HELP3\MDATA\CASE10L.D10 OUTPUT DATA FILE:

C:\HELP3\MDATA\KGVTE20Y.D7

C:\HELP3\MDATA\CASE10L.OUT

TIME: 14:36 DATE: 3/6/2017

TITLE: CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE10L (LOCATION 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 0.4300 VOL/VOL POROSITY FIELD CAPACITY 0.3210 VOL/VOL WILTING POINT 0.2210 VOL/VOL INITIAL SOIL WATER CONTENT = 0.2210 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

144.00 INCHES

CASE10L.OUT

POROSITY = 0.6710 VOL/VOL FIELD CAPACITY = 0.2920 VOL/VOL WILTING POINT = 0.0770 VOL/VOL INITIAL SOIL WATER CONTENT = 0.2837 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 = 0.3242 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.330000003000E-04 CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 20

THICKNESS = 0.20 INCHES
POROSITY = 0.8500 VOL/VOL
FIELD CAPACITY = 0.0100 VOL/VOL
WILTING POINT = 0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0020020020

EFFECTIVE SAT. HYD. COND. = 10.0000000000 CM/SEC SLOPE = 2.00 PERCENT

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

CASE10L.OUT

WILTING POINT = 0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.7500 VOL/VOL

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

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 13

THICKNESS = 30.00 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 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 18

THICKNESS = 186.00 INCHES
POROSITY = 0.6710 VOL/VOL
FIELD CAPACITY = 0.2920 VOL/VOL
WILTING POINT = 0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2919 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 25.% AND A SLOPE LENGTH OF 100. FEET.

SCS RUNOFF CURVE NUMBER	8	89.50	
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	\equiv	1.886	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	22	6.606	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.788	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	114.065	INCHES
TOTAL INITIAL WATER	=	114.065	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

	CA	CASE10L.OUT			
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			
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
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 20

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.15	2.02	1.05	1.42	2.41	2.71
	2.43	2.37	5.38	2.30	1.33	1.18
STD. DEVIATIONS	0.63	1.18	0.55	1.20	1.88	2.04
	2.55	1.63	3.12	1.75	1.17	0.85
RUNOFF						
TOTALS	0.015	0.067	0.006	0.103	0.278	0.282
	0.377	0.192	0.779	0.173	0.073	0.019
STD. DEVIATIONS	0.042	0.081	0.009	0.233	0.504	0.344
				Page 4	1	

			(CASE1OL.OU	JT	
	0.815	0.200	0.918	0.257	0.214	0.065
EVAPOTRANSPIRATION						
TOTALS	0.927	2.081	1.305	1.245	1.981	2.108
	2.038	1.886	3.610	2.255	1.096	1.069
STD. DEVIATIONS	0.558	0.899	0.714	0.924	1.308	1.378
	1.630	1.312	1.219	1.213	0.780	0.585
LATERAL DRAINAGE COLL	ECTED FROM	LAYER 4				
TOTALS	0.0557	0.0293	0.0663	0.0567	0.0409	0.0574
	0.1701	0.1696	0.1118	0.5501	0.3280	0.1472
STD. DEVIATIONS	0.0736	0.0491	0.1278	0.1001	0.0685	0.1269
	0.2914	0.3491	0.2088	0.8668	0.5012	0.2297
PERCOLATION/LEAKAGE T	HROUGH LAYE	R 6				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
PERCOLATION/LEAKAGE T	HROUGH LAYE	R 8			20	
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
AVERAGES	OF MONTHLY	AVERAGED	DAILY HE	ADS (INCH	ES)	
DAILY AVERAGE HEAD ON	TOP OF LAY	ER 5				
AVERAGES	0.0006	0.0004	0.0008	0.0007	0.0005	0.000
	0.0019	0.0019	0.0013	0.0063	0.0039	0.001
STD. DEVIATIONS	0.0008	0.0006	0.0015	0.0012	0.0008	0.001
)	0.0033	0.0040	0.0025	0.0099	0.0059	0.002

AVERAGE ANNUAL TOTALS &	(STD. DEVIAT	IO	NS) FOR Y	EARS 1 THROUG	GH 20
	INCH	IES		CU. FEET	PERCENT
PRECIPITATION	25.74	(5.706)	93448.9	100.00
RUNOFF	2.364	(1.2831)	8580.98	9.183
EVAPOTRANSPIRATION	21.601	(3.6817)	78409.91	83.907
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1.78305	(1.49648)	6472.482	6.92623

Page 5

			CASE	10L.OUT	
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.004	0.00000
AVERAGE HEAD ON TOP OF LAYER 5	0.002 (0.001)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.000	0.00000
CHANGE IN WATER STORAGE	-0.004	(0.5412)	-14.46	-0.015
**********	*****	***	******	******	*****

PEAK DAILY VALUES FOR YEARS	1 THROUGH	20	
	(INCHES)	(CU. FT.)	50
PRECIPITATION	5.07	18404.102	
RUNOFF	2.156	7827.0879	Ţ)
DRAINAGE COLLECTED FROM LAYER 4	0.19851	720.60400	
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00007	
AVERAGE HEAD ON TOP OF LAYER 5	0.070		
MAXIMUM HEAD ON TOP OF LAYER 5	0.139		
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	4.2 FEET		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00000	
SNOW WATER	0.00	0.0000	
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3	3865	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.3	1490	

*** 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	20
	LAYER	(INCHES)	(VOL/VO	DL)

		CASE10L.OUT	
1	1.4228	0.2371	
2	40.7579	0.2830	
3	7.7040	0.3210	
4	0.0020	0.0100	
5	0.0000	0.0000	
6	0.1800	0.7500	
7	9.6289	0.3210	
8	54.2892	0.2919	
NOW WATER	0.000		

APPENDIX B.14 HELP OUTPUT FOR ALTERNATIVE LINER INTERIM CASE 2OL-LOCATION 2



CASE2OL.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\MDATA\KGVPR20Y.D4
TEMPERATURE DATA FILE: C:\HELP3\MDATA\KGVTE20Y.D7
SOLAR RADIATION DATA FILE: C:\HELP3\MDATA\KGVS020Y.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\MDATA\KGVEV20Y.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\MDATA\CASE2OL.D10
OUTPUT DATA FILE: C:\HELP3\MDATA\CASE2OL.OUT

TIME: 14:43 DATE: 3/ 6/2017

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 = 0.2391 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 = 990.00 INCHES

CASE2OL.OUT

POROSITY = 0.6710 VOL/VOL FIELD CAPACITY = 0.2920 VOL/VOL WILTING POINT = 0.0770 VOL/VOL INITIAL SOIL WATER CONTENT = 0.2909 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 = 0.3245 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.330000003000E-04 CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 20

THICKNESS = 0.20 INCHES
POROSITY = 0.8500 VOL/VOL
FIELD CAPACITY = 0.0100 VOL/VOL
WILTING POINT = 0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0184 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
Page 2

CASE20L.OUT

0.4000 VOL/VOL 0.7500 VOL/VOL WILTING POINT INITIAL SOIL WATER CONTENT =

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

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 13

= 30.00 INCHES THICKNESS 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 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 18

= 408.00 INCHES THICKNESS 0.6710 VOL/VOL POROSITY = FIELD CAPACITY = 0.2920 VOL/VOL
WILTING POINT = 0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2919 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A

FAIR STAND OF GRASS, A SURFACE SLOPE OF 25.%

AND A SLOPE LENGTH OF 356. FEET.

SCS RUNOFF CURVE NUMBER FRACTION OF AREA ALLOWING RUNOFF = 80.0 PERCENT AREA PROJECTED ON HORIZONTAL PLANE = 1.000 ACRES EVAPORATIVE ZONE DEPTH = 12.0 INCHES EVAPORATIVE ZONE DEPTH INCHES INITIAL WATER IN EVAPORATIVE ZONE = 2.124 INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE = 6.606 INCHES 1.788 INCHES LOWER LIMIT OF EVAPORATIVE STORAGE = INITIAL SNOW WATER = 0.000 INCHES
INITIAL WATER IN LAYER MATERIALS = 426.166 INCHES
TOTAL INITIAL WATER = 426.166 INCHES
TOTAL SUBSURFACE INFLOW = 0.00 INCHES/ 0.00 INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM

CORPUS CHRISTI **TEXAS**

	CASE20L.OUT			
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	æ	78.00	%	
AVERAGE 3RD QUARTER RELATIVE HUMIDITY			1000	
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00	%	

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

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JUC/NAC	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
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 20

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.15	2.02	1.05	1.42	2.41	2.71
	2.43	2.37	5.38	2.30	1.33	1.18
STD. DEVIATIONS	0.63	1.18	0.55	1.20	1.88	2.04
	2.55	1.63	3.12	1.75	1.17	0.85
RUNOFF						
TOTALS	0.012	0.055	0.003	0.092	0.254	0.252
	0.350	0.170	0.716	0.149	0.066	0.016
STD. DEVIATIONS	0.037	0.071	0.006	0.216	0.479	0.315
				Page 4	1	

			(CASE20L.OL	JT	
	0.770	0.181	0.864	0.234	0.199	0.057
EVAPOTRANSPIRATION						
TOTALS	0.932	2.093	1.304	1.251	1.993	2.128
TOTALS	2.048	1.899	3.628	2.264	1.098	1.076
STD. DEVIATIONS	0.540	0.899	0.714	0.930	1.317	1.382
	1.634	1.319	1.222	1.208	0.786	0.592
LATERAL DRAINAGE COLLE		LAYER 4				
TOTALS	0.0702	0.0321	0.0735	0.0597	0.0436	0.067
	0.1643	0.1983	0.1143	0.4356	0.4270	0.221
STD. DEVIATIONS	0.0901	0.0515	0.1376	0.1032	0.0709	0.144
	0.3053	0.4238	0.2389	0.6078	0.7392	0.396
PERCOLATION/LEAKAGE TH		R 6				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
PERCOLATION/LEAKAGE TH		R 8				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
AVERAGES	OF MONTHLY	AVERAGED	DAILY HEA	ADS (INCH	ES)	
DAILY AVERAGE HEAD ON	TOP OF LAY	ER 5				
AVERAGES	0.0008	0.0004	0.0008	0.0007	0.0005	0.000
	0.0019	0.0023	0.0013	0.0050	0.0050	0.002
STD. DEVIATIONS	0.0010	0.0006	0.0016	0.0012	0.0008	0.001
	0.0035	0.0048	0.0028	0.0069	0.0087	0.004
*******	*******	*****	*****	******	******	*****

AVERAGE ANNUAL TOTALS &	(STD. DEVIA	TIC	NS) FOR YE	ARS 1 THROUG	SH 20
	INC	HES		CU. FEET	PERCENT
PRECIPITATION	25.74	(5.706)	93448.9	100.00
RUNOFF	2.135	(1.1936)	7751.57	8.295
EVAPOTRANSPIRATION	21.716	(3.6903)	78829.24	84.355
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1.90747	(1.55045)	6924.125	7.40953

Page 5

Part III, Attachment 5, Appendix B,14, p.g.-5

			CASE	20L.OUT	
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.004	0.00000
AVERAGE HEAD ON TOP OF LAYER 5	0.002 (0.001)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.000	0.00000
CHANGE IN WATER STORAGE	-0.015	(0.5500)	-56.04	-0.060
*********	******	***	*****	******	*****

PEAK DAILY VALUES FOR YEARS	1 THROUGH	20
	(INCHES)	(CU. FT.)
PRECIPITATION	5.07	18404.102
RUNOFF	2.088	7578.4883
DRAINAGE COLLECTED FROM LAYER 4	0.16451	597.18555
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	0.116	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	1.8 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00000
SNOW WATER	0.00	0.0000
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3	3901
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.3	1490

*** 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 20	
	LAYER	(INCHES)	(VOL/VOL)	
	SEEEE.			
			Page 6	

		CASE20L.OUT
1	1.4393	0.2399
2	287.7899	0.2907
3	7.7040	0.3210
4	0.0020	0.0100
5	0.0000	0.0000
6	0.1800	0.7500
7	9.6295	0.3210
8	119.1126	0.2919
SNOW WATER	0.000	

APPENDIX B.15 HELP OUTPUT FOR ALTERNATIVE LINER INTERIM CASE 3OL-LOCATION 3



CASE3OL.OUT

4		
******	********************	******
*****	*****************	*****
**		**
**		**
**	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\MDATA\KGVPR20Y.D4
TEMPERATURE DATA FILE: C:\HELP3\MDATA\KGVPR20Y.D7
SOLAR RADIATION DATA FILE: C:\HELP3\MDATA\KGVS020Y.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\MDATA\KGVEV20Y.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\MDATA\CASE3OL.D10
OUTPUT DATA FILE: C:\HELP3\MDATA\CASE3OL.OUT

TIME: 14:51 DATE: 3/6/2017

TITLE: CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE3OL (LOCATION 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 = 6.00 INCHES
POROSITY = 0.4300 VOL/VOL
FIELD CAPACITY = 0.3210 VOL/VOL
WILTING POINT = 0.2210 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2210 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.330000003000E-04 CM/SEC
OTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY

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 = 1026.00 INCHES

CASE3OL.OUT

POROSITY 0.6710 VOL/VOL 0.2920 VOL/VOL FIELD CAPACITY WILTING POINT 0.0770 VOL/VOL INITIAL SOIL WATER CONTENT = 0.2909 VOL/VOL

= 0.100000005000E-02 CM/SEC EFFECTIVE SAT. HYD. COND.

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 13

THICKNESS 24.00 INCHES 0.4300 VOL/VOL = POROSITY = 0.3210 VOL/VOL FIELD CAPACITY 0.2210 VOL/VOL WILTING POINT INITIAL SOIL WATER CONTENT = 0.3246 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.330000003000E-04 CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 20 0.20 INCHES

THICKNESS POROSITY 0.8500 VOL/VOL FIELD CAPACITY 0.0100 VOL/VOL WILTING POINT 0.0050 VOL/VOL INITIAL SOIL WATER CONTENT = 0.0184 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 10.0000000000 CM/SEC

PERCENT SLOPE 2.00 DRAINAGE LENGTH 400.0 FEET

LAYER 5 -----

TYPE 4 - FLEXIBLE MEMBRANE LINER

MATERIAL TEXTURE NUMBER 35

0.06 INCHES THICKNESS 0.0000 VOL/VOL POROSITY FIELD CAPACITY = 0.0000 VOL/VOL 0.0000 VOL/VOL WILTING POINT INITIAL SOIL WATER CONTENT = 0.0000 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.199999996000E-12 CM/SEC FML PINHOLE DENSITY 1.00 HOLES/ACRE = HOLES/ACRE FML INSTALLATION DEFECTS 2.00

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

CASE3OL.OUT

WILTING POINT = 0.4000 VOL/VOL INITIAL SOIL WATER CONTENT = 0.7500 VOL/VOL

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

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 13

THICKNESS = 30.00 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 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 18

THICKNESS = 444.00 INCHES
POROSITY = 0.6710 VOL/VOL
FIELD CAPACITY = 0.2920 VOL/VOL
WILTING POINT = 0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2919 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 3.% AND A SLOPE LENGTH OF 220. FEET.

SCS RUNOFF CURVE NUMBER	=	88.50		
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	=	1.920	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	=	446.987	INCHES	
TOTAL INITIAL WATER	=	446.987	INCHES	
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR	

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

	CASE3OL.OUT			
STATION LATITUDE	S.	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)

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 20

			,5			
	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.15	2.02	1.05	1.42	2.41	2.71
	2.43	2.37	5.38	2.30	1.33	1.18
STD. DEVIATIONS	0.63	1.18	0.55	1.20	1.88	2.04
	2.55	1.63	3.12	1.75	1.17	0.85
RUNOFF						
Walker and Andrews	a rangran	L. wasan	-			
TOTALS	0.011	0.050	0.003	0.087	0.244	0.240
	0.339	0.160	0.690	0.141	0.062	0.015
STD. DEVIATIONS	0.035	0.066	0.005	0.209	0.469	0.303
				Page 4	1	

				ACEDOL OF	rec	
	0.752	0.173	0.842	0.224	0.191	0.052
VAPOTRANSPIRATION						
TOTALC	0.022	2 100	1 202	1,256	1.998	2.129
TOTALS	0.923 2.050	2.100 1.905	1.303 3.640	2.259	1.105	1.073
	2.030	1.505	3.040	2.233	1.105	1.075
STD. DEVIATIONS	0.556	0.908	0.712	0.934	1.314	1.388
	1.630	1.324	1.226	1.208	0.790	0.591
ATERAL DRAINAGE COLL	ECTED FROM	LAYER 4				
TOTALS	0.0699	0.0385	0.0689	0.0590	0.0458	0.068
ASSEMBLE SECTION	0.1735	0.2086	0.1176	0.4423	0.4385	0.233
STD. DEVIATIONS	0.0925	0.0574	0.1339	0.1045	0.0746	0.148
SID. DEVIATIONS	0.3121	0.4439	0.2479	0.6142	0.7449	0.421
ERCOLATION/LEAKAGE T	HROUGH LAYE	R 6				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
3101 0212112010	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	000000000000000000000000000000000000000		0.0000	0.0000	0.0000	0.000
ERCOLATION/LEAKAGE T	HROUGH LAYE	R 8				0.000
ERCOLATION/LEAKAGE T	HROUGH LAYE	R 8 0.0000	0.0000	0.0000	0.0000	0.000 0.000
ERCOLATION/LEAKAGE T	0.0000 0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.000 0.000
ERCOLATION/LEAKAGE T	0.0000 0.0000 0.0000	0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.000 0.000
TOTALS STD. DEVIATIONS 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	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.000 0.000
TOTALS STD. DEVIATIONS 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 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.000 0.000
TOTALS STD. DEVIATIONS 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 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.000 0.000
TOTALS STD. DEVIATIONS 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 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.000 0.000 0.000
TOTALS STD. DEVIATIONS AVERAGES VAILY AVERAGE HEAD ON	HROUGH LAYER 0.0000 0.0000 0.0000 OF MONTHLY	0.0000 0.0000 0.0000 0.0000 AVERAGED	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.000 0.000 0.000
TOTALS STD. DEVIATIONS AVERAGES ALLY AVERAGE HEAD ON AVERAGES	0.0000 0.0000 0.0000 0.0000 0.0000 TOP OF LAY!	0.0000 0.0000 0.0000 0.0000 AVERAGED 	0.0000 0.0000 0.0000 DAILY HEA 0.0008 0.0014	0.0000 0.0000 0.0000 0.0000 ADS (INCHI	0.0000 0.0000 0.0000 0.0000 ES)	0.000 0.000 0.000 0.000
TOTALS STD. DEVIATIONS AVERAGES VAILY AVERAGE HEAD ON	HROUGH LAYER 0.0000 0.0000 0.0000 OF MONTHLY TOP OF LAYER 0.0008	0.0000 0.0000 0.0000 0.0000 AVERAGED	0.0000 0.0000 0.0000 DAILY HEA	0.0000 0.0000 0.0000 ADS (INCH	0.0000 0.0000 0.0000 ES)	0.000 0.000 0.000 0.000 0.000
TOTALS STD. DEVIATIONS AVERAGES ALLY AVERAGE HEAD ON AVERAGES	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0008 0.0008 0.0020 0.0011 0.0036	0.0000 0.0000 0.0000 0.0000 0.0000 AVERAGED ER 5 0.0005 0.0005 0.0005	0.0000 0.0000 0.0000 0.0000 DAILY HEA 0.0008 0.0014 0.0015 0.0029	0.0000 0.0000 0.0000 0.0000 ADS (INCHI	0.0000 0.0000 0.0000 0.0000 ES) 0.0005 0.0052 0.0088	0.000 0.000 0.000 0.000 0.000 0.000
TOTALS STD. DEVIATIONS AVERAGES VAILY AVERAGE HEAD ON AVERAGES STD. DEVIATIONS	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0008 0.0008 0.0020 0.0011 0.0036	0.0000 0.0000 0.0000 0.0000 0.0000 AVERAGED ER 5 0.0005 0.0005 0.0005	0.0000 0.0000 0.0000 0.0000 DAILY HEA 0.0008 0.0014 0.0015 0.0029	0.0000 0.0000 0.0000 0.0000 ADS (INCHI	0.0000 0.0000 0.0000 0.0000 ES) 0.0005 0.0052 0.0088	0.000 0.000 0.000 0.000 0.000

AVERAGE ANNUAL TOTALS &	(STD. DEVIA	TIONS) FOR Y	EARS 1 THROU	GH 20
	INC	HES	CU. FEET	PERCENT
PRECIPITATION	25.74	(5.706)	93448.9	100.00
RUNOFF	2.043	(1.1566)	7417.81	7.938
EVAPOTRANSPIRATION	21.741	(3.6990)	78919.84	84.452

LATERAL DRAINAGE COLLECTED

FROM LAYER 4

1.96422 (1.58077)

Page 5

Part III, Attachment 5, Appendix B,15, p.g.-5

7130.124

7.62997

		E30L.OUT			
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.004	0.00000
AVERAGE HEAD ON TOP OF LAYER 5	0.002 (0.002)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.000	0.00000
CHANGE IN WATER STORAGE	-0.005	(0.5491)	-18.84	-0.020
*********	*****	***	*****	*****	*****

PEAK DAILY VALUES FOR YEARS	1 THROUGH	20
	(INCHES)	(CU. FT.)
PRECIPITATION	5.07	18404.102
RUNOFF	2.060	7476.7285
DRAINAGE COLLECTED FROM LAYER 4	0.16176	587.17737
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00006
AVERAGE HEAD ON TOP OF LAYER 5	0.057	
MAXIMUM HEAD ON TOP OF LAYER 5	0.113	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	2.4 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00000
SNOW WATER	0.00	0.0000
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.	3913
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.	1490

*** 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.

6				
*******	******	*****	******	********
	FINAL WATE	R STORAGE AT EN	O OF YEAR 20	
	LAYER	(INCHES)	(VOL/VOL)	
			Page 6	

		CASE3OL.OUT
1	1.4410	0.2402
2	298.3019	0.2907
3	7.7040	0.3210
4	0.0020	0.0100
5	0.0000	0.0000
6	0.1800	0.7500
7	9.6295	0.3210
8	129.6245	0.2919
NOW WATER	0.000	

APPENDIX B.16 HELP OUTPUT FOR ALTERNATIVE LINER INTERIM CASE 4OLLOCATION 4



CASE40L.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\MDATA\KGVPR20Y.D4
TEMPERATURE DATA FILE: C:\HELP3\MDATA\KGVTE20Y.D7
SOLAR RADIATION DATA FILE: C:\HELP3\MDATA\KGVS020Y.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\MDATA\KGVEV20Y.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\MDATA\CASE40L.D10
OUTPUT DATA FILE: C:\HELP3\MDATA\CASE40L.OUT

TIME: 14:29 DATE: 3/6/2017

TITLE: CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASE40L (LOCATION 4)

NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE

LAYER 1

COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

WDF 1 VERTICAL DEDCOLATION

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 = 0.2210 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 = 1434.00 INCHES

CASE40L.OUT

POROSITY = 0.6710 VOL/VOL = 0.2920 VOL/VOL FIELD CAPACITY WILTING POINT 0.0770 VOL/VOL INITIAL SOIL WATER CONTENT = 0.2912 VOL/VOL EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 13

24.00 INCHES THICKNESS 0.4300 VOL/VOL POROSTTY 0.3210 VOL/VOL FIELD CAPACITY 0.2210 VOL/VOL WILTING POINT = INITIAL SOIL WATER CONTENT = 0.3246 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.330000003000E-04 CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER MATERIAL TEXTURE NUMBER 20

0.20 INCHES THICKNESS = 0.8500 VOL/VOL POROSITY = FIELD CAPACITY = 0.0100 VOL/VOL 0.0050 VOL/VOL 0.0185 VOL/VOL INITIAL SOIL WATER CONTENT = EFFECTIVE SAT. HYD. COND. = 10.0000000000

CM/SEC 2.00 PERCENT SLOPE DRAINAGE LENGTH 400.0 FEET

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER

MATERIAL TEXTURE NUMBER 35

= 0.06 INCHES THICKNESS 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 1.00 FML PINHOLE DENSITY HOLES/ACRE FML INSTALLATION DEFECTS = 2.00 HOLES/ACRE

= 3 - GOOD FML PLACEMENT QUALITY

LAYER 6

TYPE 3 - BARRIER SOIL LINER MATERIAL TEXTURE NUMBER 17

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

CASE40L.OUT

WILTING POINT = 0.4000 VOL/VOL INITIAL SOIL WATER CONTENT = 0.7500 VOL/VOL

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

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 13

THICKNESS = 30.00 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 1 - VERTICAL PERCOLATION LAYER MATERIAL TEXTURE NUMBER 18

 THICKNESS
 =
 192.00
 INCHES

 POROSITY
 =
 0.6710
 VOL/VOL

 FIELD CAPACITY
 =
 0.2920
 VOL/VOL

 WILTING POINT
 =
 0.0770
 VOL/VOL

 INITIAL SOIL WATER CONTENT
 =
 0.2919
 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 3.% AND A SLOPE LENGTH OF 500. FEET.

88.00 SCS RUNOFF CURVE NUMBER FRACTION OF AREA ALLOWING RUNOFF = 80.0 PERCENT AREA PROJECTED ON HORIZONTAL PLANE = 1.000 ACRES = 12.0 INCHES EVAPORATIVE ZONE DEPTH INITIAL WATER IN EVAPORATIVE ZONE = 1.920 INCHES UPPER LIMIT OF EVAPORATIVE STORAGE = 6.606 INCHES 1.788 INCHES LOWER LIMIT OF EVAPORATIVE STORAGE = 0.000 INCHES INITIAL SNOW WATER INITIAL WATER IN LAYER MATERIALS = 492.539 INCHES = 492,539 INCHES = 0.00 INCHES TOTAL INITIAL WATER INCHES/YEAR TOTAL SUBSURFACE INFLOW

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

		CASE40L.OUT		
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 ANTIONE WITH STEED	=			
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	76.00	%	
AVERAGE 2ND QUARTER RELATIVE HUMIDITY				
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
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

AVEDACE MONTHLY	MALLIES	TM	TNCHES	FOR	VEARS	1 THROUGH	20

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC	
PRECIPITATION							
TOTALS	1.15	2.02	1.05	1.42	2.41	2.71	
	2.43	2.37	5.38	2.30	1.33	1.18	
CTD DEVITATIONS	0 62	1.18	0.55	1.20	1.88	2.04	
STD. DEVIATIONS	0.63 2.55	1.63	3.12	1.75	1.17	0.85	
RUNOFF							
TOTALS	0.010	0.044	0.002	0.080	0.229	0.222	
	0.322	0.145	0.650	0.131	0.058	0.013	
STD. DEVIATIONS	0.032	0.059	0.004	0.198	0.452	0.284	
				Page 4	1		

				ASE40L.OU	IT	
	0.721	0.160	0.809	0.208	0.182	0.047
EVAPOTRANSPIRATION						
TOTALS	0.926	2.091	1.307	1.259	2.002	2.140
TOTALS	2.063	1.908	3.649	2.262	1.101	1.080
The second of th				0.000		4 202
STD. DEVIATIONS	0.553 1.651	0.908 1.324	0.722 1.215	0.938 1.209	1.315 0.795	1.392 0.582
	1.031	1.524	1.213	1.205	0.755	0.302
LATERAL DRAINAGE COLL	ECTED FROM	LAYER 4				
TOTALS	0.0720	0.0389	0.0796	0.0588	0.0484	0.0755
	0.1785	0.2158	0.1255	0.4555	0.4591	0.2478
STD. DEVIATIONS	0.0945	0.0552	0.1549	0.1061	0.0808	0.1552
2.27	0.3193	0.4566	0.2773	0.6167	0.7573	0.4462
PERCOLATION/LEAKAGE TH	HROUGH LAYE	R 6				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE TH	HROUGH LAYE	R 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
SID. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	OF MONTHLY			2.0	ES)	
DAILY AVERAGE HEAD ON	TOP OF LAY	ER 5	8 8			
DATEL AVERAGE DEAD ON						
						0 0000
AVERAGES	0.0008	0.0005	0.0009	0.0007	0.0006	
		0.0005 0.0025	0.0009 0.0015	0.0007 0.0052	0.0006 0.0054	
	0.0008				0.0054 0.0009	0.0028
AVERAGES	0.0008 0.0020	0.0025	0.0015	0.0052	0.0054	0.0028
AVERAGES	0.0008 0.0020 0.0011 0.0036	0.0025 0.0007 0.0052	0.0015 0.0018 0.0033	0.0052 0.0012 0.0070	0.0054 0.0009 0.0089	0.0028 0.0018 0.0051
AVERAGES STD. DEVIATIONS	0.0008 0.0020 0.0011 0.0036	0.0025 0.0007 0.0052	0.0015 0.0018 0.0033	0.0052 0.0012 0.0070	0.0054 0.0009 0.0089	0.0009 0.0028 0.0018 0.0051

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 20 CU. FEET PERCENT **INCHES** 100.00 PRECIPITATION 25.74 (5.706) 93448.9 1.907 (1.1083) 7.406 RUNOFF 6921.00 **EVAPOTRANSPIRATION** 21.787 (3.6980) 79085.98 84.630

2.05532 (1.61590)

R 4 6 2

LATERAL DRAINAGE COLLECTED

FROM LAYER 4

Page 5

7460.818

7.98385

			CASE	40L.OUT	
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.004	0.00000
AVERAGE HEAD ON TOP OF LAYER 5	0.002 (0.002)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.000	0.00000
CHANGE IN WATER STORAGE	-0.005	(0.5751)	-18.88	-0.020
**********	******	***	********	********	******

	PEAK DAILY VALUES FOR YEARS	1 THROUGH	20
		(INCHES)	(CU. FT.)
F	PRECIPITATION	5.07	18404.102
F	RUNOFF	2.016	7318.0361
[DRAINAGE COLLECTED FROM LAYER 4	0.16526	599.88171
F	PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00006
ļ	AVERAGE HEAD ON TOP OF LAYER 5	0.058	
N	MAXIMUM HEAD ON TOP OF LAYER 5	0.115	
I	LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	4.6 FEET	
F	PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00000
9	SNOW WATER	0.00	0.0000
ı	MAXIMUM VEG. SOIL WATER (VOL/VOL)	e	3947
N	MINIMUM VEG. SOIL WATER (VOL/VOL)	e	.1490

*** 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 WATE	R STORAGE AT END	OF YEAR 20	
LAYER	(INCHES)	(VOL/VOL)	
		Page 6	
			LAYER (INCHES) (VOL/VOL)

		CASE40L.OL	CASE40L.OUT			
1	1.4410	0.2402				
2	417.4379	0.2911				
3	7.7040	0.3210				
4	0.0020	0.0100				
5	0.0000	0.0000				
6	0.1800	0.7500				
7	9.6289	0.3210				
8	56.0412	0.2919				
SNOW WATER	0.000					

APPENDIX B.17 HELP OUTPUT FOR ALTERNATIVE LINER CLOSED CASE 5OL-LOCATION 1



CASE5OL.OUT

A		
*****	**********************	******
******	*****************	******
**		**
**		**
**	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\MDATA\KGVPR30Y.D4
TEMPERATURE DATA FILE: C:\HELP3\MDATA\KGVPR30Y.D7
SOLAR RADIATION DATA FILE: C:\HELP3\MDATA\KGVS030Y.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\MDATA\KGVEV30Y.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\MDATA\CASE5OL.D10
OUTPUT DATA FILE: C:\HELP3\MDATA\CASE5OL.OUT

TIME: 16: 7 DATE: 3/ 6/2017

NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE

LAYER 1

COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

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 = 0.2719 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

CASE5OL.OUT

 POROSITY
 =
 0.8500 VOL/VOL

 FIELD CAPACITY
 =
 0.0100 VOL/VOL

 WILTING POINT
 =
 0.0050 VOL/VOL

 INITIAL SOIL WATER CONTENT
 =
 0.0100 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 10.0000000000 CM/SEC

SLOPE = 2.00 PERCENT DRAINAGE LENGTH = 250.0 FEET

LAYER 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. = 0.39999993000E-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 = 144.00 INCHES
POROSITY = 0.6710 VOL/VOL
FIELD CAPACITY = 0.2920 VOL/VOL
Page 2

CASESOL.OUT

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

= 24.00 INCHES THICKNESS 0.4300 VOL/VOL **POROSITY**

EFFECTIVE SAT. HYD. COND. = 0.330000003000E-04 CM/SEC

LAYER 8

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 20

= 0.20 INCHES **THICKNESS** 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 0.8500 VOL/VOL

CM/SEC

2.00 PERCENT 250.0 FEET DRAINAGE LENGTH

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

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

CASE5OL.OUT EFFECTIVE SAT. HYD. COND. = 0.300000003000E-08 CM/SEC

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 13

THICKNESS = 30.00 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 12

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 18

THICKNESS = 186.00 INCHES

POROSITY = 0.6710 VOL/VOL

FIELD CAPACITY = 0.2920 VOL/VOL

WILTING POINT = 0.0770 VOL/VOL

INITIAL SOIL WATER CONTENT = 0.2919 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 25.% AND A SLOPE LENGTH OF 100. FEET.

SCS RUNOFF CURVE NUMBER = 85.60

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 = 2.674 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 = 124.412 INCHES
TOTAL INITIAL WATER = 124.412 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

Page 4

Revision: 0

CASE50L.OUT

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 = 76.00 %
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)

JUC/NAC	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 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	0.007	0.022	0.005	0.051	0.188	0.174
	0.342	0.218	0.608	0.191	0.067	0.007
STD. DEVIATIONS	0.022	0.041	0.026	0.171	0.500	0.243
	0.789	0.366	0.822	0.318	0.265	0.028

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Part III, Attachment 5, Appendix B,17, p.g.-5

EVAPOTRANSPIRATION			(CASE5OL.OL	JT	
EVAPOTRANSPIRATION						
TOTALS	1.093 1.754	1.768 2.186	1.331 3.474	1.252 2.435	1.966 1.312	2.071 1.107
STD. DEVIATIONS	0.665 1.256	0.864 1.504	0.621 1.237	0.803 1.136	1.191 0.899	1.228 0.681
LATERAL DRAINAGE COLL	ECTED FROM	LAYER 2				
TOTALC	0.0698	0.2237	0.1155	0.0457	0.1805	0.3327
TOTALS	0.3318	0.3490	0.8839	0.7081	0.2403	0.0780
STD. DEVIATIONS	0.1315 0.5455	0.2604 0.5857	0.1270 0.9977	0.1234 0.7204	0.2785 0.3203	0.4691 0.1153
PERCOLATION/LEAKAGE TI	HROUGH LAYE	R 4				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	0.0000
LATERAL DRAINAGE COLL	ECTED FROM	LAYER 8				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
IOIALS	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
PERCOLATION/LEAKAGE T	HROUGH LAYE	R 10				
TOTALE	0 0000	0 0000	0.0000	0.0000	0.0000	0.000
TOTALS	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
PERCOLATION/LEAKAGE T	HROUGH LAYE	R 12				
TOTALC	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	OF MONTHLY					
· Table of J. 14 A.						
DAILY AVERAGE HEAD ON	TOP OF LAY	ER 3				
AVERAGES	a aaas	0.0017	0.0008	0.0003	0.0013	0.013
AVERAGES	0.0206	0.0177	0.1061		0.0018	0.000
STD. DEVIATIONS		0.0020 0.0537	0.0009 0.2641	0.0009 0.0529	0.0020 0.0024	0.041
DAILY AVERAGE HEAD ON	TOP OF LAY	ER 9				
AVEDAGEC	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
				Page 6		

CESOI	

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	6.6666
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	INC	HES		CU. FEET	PERCENT
PRECIPITATION	27.20	(5.704)	98722.7	100.00
RUNOFF	1.880	(1.2157)	6825.49	6.914
EVAPOTRANSPIRATION	21.749	(3.7373)	78947.65	79.969
LATERAL DRAINAGE COLLECTED FROM LAYER 2	3.55912	(1.91851)	12919.604	13.08676
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00001	(0.00001)	0.023	0.00002
AVERAGE HEAD ON TOP OF LAYER 3	0.016 (0.026)		
LATERAL DRAINAGE COLLECTED FROM LAYER 8	0.00001	(0.00001)	0.022	0.00002
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.001	0.00000
AVERAGE HEAD ON TOP OF LAYER 9	0.000 (0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 12	0.00000	(0.00000)	0.000	0.0000
CHANGE IN WATER STORAGE	0.008	(0.4489)	29.91	0.030

PEAK DAILY VALUES FOR YEARS	1 THROUGH	30
	(INCHES)	(CU. FT.)
PRECIPITATION	5.07	18404.102
RUNOFF	2.585	9382.1035
DRAINAGE COLLECTED FROM LAYER 2	0.91251	3312.41650
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000012	0.04380
AVERAGE HEAD ON TOP OF LAYER 3	14.568	
MAXIMUM HEAD ON TOP OF LAYER 3	18.997	
LOCATION OF MAXIMUM HEAD IN LAYER 2		
(DISTANCE FROM DRAIN)	87.9 FEET	
	Page	7

CASI	 0.00	MIT.

DRAINAGE COLLECTED FROM LAYER 8	0.00001	0.03665
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	
PERCOLATION/LEAKAGE THROUGH LAYER 12	0.000000	0.00000
SNOW WATER	0.02	73.7433
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4285	7.
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.2210) and

*** 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.

TTRIAL	LIATED	CTODACE	AT	CILIA	OF	VE AD	20
FINAL	WAIFR	STORAGE	AI	EMD	UF	YEAR	30

LAYER	(INCHES)	(VOL/VOL)
1	6.7730	0.2822
2	0.0020	0.0100
3	0.0000	0.0000
4	0.1800	0.7500
5	3.8520	0.3210
6	42.0480	0.2920
7	7.7040	0.3210
8	0.0020	0.0100
9	0.0000	0.0000
10	0.1800	0.7500
11	9.6289	0.3210
12	54.2892	0.2919
SNOW WATER	0.000	

		CASESOL.OUT
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*****	*******	**************

APPENDIX B.18 HELP OUTPUT FOR ALTERNATIVE LINER CLOSED CASE 6OL-LOCATION 2



CASEGOL.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\MDATA\KGVPR30Y.D4
TEMPERATURE DATA FILE: C:\HELP3\MDATA\KGVPR30Y.D7
SOLAR RADIATION DATA FILE: C:\HELP3\MDATA\KGVS030Y.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\MDATA\KGVEV30Y.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\MDATA\CASE6OL.D10
OUTPUT DATA FILE: C:\HELP3\MDATA\CASE6OL.OUT

TIME: 16:16 DATE: 3/ 6/2017

TITLE: CITY OF KINGSVILLE SOLID WASTE LANDFILL-CASEGOL (LOCATION 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 = 24.00 INCHES

POROSITY = 0.4300 VOL/VOL

FIELD CAPACITY = 0.3210 VOL/VOL

WILTING POINT = 0.2210 VOL/VOL

INITIAL SOIL WATER CONTENT = 0.2722 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.33000003000E-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

CASEGOL.OUT

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. = 10.000000000000 SLOPE = 2.00 PERC CM/SEC

2.00 PERCENT = 250.0 FEET DRAINAGE LENGTH

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

0.24 INCHES **THICKNESS** 0.7500 VOL/VOL POROSITY 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

= 12.00 INCHES THICKNESS 0.4300 VOL/VOL

 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

 POROSITY

EFFECTIVE SAT. HYD. COND. = 0.330000003000E-04 CM/SEC

LAYER 6 -----

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 18

990.00 INCHES THICKNESS = POROSITY = 0.6710 VOL/VOL 0.2920 VOL/VOL FIELD CAPACITY Page 2

Part III, Attachment 5, Appendix B,18, p.g.-2

Part III

CASEGOL.OUT

0.0770 VOL/VOL WILTING POINT 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

24.00 INCHES **THICKNESS** 0.4300 VOL/VOL POROSITY FIELD CAPACITY 0.3210 VOL/VOL INITIAL SOIL WATER CONTENT = 0.3210 VOL/VOL

EFFECTIVE SAT HVD COND

EFFECTIVE SAT. HYD. COND. = 0.330000003000E-04 CM/SEC

LAYER 8

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 20

0.20 INCHES THICKNESS POROSITY = 0.8500 VOL/VOL 0.0100 VOL/VOL FIELD CAPACITY WILTING POINT 0.0050 VOL/VOL INITIAL SOIL WATER CONTENT = 0.0100 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 10.0000000000 CM/SEC

SLOPE = 2.00 PERCENT DRAINAGE LENGTH 250.0 FEET

LAYER 9

TYPE 4 - FLEXIBLE MEMBRANE LINER

MATERIAL TEXTURE NUMBER 35

0.06 INCHES THICKNESS = 0.0000 VOL/VOL POROSITY 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 = 0.7500 VOL/VOL POROSITY · I FIELD CAPACITY 0.7470 VOL/VOL WILTING POINT 0.4000 VOL/VOL INITIAL SOIL WATER CONTENT = 0.7500 VOL/VOL

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

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 13

THICKNESS = 30.00 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 12

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 18

THICKNESS = 408.00 INCHES
POROSITY = 0.6710 VOL/VOL
FIELD CAPACITY = 0.2920 VOL/VOL
WILTING POINT = 0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2919 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 25.%

AND A SLOPE LENGTH OF 356. FEET.

SCS RUNOFF CURVE NUMBER	=	84.60	
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	=	2.681	INCHES
	=	5.160	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.652	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	436.275	INCHES
TOTAL INITIAL WATER	=	436.275	INCHES
TOTAL SUBSURFACE THELOW	=	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
Page 4

CASEGOL.OUT

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
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

	JUC/NAC	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	0.004	0.047	0.171	0.149	
TOTALS						0.005	
	0.327	0.193	0.573	0.168	0.066	0.005	
STD. DEVIATIONS	0.018	0.033	0.020	0.170	0.498	0.215	
	0.772	0.343	0.823	0.315	0.283	0.021	

CLAR DOTE AMERICA TRANS				ASE60L.OU	<i>3</i> 1	
EVAPOTRANSPIRATION						
TOTALS	1.096 1.756	1.761 2.192	1.331 3.492	1.252 2.429	1.971 1.316	2.085 1.104
STD. DEVIATIONS	0.662 1.251	0.861 1.505	0.620 1.239	0.803 1.134	1.183 0.905	1.235 0.683
LATERAL DRAINAGE COLLE	CTED FROM	LAYER 2				
TOTALS	0.0775 0.3452	0.2338 0.3639	0.1173 0.9017	0.0485 0.7403	0.1907 0.2420	0.3438 0.076
STD. DEVIATIONS	0.1419 0.5558	0.2767 0.6168	0.1258 1.0007	0.1298 0.7614	0.2881 0.3121	0.485 0.105
PERCOLATION/LEAKAGE TH	ROUGH LAYE	R 4				
TOTALS	0.0000	0.0000	0.0000	0.0000 0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.000
LATERAL DRAINAGE COLLE	DEPLOYED NORMANDO	LAYER 8				
TOTALS	0.0000	0.0000	0.0000	0.0000 0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.000
PERCOLATION/LEAKAGE TH	ROUGH LAYE	R 10				
TOTALS	0.0000 0.0000	0.0000	0.0000 0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000	0.0000	0.0000 0.0000	0.0000	0.0000	0.000
PERCOLATION/LEAKAGE TH	IROUGH LAYE	R 12				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000 0.0000	0.0000	0.0000 0.0000	0.0000	0.0000	0.000
AVERAGES	OF MONTHLY		DAILY HE	ADS (INCH	ES) 	
DAILY AVERAGE HEAD ON	TOP OF LAY	ER 3				
AVERAGES	0.0006 0.0205	0.0018 0.0202	0.0008 0.1047	0.0004 0.0279		0.016
STD. DEVIATIONS		0.0022 0.0598		0.0010 0.0609		
DAILY AVERAGE HEAD ON	TOP OF LAY	ER 9				
AVERAGES		0.0000 0.0000	0.0000 0.0000	0.0000	0.0000	0.000
				Page 6		

Part III, Attachment 5, Appendix B,18, p.g.-6

CASEGOL.OUT

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

				CU. FEET	PERCENT
PRECIPITATION			5.704)	98722.7	100.00
RUNOFF	1.723	(1.2076)	6253.77	6.335
EVAPOTRANSPIRATION	21.785	(3.7320)	79078.27	80.101
LATERAL DRAINAGE COLLECTED FROM LAYER 2	3.68090	(1.95906)	13361.677	13.53456
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00001	(0.00001)	0.024	0.00002
AVERAGE HEAD ON TOP OF LAYER 3	0.016 (0.026)		
LATERAL DRAINAGE COLLECTED FROM LAYER 8	0.00001	(0.00001)	0.023	0.00002
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.002	0.00000
AVERAGE HEAD ON TOP OF LAYER 9	0.000 (0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 12	0.00000	(0.00000)	0.000	0.00000
CHANGE IN WATER STORAGE	0.008	(0.4598)	28.94	0.029

PEAK DAILY VALUES FOR YEARS	1 THROUGH	30
***************************************	(INCHES)	(CU. FT.)
PRECIPITATION	5.07	18404.102
RUNOFF	2.585	9382.1035
DRAINAGE COLLECTED FROM LAYER 2	0.91340	3315.63574
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000012	0.04489
AVERAGE HEAD ON TOP OF LAYER 3	14.828	
MAXIMUM HEAD ON TOP OF LAYER 3	19.279	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	88.6 FEET	
	Page	7

CAS		

DRAINAGE COLLECTED FROM LAYER 8	0.00001	0.03755
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	0.006	
LOCATION OF MAXIMUM HEAD IN LAYER 8 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 12	0.000000	0.00000
SNOW WATER	0.02	73.7433
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4270	
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.

	LAYER	(INCHES)	(VOL/VOL)	
	1	6.7725	0.2822	
	2	0.0020	0.0100	
	3	0.0000	0.0000	
	4	0.1800	0.7500	
The second	5	3.8520	0.3210	
	6	289.0800	0.2920	
	7	7.7040	0.3210	
	8	0.0020	0.0100	
	9	0.0000	0.0000	
	10	0.1800	0.7500	
	11	9.6295	0.3210	
	12	119.1125	0.2919	

	CASEBUL.001
*******	*************
*********	***************

APPENDIX B.19 HELP OUTPUT FOR ALTERNATIVE LINER CLOSED CASE 7OL-LOCATION 3



CASE7OL.OUT

PRECIPITATION DATA FILE: C:\HELP3\MDATA\KGVPR30Y.D4
TEMPERATURE DATA FILE: C:\HELP3\MDATA\KGVPR30Y.D7
SOLAR RADIATION DATA FILE: C:\HELP3\MDATA\KGVSO30Y.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\MDATA\KGVEV30Y.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\MDATA\CASE7OL.D10
OUTPUT DATA FILE: C:\HELP3\MDATA\CASE7OL.OUT

TIME: 16:25 DATE: 3/ 6/2017

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

CASE7OL.OUT

POROSITY = 0.8500 VOL/VOL
FIELD CAPACITY = 0.0100 VOL/VOL
WILTING POINT = 0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0100 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 10.0000000000 CM/SEC

SLOPE 2.00 PERCENT DRAINAGE LENGTH 250.0 FEET

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER MATERIAL TEXTURE NUMBER 36

= 0.04 INCHES THICKNESS 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. = 0.39999993000E-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

= 12.00 INCHES THICKNESS 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

= 1026.00 INCHES THICKNESS 0.6710 VOL/VOL POROSITY = 0.2920 VOL/VOL FIELD CAPACITY

CASE70L.OUT

0.0770 VOL/VOL WILTING POINT 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 0.3210 VOL/VOL FIELD CAPACITY 0.2210 VOL/VOL WILTING POINT 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

0.20 INCHES THICKNESS = 0.8500 VOL/VOL POROSITY 0.0100 VOL/VOL = ' FIELD CAPACITY WILTING POINT 0.0050 VOL/VOL INITIAL SOIL WATER CONTENT = 0.0100 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 10.0000000000 CM/SEC

SLOPE 2.00 PERCENT DRAINAGE LENGTH 250.0 FEET

LAYER 9

TYPE 4 - FLEXIBLE MEMBRANE LINER MATERIAL TEXTURE NUMBER 35

THICKNESS 0.06 INCHES = 0.0000 VOL/VOL POROSITY = 0.0000 VOL/VOL = 0.0000 VOL/VOL FIELD CAPACITY WILTING POINT INITIAL SOIL WATER CONTENT = 0.0000 VOL/VOL EFFECTIVE SAT. HYD. COND. = 0.199999996000E-12 CM/SEC FML PINHOLE DENSITY = FML INSTALLATION DEFECTS = = 1.00 HOLES/ACRE

= 3 - GOOD FML PLACEMENT QUALITY

LAYER 10

2.00

TYPE 3 - BARRIER SOIL LINER MATERIAL TEXTURE NUMBER 17

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

Page 3

HOLES/ACRE

CASE70L.OUT

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

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 13

THICKNESS = 30.00 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 12

TYPE 1 - VERTICAL PERCOLATION LAYER MATERIAL TEXTURE NUMBER 18

= 444.00 INCHES = 0.6710 VOL/VOI THICKNESS POROSITY = 0.6710 VOL/VOL
FIELD CAPACITY = 0.2920 VOL/VOL
WILTING POINT = 0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2919 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A

GOOD STAND OF GRASS, A SURFACE SLOPE OF 3.%

AND A SLOPE LENGTH OF 220. 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 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 SNOW WATER = 0.000 INCHES
INITIAL WATER IN LAYER MATERIALS = 457.386 INCHES
TOTAL INITIAL WATER = 457.386 INCHES
TOTAL SUBSURFACE INFLOW = 0.00 INCHES/ 0.00 INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM

CORPUS CHRISTI TEXAS

= 27.77 DEGREES STATION LATITUDE

MAXIMUM LEAF AREA INDEX = 3.50

CASE7OL.OUT

START OF GROWING SEASON (JULIAN DATE)			
END OF GROWING SEASON (JULIAN DATE)	=	367	
			INCHES
AVERAGE ANNUAL WIND SPEED	=	12.00	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY			
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
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	0.044	0.164	0.137	
	0.325	0.178	0.562	0.159	0.064	0.004	
STD. DEVIATIONS	0.016	0.029	0.018	0.166	0.498	0.200	
	0.770	0.331	0.824	0.315	0.281	0.018	

EVAPOTRANSPIRATION			(CASE7OL.OL	JT	
TOTALS	1.095 1.754	1.769 2.181	1.332 3.481	1.252 2.435	1.978 1.313	2.082
STD. DEVIATIONS	0.663 1.244	0.860 1.501	0.624 1.235	0.803 1.138	1.187 0.902	1.231 0.681
LATERAL DRAINAGE COLL	ECTED FROM	LAYER 2				
TOTALS	0.0767	0.2331	0.1179	0.0493	0.1925	0.3537
TOTALS	0.3548	0.3828	0.9254	0.7490	0.2449	0.0806
STD. DEVIATIONS	0.1439 0.5774	0.2713 0.6301	0.1269 1.0117	0.1333 0.7734	0.2928 0.3251	0.4967 0.1272
PERCOLATION/LEAKAGE T	HROUGH LAYE	R 4				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
IOTALS	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
LATERAL DRAINAGE COLL	ECTED FROM	LAYER 8				
			0.0000	0.0000	0.0000	0 0000
TOTALS	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	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
PERCOLATION/LEAKAGE T	HROUGH LAYE	R 10				
TOTALS	0.0000	0.0000	0.0000		0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
PERCOLATION/LEAKAGE T	HROUGH LAYE	R 12				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
CONTENT COGNICATION ONLY CARTEST TRAIN	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
AVERAGES	OF MONTHLY	AVERAGED	DAILY HE	ADS (INCH	ES)	
	* -					
DAILY AVERAGE HEAD ON	TOP OF LAY	ER 3				
AVERAGES	0.0005	0.0018	0.0008	0.0004	0.0014	0.018
	0.0223	0.0241	0.1085	0.0318	0.0018	0.000
STD. DEVIATIONS	0.0010		0.0009	0.0010	0.0021	0.062
	0.1021	0.0699	0.2572	0.0681	0.0024	0.000
DAILY AVERAGE HEAD ON	TOP OF LAY	ER 9				
AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
				Page 6		
				01		

CASE70L.OUT

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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				CU. FEET	PERCENT	
PRECIPITATION				98722.7	100.00	
RUNOFF	1.657	(1.2106)	6015.83	6.094	
EVAPOTRANSPIRATION	21.773	(3.7354)	79036.62	80.059	
LATERAL DRAINAGE COLLECTED FROM LAYER 2	3.76085	(1.98336)	13651.874	13.82851	
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00001	(0.00001)	0.025	0.00003	
AVERAGE HEAD ON TOP OF LAYER 3	0.018 (0.026)			
LATERAL DRAINAGE COLLECTED FROM LAYER 8	0.00001	(0.00001)	0.024	0.00002	
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.002	0.0000	
AVERAGE HEAD ON TOP OF LAYER 9	0.000 (0.000)			
PERCOLATION/LEAKAGE THROUGH LAYER 12	0.00000	(0.00000)	0.000	0.0000	
CHANGE IN WATER STORAGE	0.005	(0.4439)	18.34	0.019	

		(INCHES)	(CU. FT.)
PRECIPITATION		5.07	18404.102
RUNOFF		2.585	9382.1035
DRAINAGE COLLECTED FROM LAYER 2		0.91351	3316.05835
PERCOLATION/LEAKAGE THROUGH LAYE	R 4	0.000012	0.04505
AVERAGE HEAD ON TOP OF LAYER 3		14.866	
MAXIMUM HEAD ON TOP OF LAYER 3		19.319	
LOCATION OF MAXIMUM HEAD IN LAYE	R 2		

CASE 70	

DRAINAGE COLLECTED FROM LAYER 8	0.00001 0.03769
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	0.006
LOCATION OF MAXIMUM HEAD IN LAYER 8 (DISTANCE FROM DRAIN)	0.0 FEET
PERCOLATION/LEAKAGE THROUGH LAYER 12	0.000000 0.000000
SNOW WATER	0.02 73.7433
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4264
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.

ETMAI	MATER	STORAGE	ΔT	FND	OF	VFAR	30

 LAYER	(INCHES)	(VOL/VOL)	
	5		
1	6.7715	0.2821	
2	0.0020	0.0100	
3	0.0000	0.0000	
4	0.1800	0.7500	
5	3.8520	0.3210	
6	299.5920	0.2920	
7	7.7040	0.3210	
8	0.0020	0.0100	
9	0.0000	0.0000	
10	0.1800	0.7500	
11	9.6295	0.3210	
12	129.6245	0.2919	
SNOW WATER	0.000		
		Dage	. 0

Page 8

Revision: 0

	CASE/01.001
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APPENDIX B.20 HELP OUTPUT FOR ALTERNATIVE LINER CLOSED CASE 8OL-LOCATION 4



CASE8OL.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	**
**		**
**		**
****	*********************	******
****	*********************	*****

C:\HELP3\MDATA\KGVPR30Y.D4 PRECIPITATION DATA FILE: TEMPERATURE DATA FILE: C:\HELP3\MDATA\KGVTE30Y.D7 SOLAR RADIATION DATA FILE: C:\HELP3\MDATA\KGVSO30Y.D13 C:\HELP3\MDATA\KGVEV30Y.D11 EVAPOTRANSPIRATION DATA: SOIL AND DESIGN DATA FILE: C:\HELP3\MDATA\CASE80L.D10 OUTPUT DATA FILE: C:\HELP3\MDATA\CASE80L.OUT

TIME: 16:36 DATE: 3/6/2017

TITLE: ITY OF KINGSVILLE SOLID WASTE LANDFILL-CASESOL (LOCATION 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

24.00 INCHES THICKNESS POROSITY 0.4300 VOL/VOL 0.3210 VOL/VOL FIELD CAPACITY WILTING POINT 0.2210 VOL/VOL 0.2757 VOL/VOL INITIAL SOIL WATER CONTENT =

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

CASE8OL.OUT

POROSITY = 0.8500 VOL/VOL

FIELD CAPACITY = 0.0100 VOL/VOL

WILTING POINT = 0.0050 VOL/VOL

INITIAL SOIL WATER CONTENT = 0.0100 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 10.0000000000 CM/SEC

SLOPE = 2.00 PERCENT DRAINAGE LENGTH = 250.0 FEET

LAYER 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 = 1434.00 INCHES
POROSITY = 0.6710 VOL/VOL
FIELD CAPACITY = 0.2920 VOL/VOL
Page 2

CASE80L.OUT

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 = 0.20 INCHES
POROSITY = 0.8500 VOL/VOL
FIELD CAPACITY = 0.0100 VOL/VOL
WILTING POINT = 0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0100 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 10.0000000000 CM/SEC

SLOPE = 2.00 PERCENT DRAINAGE LENGTH = 250.0 FEET

LAYER 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
FEEECTIVE SAT HYD COND = 0.19999996000E-12

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

CASE8OL.OUT EFFECTIVE SAT. HYD. COND. = 0.300000003000E-08 CM/SEC

LAYER 11 ------

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 13 = 30.00 INCHES THICKNESS 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 12

TYPE 1 - VERTICAL PERCOLATION LAYER MATERIAL TEXTURE NUMBER 18

= 192.00 INCHES THICKNESS POROSITY = 0.6710 VOL/VOL
FIELD CAPACITY = 0.2920 VOL/VOL
WILTING POINT = 0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2919 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #13 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 3.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	83.40	
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	=	2.765	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	=	502.935	INCHES
TOTAL INITIAL WATER	=	502.935	INCHES
TOTAL SUBSURFACE THELOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA ______

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CORPUS CHRISTI TEXAS

= 27.77 DEGREES STATION LATITUDE MAXIMUM LEAF AREA INDEX = 3.50 Page 4

CASE80L.OUT

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 = 76.00 %
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
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	0.003	0.010	0.003	0.042	0.156	0.122
70	0.316	0.163	0.535	0.147	0.061	0.003
STD. DEVIATIONS	0.013	0.024	0.015	0.164	0.497	0.184
	0.758	0.318	0.809	0.320	0.279	0.014

EVAPOTRANSPIRATION			C	ASE80L.OL	JΤ	
TOTALS	1.098 1.756	1.771 2.189	1.335 3.487	1.250 2.438	1.982 1.317	2.083 1.099
STD. DEVIATIONS	0.661 1.255	0.863 1.518	0.626 1.230	0.802 1.138	1.189 0.905	1.239 0.685
LATERAL DRAINAGE COLL	ECTED FROM	LAYER 2				
		0.2224	0 1160	0 0533	0 1055	0.3680
TOTALS	0.0759	0.2321 0.3858	0.1168 0.9507	0.0532 0.7510	0.1955 0.2525	0.0787
STD. DEVIATIONS	0.1410 0.5970	0.2677 0.6265	0.1258 1.0470	0.1423 0.7857	0.2933 0.3241	0.5138 0.1151
PERCOLATION/LEAKAGE TH	ROUGH LAYE	R 4				
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
TOTALS	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 COLL	ECTED 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 T	HROUGH LAYE	R 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
PERCOLATION/LEAKAGE T	HROUGH LAYE	R 12				
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
	3.0000	_,,,,,,,			-	
	OF MONTHLY				ES) 	
DAILY AVERAGE HEAD ON	TOP OF LAY	ER 3				
AVERAGES		0.0018		0.0004		0.0187
	0.0273	0.0201	0.1213	0.0321	0.0019	0.0006
STD. DEVIATIONS					0.0021	0.0583
	0.1291	0.0571	0.2670	0.0798	0.0024	0.0008
DAILY AVERAGE HEAD ON	TOP OF LAY	ER 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
				D		

CASEROL OUT

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

				CU. FEET	
PRECIPITATION					
RUNOFF	1.562	(1.2013)	5669.92	5.743
EVAPOTRANSPIRATION	21.805	(3.7516)	79151.28	80.175
LATERAL DRAINAGE COLLECTED FROM LAYER 2	3.82437	(2.05115)	13882.466	14.06208
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00001	(0.00001)	0.027	0.00003
AVERAGE HEAD ON TOP OF LAYER 3	0.019 (0.029)		
LATERAL DRAINAGE COLLECTED FROM LAYER 8	0.00001	(0.00001)	0.025	0.00003
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.002	0.00000
AVERAGE HEAD ON TOP OF LAYER 9	0.000 (0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 12	0.00000	(0.00000)	0.000	0.00006
CHANGE IN WATER STORAGE	0.005	(0.4494)	19.00	0.019

(INCHES)	(CU. FT.)
5.07	18404.102
2.585	9382.1035
0.91331	3315.29883
0.000012	0.04488
14.828	
19.277	
88.6 FEET	
	2.585 0.91331 0.000012 14.828 19.277

	-	_	-	40	G 300	-	-	
CA			w	101	k(1)	rν		

DRAINAGE COLLECTED FROM LAYER 8	0.00001	0.03850
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	0.006	
LOCATION OF MAXIMUM HEAD IN LAYER 8 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 12	0.000000	0.00000
SNOW WATER	0.02	73.7433
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4265	
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 EN	D OF YEAR 30	
 LAYER	(INCHES)	(VOL/VOL)	
1	6.7738	0.2822	
2	0.0020	0.0100	
3	0.0000	0.0000	
4	0.1800	0.7500	
5	3.8520	0.3210	
6	418.7280	0.2920	
7	7.7040	0.3210	
8	0.0020	0.0100	
9	0.0000	0.0000	
10	0.1800	0.7500	
11	9.6289	0.3210	
12	56.0412	0.2919	
SNOW WATER	0.000		

		CASE80L.OUT		
******	********	********	******	******
******	******	********	**********	******

APPENDIX C MULTIMED MODEL ANALYSIS



APPENDIX C.1 CONTENTS



CONTENTS

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MULTIMED Aquifer-Specific Data	Appendix C.6
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Calculations of the Dilution Attenuation Factor	Appendix D
Leachate Data	Appendix E
MULTIMED Model Output	Appendix F



APPENDIX C.2 MULTIMED CHEMICAL-SPECIFIC DATA



MULTIMED CHEMICAL - SPECIFIC DATA

Variable Name	Units	Value	Comments	
Solid phase decay coefficient	1/yr	0	decay not used	
Dissolved phase decay coefficient	1/yr	0	decay not used	
Chemical decay coefficient	1/yr	0	decay not used	
Acid catalyst hydrolysis constant	1/m-yr	0	hydrolysis not used	
Neutral hydrolysis rate constant	1/yr	0	hydrolysis not used	
Base catalyst hydrolysis constant	1/m-yr	0	hydrolysis not used	
Reference temperature	degrees C	20	not used in model since decay not used	
Normalized distribution coefficient	ml/g	0	O because simulation is steady state, with no chemical decay	
Distribution coefficient	ml/g		derived by MULTIMED from normalized distribution coefficient	
Biodegradation coefficient	1/yr	0	biodegradation not allowed by TCEQ	

APPENDIX C.3 MULTIMED SOURCE-SPECIFIC DATA



MULTIMED SOURCE - SPECIFIC DATA

Variable Name	Units	Value	Comments
Infiltration rate	m/yr	varies	See table below.
Area of waste disposal unit	m ²	485,623	120 acres
Spread of contaminant source	m	0	Derived by MULTIMED
Recharge rate	m/yr	0.0368	Five percent of average annual precipitation (1.45 inches/yr)
Initial concentration at landfill (C ₀)	mg/L	1.0	Set at 1.0 to find DAF
Length scale of facility	m		Derived by MULTIMED
Width scale of facility	m		Derived by MULTIMED

Case Infiltration Comments				
	Comments			
nace (m, y, y				
*4.20 40-7	Calculated using peak daily percolation/			
*1.28 X 10	leakage rate through GCL. See Appx. B.2			
_	Calculated using peak daily percolation/			
1.79 x 10 ⁻⁷	leakage rate through GCL. See Appx. B.2			
	Calculated using peak daily percolation/			
1.79 x 10 ⁻⁷	leakage rate through GCL. See Appx. B.2			
_	Calculated using peak daily percolation/			
1.79 x 10 ⁻⁷	leakage rate through GCL. See Appx. B.2			
	Calculated using peak daily percolation/			
5.11 x 10 ⁻⁸	leakage rate through GCL. See Appx. B.2			
۰	Calculated using peak daily percolation/			
5.11 x 10 ⁻⁸	leakage rate through GCL. See Appx. B.2			
	Calculated using peak daily percolation/			
5.11 x 10 ⁻⁸	leakage rate through GCL. See Appx. B.2			
	Calculated using peak daily percolation/			
5.11 x 10 ⁻⁸	leakage rate through GCL. See Appx. B.2			
	5.11 x 10 ⁻⁸ 5.11 x 10 ⁻⁸			

^{*} Determined Using Peak Daily Percolation/Leakage Rate Through GCL and Converted to (M/YR) Example: $((.00005 \, \text{FT}^3/\text{Day-Acre})x(1 \, \text{Acre}/43,560 \, \text{FT}^2)/(1 \, \text{Meter}/3.28 \, \text{FT})) \times (365 \, \text{Days}/1 \, \text{YR}) = 1.28 \times 10^{-7} \, \text{M/YR}$

Hanson Professional Services Inc. Submittal Date: September 2018 Revision: 0

APPENDIX C.4 MULTIMED SOURCE-SPECIFIC DATA-OVERLINER DEMONSTRATION



MULTIMED SOURCE - SPECIFIC DATA

Overliner Demonstration

Variable Name	Units	Value	Comments
Infiltration rate	m/yr	varies	See table below.
Area of waste disposal unit	m ²	485,623	120 acres
Spread of contaminant source	m	0	Derived by MULTIMED
Recharge rate	m/yr	0.0368	Five percent of average annual precipitation (1.45 inches/yr)
Initial concentration at landfill (C ₀)	mg/L	1.0	Set at 1.0 to find DAF
Length scale of facility	m		Derived by MULTIMED
Width scale of facility	m		Derived by MULTIMED

Case Infiltration Comments				
Case	Rate (m/yr)	Comments		
Interim Cases with Overliner	nate (m, yr,			
Location 1 (Case 1OL)				
• 12 feet of waste above liner				
• 15.5 feet of waste below liner		Calculated using peak daily percolation/		
20 yr	*1.79 x 10 ⁻⁷	leakage rate through GCL. See Appx. B.12		
Location 2 (Case 2OL)				
82.5 feet of waste above liner				
34 feet of waste below liner	_	Calculated using peak daily percolation/		
20 yr	1.53 x 10 ⁻⁷	leakage rate through GCL. See Appx. B.12		
Location 3 (Case 3OL)				
• 85.5 feet of waste above liner				
37 feet of waste above liner		Calculated using peak daily percolation/		
20 yr	1.53 x 10 ⁻⁷	leakage rate through GCL. See Appx. B.12		
20 7.	2.55 X 25	leanage rate through decide 7,ppx. B.12		
Location 4 (Case 4OL)				
• 119.5 feet of waste above liner				
16 feet of waste above liner		Calculated using peak daily percolation/		
20 yr	1.53 x 10 ⁻⁷	leakage rate through GCL. See Appx. B.12		
Closed cases with Overliner				
Location 1 (Case 5OL)				
• 12 feet of waste above liner				
15.5 feet of waste below liner		Calculated using peak daily percolation/		
30 yr	5.11 x 10 ⁻⁸	leakage rate through GCL. See Appx. B.12		
,				
Location 2 (Case 6OL)				
82.5 feet of waste above liner				
34 feet of waste below liner		Calculated using peak daily percolation/		
30 yr	5.11 x 10 ⁻⁸	leakage rate through GCL. See Appx. B.12		
Location 3 (Case 7OL)				
85.5 feet of waste above liner				
• 37 feet of waste above liner		Calculated using peak daily percolation/		
30 yr	5.11 x 10 ⁻⁸	leakage rate through GCL. See Appx. B.12		
30 yi	J.11 X 10	leakage rate tillough OCL. See Appx. B.12		
Location 4 (Case 8OL)				
• 119.5 feet of waste above liner				
16 feet of waste below liner		Calculated using peak daily percolation/		
30 yr	5.11 x 10 ⁻⁸	leakage rate through GCL. See Appx. B.12		
	1	1		

^{*} Determined Using Peak Daily Percolation/Leakage Rate Through GCL and Converted to (M/YR) Example: $((.00007 \text{ FT}^3/\text{Day-Acre})x(1 \text{ Acre}/43,560 \text{ FT}^2)/(1 \text{ Meter}/3.28 \text{ FT})) x (365 \text{ Days}/1 \text{ YR}) = 1.79 \text{ x } 10^{-7} \text{ M/YR}$

APPENDIX C.5 UNSATURATED ZONE DATA



MULTIMED UNSATURATED ZONE DATA

Note that the unsaturated zone was not modeled as part of this point of compliance demonstration. The attenuating effects of the unsaturated zone were conservativeley disregarded.

APPENDIX C.6 MULTIMED AQUIFER-SPECIFIC DATA



MULTIMED AQUIFER - SPECIFIC DATA

Variable Name	Units	Value	Comments
Particle Diameter*	cm	0.0381	From Permit 235-B Amendment Volume II of V
			Pages 36-39 (PDF)-1998
			Material ranges from fine to coarse. Use an average
			for medium sand (0.010-0.020 in); 0.015 in or 0.0381 cm
Aquifer porosity*	unitless	0.43	From Permit 235-B Amendment Volume V of V
			Pages 467-473 (PDF)-1998
Bulk density	g/cc	1.65	From Permit 235-B Amendment Volume V of V
			Pages 467-473 (PDF)-1998
Aquifer thickness	m	10	From Permit 235-B Amendment Volume V of V Pgs.
			467-473 (PDF)-1998 Avg depth of uppermost aquifer
Mixing zone depth	m		Derived by MULTIMED
Hydraulic conductivity	m/yr	130	From Permit 235-B Amendment Volume V of V
			Pages 467-473 (PDF)-1998
			Average hydraulic conductivity of 4.12 x 10 ⁻⁴ cm/sec
Hydraulic gradient	unitless	0.0031	From Groundwater Contour Map (January 2016)
Groundwater seepage velocity	m/yr		Derived by MULTIMED
Retardation coefficient	unitless		Derived by MULTIMED
Longitudinal dispersivity	m		Derived by MULTIMED
Transveral dispersivity	m		Derived by MULTIMED
Vertical dispersivity	m		Derived by MULTIMED
Organic carbon content	%	0.003	From Permit 235-B Amendment Volume V of V
			Pages 467-473 (PDF)-1998
Receptor distance from well	m	Varies	Distance from analysis location to point of
			compliance.
Z-distance from water table	m	0	Assume water table is at bottom of liner.

Note: According to Amendment Application (1998) the Evangeline Aquifer is the principal aquifer in the region and is considered one of the most prolific aquifers in the Texas Coastal Plain. The aquifer is composed of at least the Goliad Sand and includes sections of sand in the Fleming Formation. The Goliad consists of fine to coarse, mostly gray calcareous sand interbedded with sandstone and varicolored clay. (assume medium sand (0.015 in) particle diamter or (0.0381 cm)

* If Aquifer porosity is known MULTIMED will not use particle diameter.

APPENDIX C.7 MULTIMED AQUIFER-SPECIFIC DATA-OVERLINER DEMONSTRATION



MULTIMED AQUIFER - SPECIFIC DATA

Overliner Demonstration

Variable Name	Units	Value	Comments
Particle Diameter*	cm	0.0381	From Permit 235-B Amendment Volume II of V
			Pages 36-39 (PDF)-1998
			Material ranges from fine to coarse. Use an average
			for medium sand (0.010-0.020 in); 0.015 in or 0.0381 cm
Aquifer porosity*	unitless	0.43	From Permit 235-B Amendment Volume V of V
			Pages 467-473 (PDF)-1998
Bulk density	g/cc	1.65	From Permit 235-B Amendment Volume V of V
			Pages 467-473 (PDF)-1998
Aquifer thickness	m	10	From Permit 235-B Amendment Volume V of V Pgs.
			467-473 (PDF)-1998 Avg depth of uppermost aquifer
Mixing zone depth	m		Derived by MULTIMED
Hydraulic conductivity	m/yr	130	From Permit 235-B Amendment Volume V of V
			Pages 467-473 (PDF)-1998
			Average hydraulic conductivity of 4.12 x 10 ⁻⁴ cm/sec
Hydraulic gradient	unitless	0.002	From Groundwater Contour Map (January 2016)
Groundwater seepage velocity	m/yr		Derived by MULTIMED
Retardation coefficient	unitless		Derived by MULTIMED
Longitudinal dispersivity	m		Derived by MULTIMED
Transveral dispersivity	m		Derived by MULTIMED
Vertical dispersivity	m		Derived by MULTIMED
Organic carbon content	%	0.003	From Permit 235-B Amendment Volume V of V
			Pages 467-473 (PDF)-1998
Receptor distance from well	m	Varies	Distance from analysis location to point of
			compliance.
Z-distance from water table	m	0	Assume water table is at bottom of liner.

Note: According to Amendment Application (1998) the Evangeline Aquifer is the principal aquifer in the region and is considered one of the most prolific aquifers in the Texas Coastal Plain. The aquifer is composed of at least the Goliad Sand and includes sections of sand in the Fleming Formation. The Goliad consists of fine to coarse, mostly gray calcareous sand interbedded with sandstone and varicolored clay. (assume medium sand (0.015 in) particle diamter or (0.0381 cm)

* If Aquifer porosity is known MULTIMED will not use particle diameter.

'APPENDIX E ALTERNATE LINER DESIGN REPORT-CITY OF KINGSVILLE MUNICIPAL SOLID WASTE DISPOSAL FACILITY PERMIT AMENDMENT APPLICATION MSW 235-B', PAGES 467-473 FROM PERMIT 235-B AMENDMENT VOLUME V OF V



APPENDIX E

ALTERNATE LINER DESIGN REPORT

City of Kingsville Municipal Solid Waste Disposal Facility Permit Amendment Application MSW 235-B



THIS CERTIFICATION IS INTENDED FOR PERMITTING PURPOSES ONLY AND INCLUDES PAGES 1 THROUGH 7.

November 1997

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ALTERNATE LINER DESIGN REPORT

The City of Kingsville, Texas is proposing a municipal solid waste landfill facility and wishes to consider an alternate design. The proposed site has an expected life of 29 years, area of approximately 120 acres in size, an excavation depth of 20 feet to the bottom of the liner, and an estimated horizontal projection of the leachate collection layer from the top to the collector of 155 ft. Through an extensive ground-water characterization study, the following information was acquired:

	Aquifer Specific Data
Aquifer porosity Bulk density Aquifer thickness Average hydraulic conductivity Hydraulic gradient Seepage velocity Aquifer temperature pH Organic carbon content	0.43 (Silty Clay Loam) 1.65 g/cc = 103 lbm/ft ³ 10m = 32.81 ft. 4.12 X 10 ⁴ cm/sec 0.00331 ft/ft = 0.00331 m/m 3.3 ft/yr 21°C 7.2 0.003

Four scenarios were considered in evaluating this proposed site:

Case 1 - A closed landfill with a synthetic GeoClay barrier liner (3.0 X 10⁹ cm/sec), a 60 mil HDPE membrane liner (2 x 10¹² cm/sec), a Geocomposite drainage layer (10 cm/sec), a 24 inch protective soil layer, 60 feet of waste, an 18 inch soil cover layer, a 60 mil HDPE membrane, a Geocomposite drainage layer, and a 24 inch infiltration and vegetative erosion control layer.

Case 2 - A closed landfill with a standard composite Subtitle "D" Liner with a Geocomposite drainage layer, 60 feet of waste, and a standard Subtitle "D" cover.

Case 3 - An open landfill with a synthetic GeoClay barrier liner (3.0 X 10⁹ cm/sec), a 60 mil HDPE membrane liner (2 x 10¹² cm/sec), a Geocomposite drainage layer (10 cm/sec), a 24 inch protective soil layer, 30 feet of waste (open face 2 acres w/ 320 foot drain length at 4H:1V), and 12 inches of daily soil cover.

Case 4 - An open landfill with a standard composite Subtitle "D" Liner with a Geocomposite drainage layer, 30 feet of waste (open face 2 acres w/ 320 foot drain length at 4H:1V), and 12 inches of daily soil cover.

	Avg. Impingement on Drainage Layer, inches	Average Annual Head on Barrier Layer, inches	Avg. Percolation Thru Barrier Layer, ft ³ /yr
Case 1	0.00002	0.000	0.003
Case 2	0.00002	0.000	0.003
Case 3	1.00798	0.000	0.007
Case 4	0.88389	0.000	0.009

Results of HELP Model

Evaluation of Leakage Through a Composite Liner

0.88389

To calculate the leakage rate through a composite liner, it is necessary to determine the impingement rate e (volume of leachate reaching the leachate collection system). From the HELP3 model printout for Case 4, the average annual precipitation is 40.590 inches (295,000 cubit feet), the average annual evapotranspiration is 20.510 inches (148,900 cubic feet), and the peak daily impingement onto the drainage layer is 0.07075 inches/day (513.7 ft3/day).

Maximum thickness of leachate in the leachate collection system T_{max} must be less than the thickness of the leachate collection system, and T_{max} must be less than 30 cm as per 31 TAC 330.203.

Thus:

Case 4

e =
$$0.07075$$
 inches/day = 2.1×10^8 m/s
k = 1.0×10^1 cm/sec = 1.0×10^1 m/s
tan β = 2.0%
L = 155 ft = 47.2 meters

$$T_{\text{max}} = \frac{47.2 * \sqrt{0.0000008.4 + 0.0004} - 0.020}{1.9996}$$

 $T_{\text{max}} = 0.000495 \text{ meters} = 0.0195 \text{ inches}$

This value compares well with 0.019 inches calculated in Case 4 and is less than the maximum allowed head of 30 cm (12 inches).

However, when evaluating leakage through a liner to use in a fate and transport model (i.e., Multimed), a more conservative value is recommended. One reasonably conservative estimate would be to assume the sand drainage layer is saturated, or h = Pages 469 from Permit 235-B Amendment Volume V of V 12 inches.

Leakage through a composite liner:

$$a = 0.16 \text{ sq. in.} = 0.0001 \text{ m}^2$$

 $h_{tb} = 12.0 \text{ in.} = 0.305 \text{ m.}$
 $k_{st} = 1.0 \times 10^7 \text{ cm/sec} = 1.0 \times 10^9 \text{ m/s}$

For good contact:

$$Q_{tb} = 0.21*(1.0 \text{ X } 10^4 \text{m}^2)^{0.1}*(0.305\text{m})^{0.9}*(1.0 \text{ X } 10^9 \text{m/sec})^{0.74}$$

 $Q_{tb} = 0.63 \text{ X } 10^8 \text{ m}^3/\text{sec/hole} = 0.1438 \text{ gal/day/hole}$

For poor contact:

$$Q_{tb} = (1.15/0.21)*0.1438 = 0.7875 \text{ gal/hole/day}$$

Assuming 7 holes per acre, the estimated leakage through a composite liner with poor contact would be:

Evaluation of Leakage Through a GeoClay Synthetic Liner

To calculate the leakage rate through a synthetic GeoClay liner, it is necessary to determine the impingement rate e (volume of leachate reaching the leachate collection system). From the HELP3 model printout for Case 2, the average annual precipitation is 40.590 inches (295,000 cubit feet), the average annual evapotranspiration is 20.882 inches (151,600 cubic feet), and the peak daily impingement onto the drainage layer is 0.07850 inches/day (570.0 ft³/day).

Maximum thickness of leachate in the leachate collection system T_{max} must be less than the thickness of the leachate collection system, and T_{max} must be less than 30 cm as per 31 TAC 330.203.

Thus:

e = 0.0785 inches/day = 2.3 X
$$10^8$$
 m/s k = 1.0 X 10^1 cm/sec = 1.0 X 10^1 m/s tan β = 2.0% L = 155 ft = 47.2 meters

$$T_{\text{max}} = \frac{47.2 * \sqrt{0.00000092 + 0.0004} - 0.020}{1.9996}$$

Pages 470 from Permit 235-B Amendment Volume V of V E-3

$$T_{max} = 0.0005426 \text{ meters} = 0.0214 \text{ inches}$$

This value compares well with 0.022 inches calculated in Case 3 and is less than the maximum allowed head of 30 cm (12 inches).

However, when evaluating leakage through a liner to use in a fate and transport model (i.e., Multimed), a more conservative value is recommended. One reasonably conservative estimate would be to assume the sand drainage layer is saturated, or h = 12 inches.

Leakage through a composite liner:

$$a = 0.16 \text{ sq. in.} = 0.0001 \text{ m}^2$$

 $h_{tb} = 12.0 \text{ in.} = 0.305 \text{ m.}$
 $k_{st} = 3.0 \times 10^9 \text{ cm/sec} = 3.0 \times 10^{11} \text{ m/s}$

For good contact:

$$Q_{tb} = 0.21*(1.0 \text{ X } 10^4 \text{m}^2)^{0.1}*(0.305\text{m})^{0.9}*(3.0 \text{ X } 10^{11\text{m/sec}})^{0.74}$$

 $Q_{tb} = 4.677 \text{ X } 10^{10} \text{ m}^3/\text{sec/hole} = 0.01068 \text{ gal/day/hole}$

For poor contact:

$$Q_{b} = (1.15/0.21)*0.01068 = 0.05847 \text{ gal/hole/day}$$

Assuming 7 holes per acre, the estimated leakage through a composite liner with poor contact would be:

$$Q = (7 \text{ holes/acre})*(2 \text{ acres})*(0.05847\text{gal/day/hole})$$

 $Q = 0.8185 \text{ gal/day} = \text{INFiltration Rate} = 0.000140\text{m/yr}$

Analysis of the 30 cm (12 inches) head on High Drainage Layers:

The 12 inch head on these synthetic liners with Geocomposite drainage layers seems unreasonable. Therefore, let's answer some questions prior to proceding to input the MultiMed Model.

First, What flow would be required to create a 12" head on the drainage layer?

Solving the Head Equation in reverse for impingement rate:

$$T_{max} = 12" = 0.3048 \text{ meters}$$

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$$0.3048m = \frac{47.2 * (\sqrt{4 * (\frac{e}{0.1}) + 0.0004 - 0.020)}}{1.9996}$$

e = 0.00001708 m/sec = 58.10 inches/day!!!!!!

This impingement rate is more than the max annual rainfall coming in one day; more than a 25 year, 24 hour storm; more than a 100 year, 24 hour storm; and equals 3,155,530 gallons/day impingement

just to create 12 inches of head on the drainage layer! Nevertheless, the two compartive cases (cases 11&12) have been run. They illustrate that the Subtitle D Liner will not pass the criteria under 12" head, but that the alternateve GeoClay liner will.

A better conservative estimate for this type of system would be an assumption of a 25 year, 24 hour storm (9 inches/day) hitting the landfill, and using the HELP3 model to estimate the drainage layer impingement in each case. The peak daily precipitation rate for the HELP3 model cases was 7.92 inches. Therefore, we shall increase the impingement on the lower synthetic liner by the ratio of (9.00"/7.92") This generates the following impingement rates on the liners for cases 1 through 4:

Case No.	25 yr, 24 hr Storm HELP Perc'n thru Barrier Layer, ft3/day	25 yr, 24 hr Storm HELP Perc'n thru Barrier Layer, inch/day	25 yr, 24 hr Storm HELP Perc'n thru Barrier Layer, meter/year
1 - COK Alt. Liner Closed	0.0000114	0.000000571	0.0000053
2 - STD Liner Closed	0.0000114	0.000000571	0.0000053
3 - COK Alt. Liner Open	0.0000682	0.00000343	0.0000318
4 - STD Liner Open	0.00025	0.0000126	0.000117

These infiltration rates were used as input to the MultiMed Model and produced the following results:

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Evaluation of leachate concentration at Point of Compliance

Based on the above calculations, the infiltration rate to be input into the Mulitmed models are:

For GeoClay Barrier Liner(Closed): Infiltration = 0.031 gal/day = 0.0000053 m/yr For Std Subtitle "D" Liner(Open): Infiltration = 0.031 gal/day = 0.0000053 m/yr For GeoClay Barrier Liner(Open): Infiltration = 0.1862 gal/day = 0.0000318 m/yr For Std Subtitle "D" Liner(Open): Infiltration = 0.6826 gal/day = 0.000117 m/yr

The first Mulitmed model was run for Case 1 (Closed landfill, alternate design, steady state). The second model run for Case 2 (Closed landfill, Subtitle "D", steady state). The third model run for Case 3 (Open landfill, alternate design, steady state). The fourth model run for Case 4 (Open landfill, Subtitle "D", steady state). Results of these models are tabulated below:

Results of Multimed Models

	Concentration at POC	Dilution Attenuation Factor
Case 1 (steady state)	0.0002089	4,787
Case 2 (steady state)	0.0002089	4,787
Case 3 (steady state)	0.001253	798
Case 4 (steady-state)	0.0004606	217

Conclusions

As can be seen by comparing the Dilution Attenuation Factors (DAF's) for the alternate design scenarios, Case 1 and Case 3 (4,787 and 798, respectively) with the minimum required DAF's listed in Table 2, is has been demonstrated through the use of the HELP and Multimed models that the alternate design is sufficient for all constituents.

'CITY OF KINGSVILLE MSWLF-PERMIT 235-B ATTACHMENT 4-GEOLOGY REPORT, 4.0 REGIONAL AQUIFERS', PAGES 36-39 FROM 235-B AMENDMENT VOLUME II OF V



City of Kingsville MSWLF - Permit 235 B Attachment 4 - Geology Report

4.0 Regional Aquifers

The Evangeline Aquifer is the principal aquifer in the region and is considered one of the most prolific aquifers in the Texas Coastal Plain. The aquifer is composed of at least the Goliad Sand and includes sections of sand in the Fleming Formation. Only in South Texas the base of the Evangeline coincides with the base of the Goliad. The upper boundary of the Evangeline probably follows closely the top of the Goliad Sand where present, but this relationship is somewhat speculative (Muller, 1979). (See Figure 4.11) Ground water flow direction in the Evangeline is in a Northerly direction based on a water level map of the Goliad sand. There are two very significant cones of depression in the Evangeline (Goliad) aquifer located to the northwest of the City of Kingsville MSWLF site. These depressions are primarily due to large groundwater production rates by the City of Kingsville and the Exxon King Ranch Gas Plant. The extent of salt water intrusion from the Gulf of Mexico into the Evangeline (Goliad) aquifer is shown on Figure 4.16.

The Goliad consists of fine to coarse, mostly gray calcareous sand interbedded with sandstone and varicolored clay. Recharge within the site area occurs along the outcrop which is located in western Hidalgo, central-eastern Starr, central Jim Hogg, Duval, southeastern Webb, northeastern Brooks, northern Jim Wells, and extreme northeast Zapata counties, as well as other counties to the north. The maximum width of the outcrop is west of Falfurrias where the Goliad Sand extends for nearly 50 miles at the surface and completely overlaps the underlying Lagarto Clay and Oakville Sandstone and nearly overlaps the Catahoula Tuff (Shafer, 1973). (See Figure 4.12)

The water of the Goliad is under artesian pressure and is yielded to flowing and nonflowing wells. The average coefficient of transmissibility determined during drawdown of the fresh to slightly saline water section of the Goliad Sand in southwestern Kleberg County measured in well no. RR-83-41-803, was about 34,400 gpd per foot. The specific capacity of the well was 17.8 gpm per foot. This was derived from a screened interval of 126 feet near the north boundary of Kenedy and south boundary of Kleberg Counties.

Fresh water of domestic use quality in the Evangeline is found in well developed sands at depths of 500 feet and greater in the MSWLF area. From surface to the fresh water sands in the Evangeline the lithology is predominately a clay described as silty, calcareous, firm to hard with occasionally silty sands.

The regional Chicot aquifer lies approximately 220 feet below ground surface in the vicinity of the MSWLF according to two deep well logs obtained from a local mineral company. (See Section 4.2) The Light Olive Green Clay layer serves as aquiclude between the uppermost aquifer below the landfill site and the Chicot aquifer. In Kleberg County, and specifically the MSWLF, the waters from the Chicot aquifer are generally slightly-saline to saline and yield only marginal quantities of water.

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City of Kingsville MSWLF - Permit 235 B Attachment 4 - Geology Report

The local unconfined water table aquifer tends to flow in all directions away from the landfill site. The only exception is that for a period of time after excessive rainfall events, ground water in this local uppermost aquifer tends to flow toward the site from the northwest. This determination is based on water levels recorded in wells completed for use in the current expansion phase. However, the largest gradients for ground water flow are in the northeast and southwest directions. The flow toward the southwest is along a caliche channel which slopes to the southwest toward some lower elevation caliche pits. The flow toward the northeast is toward the Santa Gertrudis creek. However, the ground water tends to flow through some fairly tight clay in that direction. The high point of ground water at the MSWLF site is at least partially a following of the surface topography and influenced by direct recharge from any ponding which is not promptly removed. Attachment 5, Appendix E gives a more thorough analysis of ground water direction and rate of ground water flow.

The initial interpretation, based on available data and monitor well density and location, indicated a predominate flow to the north or west. Completion of monitor and observation wells in the current expansion program indicate a northeast flow direction. Later analysis shows that ground water flows slowly away from MSWLF in all directions. This is based on measurements of the top of the saturated zone as evidence by water levels in wells. The initial flow direction determined by REI when the landfill was started was toward the northeast.

4.1 Water Quality

The water quality of the Goliad is highly variable. Chloride contents in the wells sampled ranged from 94 to 9,100 mg/l, exceeding 250 mg/l in 60% of the samples. Sulfate content ranged from 26 to 4,630 mg/l. In Kleberg County, 33% of the samples exceeded 250 mg/l sulfate. Dissolved-solids content ranged from 601 to 49,900 mg/l. Over 75% exceeded 1,000 mg/l dissolved-solids. In summary, ground water that meets most of the quality standards of the U.S. Public Health Service is available from wells less than 1,000 feet deep in the Goliad Sand, Principally in southern Jim Wells County, the western one-half of Kleberg County, and in a few other relatively small areas throughout the report area. Shallow, moderately saline to very saline water overlies the fresh to slightly saline water at most places (Shafer, 1973). (See Figure 4.13)

The Beaumont Clay and Lissie Formation, undifferentiated, (Chicot Aquifer) yields small quantities of slightly to moderately saline water to a few shallow wells used mostly for stock needs in eastern Kleberg and Kenedy Counties. Test wells drilled near Riviera, 15 miles south of Kingsville, in southern Kleberg County show that in this area the shallow sands of the Beaumont and Lissie (Chicot) usually contain very saline water. This group is not considered a supply of useable water because of the highly mineralized water associated with formations in most places. The casings of many wells are cemented through these

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formations. (Shafer, 1973)

Water held in the Beaumont Clay and Lissie Formation, undifferentiated, (Chicot) is under water-table (unconfined) conditions. There were no recoverable aquifer tests from reference material on this formation as it occurs in the area of the site. This formation is not recognized as a useable source of ground water.

Historical ground water monitoring from in-place monitor wells indicates that the sulfates range approximately from 45 to 500 mg/l, chlorides from approximately 50 to 500 mg/l, and dissolved-solids from approximately 500 to 6,000 mg/l. Values of pH have consistently ranged between 7.00 and 8.00. More detailed analytical data from the ground water monitor wells at the site is given in Table 5.1 in Attachment 5.

4.2 Hydraulic Connection

No hydraulic connection was found between the uppermost fluvial-deltaic beds which will host the MSWLF and the deeper Chicot and Evangeline (Goliad) aquifers.

Deep elevations prepared from water well data located in the vicinity show that the Chicot aquifer is located approximately 200 feet below ground surface in the MSWLF vicinity. This data is confirmed by electric logs from two (2) deep uranium tests located on the southeast side and adjacent to the MSWLF acreage block (URI, Inc. well nos. 2001 & 2016). These wells exhibit the top of the main Chicot sand body at depths of 220 & 225' of measured depth, respectively. The top of the deeper Evangeline (Goliad) sands are found at approximately 500' MD. A confining clay, at the base of the fluvial—deltaic section which will host the MSWLF, is indicated in both URI wells to depths of 120' and 130' respectively. In addition, four deep borings (wells 21,23,24,25) at the MSWLF confirm that the "light olive green clay" is ubiquitous under the site with a minimum proven thickness of 38'.

TABLE 4.2.1

WELL#	ELEVATION (feet)	TOTAL DEPTH (feet)	TOP LT OLIVE GRN CLAY (ft.,+M.S.L.)	FOOTAGE OF CLAY
21	52.4	84	+6.4	38
23	49.5	86	+13.5	38
24	47.4	72	+15.4	40
25	61.1	88	+11.1	38

The "light olive green clay" is the aquiclude for the MSWLF facility.

City of Kingsville MSWLF - Permit 235 B Attachment 4 - Geology Report

4.3 Recharge

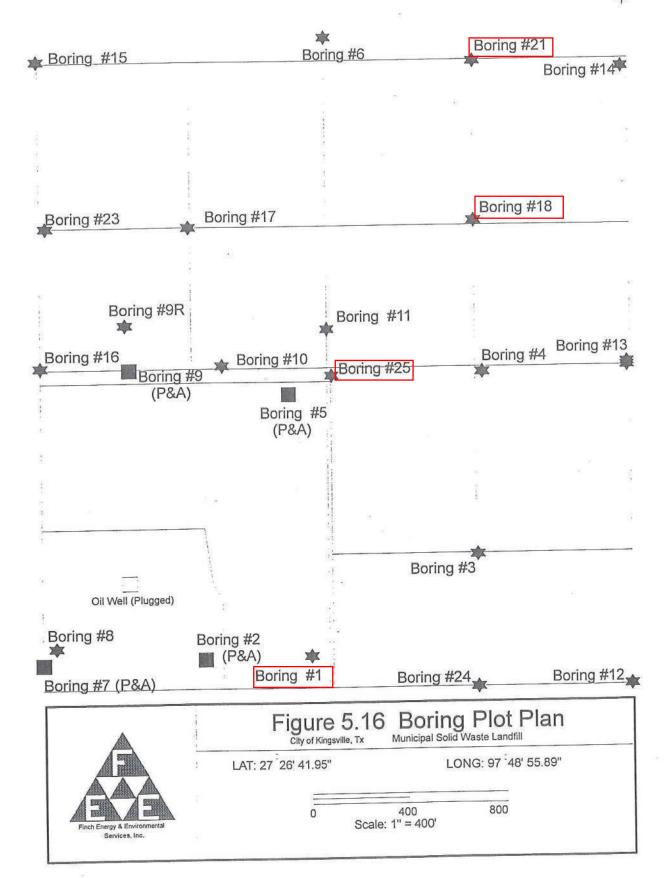
Recharge within a 5 mile radius is from downward percolation of surface water, infiltration from streams, impoundments and water retained in abandoned caliche pits. (Figure 4.14) Flow through the soils is very slow.

4.4 Water Use

A survey of, and for, water wells within a 1 mile radius of the MSWLF site was prepared by Agency Information Consultants (AIC). All known water wells within the survey area produce water for domestic use from the Evangeline Aquifer (Goliad Sand). Thirty one wells were identified in the survey area. (See Figure 4.15) Depth to the top of the perforated or screened interval varies from 524 feet to 726 feet, with an average depth of 621 feet. (See Figures 4.12 & 4.13) There are no known water wells completed in the Chicot aquifer for potable water. There are a few stock wells. The water from the Chicot is mostly very saline. This salinity causes casing corrosion problems with the good fresh water wells in the Goliad aquifer unless they are cemented properly through the Chicot.

'CITY OF KINGSVILLE MSWLF-PERMIT 235-B 'FIGURE 5.16 BORING PLOT PLAN', PAGE 197 FROM PERMIT 235-B AMENDMENT VOLUME II OF V





Page 197 from Permit 235-B Amendment Volume II of V

'CITY OF KINGSVILLE MSWLF-PERMIT 235-B 'SUBSURFACE EXPLORATION RECORD B/W NO. 21', PAGE 371 FROM PERMIT 235-B AMENDMENT VOLUME II OF V



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FINCH ENERGY AND ENVIRONMENTAL SERVICES, Inc. P.O. Box 73, Kingsville, Texas 78364-0073



SUBSURFACE EXPLORATION RECORD

	Client:	City of	Kingsville			Boring/Well No.:	21	-
	Project N	ame: K	ingsville Landf	ill		Date Drilled:	April 27, 1998	_
	Project Lo	ocation:	5 mi SE of City			Boring Method: HOLLOW STEM AUGER		
	LAT: 27°	26' 09" LONG	G: 97° 48′ 47.	6"	Sample Method:	Shelby Tube	-00	
	MSWLFI	D: Pe	rmit #235-B			Surface Elevation:	52.41' MSL	_
						Depth to Water:	17.8' BGS	
						Total Depth:	84' BGS	_5
					(md		1000	_
	on 'ell		(Feet)	4	d) Bu	Screen:		_
	or V		H.	Y.E.	eadi	Borehole Dia.:	6 inch	_
	Monitor Well Construction	TT	DEPTH (feet)	SAMPLE	PID Reading (ppm)	Driller ID:	PSI - Craig Schena	
	2 0		_	0) <u>2</u>	о.	SOIL CLAS	SIFICATION	
			0	MC Harporton	Sugg	Dark Brown Sand Clay -	Topsoil	
			10 —			Caliche Bearing Channel	(1)	
						Sand Filled Channel (II)		
stalled;	; boring only		20 —			Sandy Clay	######################################	
				MAN CO			#E	
			— x —			South Control of the		
						Clayey Sand (Clay Dune)		
			- 40 -		i			
			50			LT OLIVE GREEN CLAY		
			- 60 -		1			
				E STATE OF	i			
			70 —		1			
					Ì			
			- 60 -		ĺ			
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	1.			L	1			
			Water depth	on Drilling = 25.0	ft. B	GS	TOTAL DEPTH = 84 feet	

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'CITY OF KINGSVILLE MSWLF-PERMIT 235-B 'SUBSURFACE EXPLORATION RECORD B/W NO. 18', PAGE 369 FROM PERMIT 235-B AMENDMENT VOLUME II OF V

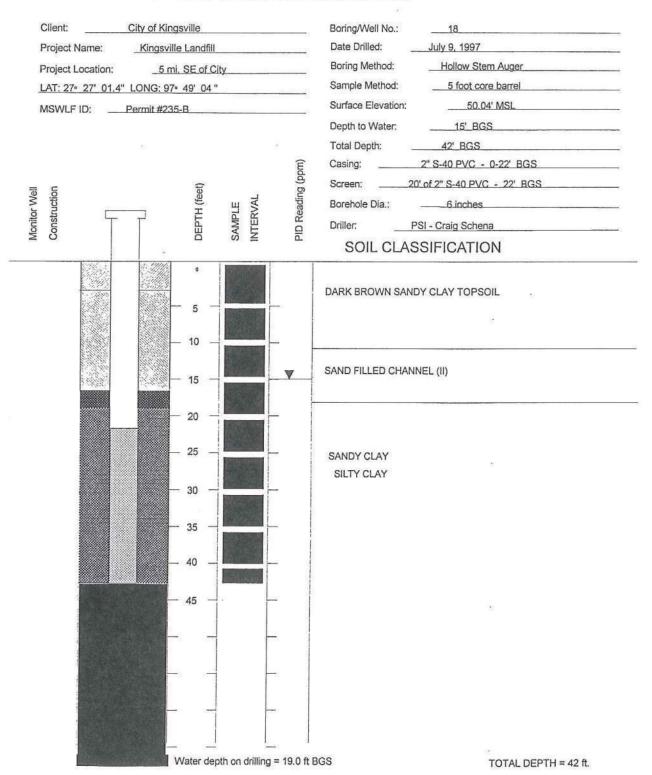


FINCH ENERGY AND ENVIRONMENTAL SERVICES, Inc. P.O. Box 73, Kingsville, Texas 78364-0073 (512) 592-9810 (512) 592-5552 FAX

PAGE_1_OF_1_



SUBSURFACE EXPLORATION RECORD



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'CITY OF KINGSVILLE MSWLF-PERMIT 235-B 'SUBSURFACE EXPLORATION RECORD B/W NO. 25', PAGE 374 FROM PERMIT 235-B AMENDMENT VOLUME II OF V



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FINCH ENERGY AND ENVIRONMENTAL SERVICES, Inc. P.O. Box 73, Kingsville, Texas 78364-0073



SUBSURFACE EXPLORATION RECORD

Client:	City of k	(ingsville			Boring/Well No.:	25
Project Na		Kingsville Landfill			Date Drilled: _	April 29, 1998
	Project Location: 5 mi SE of City				Boring Method:	HOLLOW STEM AUGER
	LAT: 27° 26' 55.2" LONG: 97° 48' 41.8"			Sample Method:	SPLIT SPOON	
		mit #235-B	+1.0		Surface Elevation:	61.12' MSL
MSWLF II	DFei	1111(#233-6			Depth to Water:	21.1' BGS
					Total Depth:	88' BGS
				E		
				dd)	Screen:	
Well		(feel	m ₹	ading	Borehole Dia.:	6 inch
Monitor Well Construction	午	DEPTH (feet)	SAMPLE	PID Reading (ppm)	Driller ID:	PSI - Craig Schena
Mor		DE	SA	PI		SSIFICATION
		0	S DESCRIPTION OF THE PERSON OF		TOP SOIL & DARK BF	ROWN CLAY
		10			CALICHE BEARING CH	HANNEL (I)
stalled; boring only					SAND FILLED CHANNI	EL (II)
,		20				
		30		-		
		40	27.502.51		SANDY CLAY	
2						
		50 -		-	LT OLIVE GREEN CLA	Y
71				-		
		70				8
					32	
7		- 60 -				
		- 60 -		TDH		
		100 —				
	1 [F -	-	4		
25		-		-		
	-					
		Mater den	th on Drilling =	3100	RGS	TOTAL DEPTH = 88 feet

Hanson Professional Services Inc. Submittal Date: September 2018

Revision: 0

'CITY OF KINGSVILLE MSWLF-PERMIT 235-B 'SUBSURFACE EXPLORATION RECORD B/W NO. 1', PAGE 351 FROM PERMIT 235-B AMENDMENT VOLUME II OF V



PAGE_1_ OF _1_

FINCH ENERGY AND ENVIRONMENTAL SERVICES, Inc. P.O. Box 73, Kingsville, Texas 78364-0073

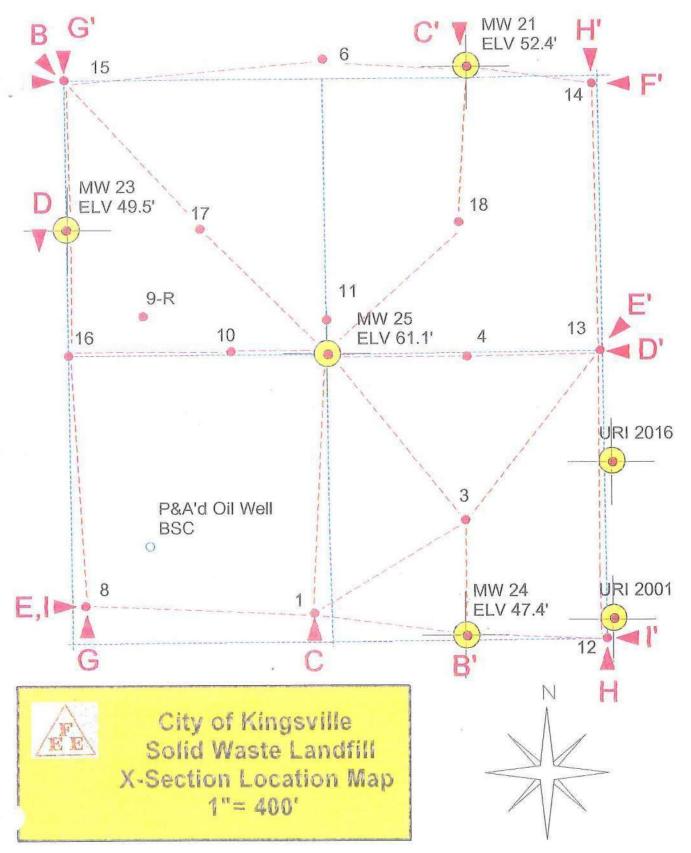


SUBSURFACE EXPLORATION RECORD

Client: Project Name: Project Location: LAT: 27° 26' 42.2" MSWLF ID:	City of Kingsville Kingsville Landfil 5 mi SE of City LONG: 97• 49: 10.6" Permit #235-B		Boring/Well No.:1 Date Drilled:June 19, 1984 Boring Method:Hollow_Stem Auger Sample Method: SHELBY_TUBE & SPLIT_SPOON Surface Elevation:59.25' MSL Depth to Water:31 0' BGS Total Depth:42' BGS Casing:2" S-40 PVC - 0-32' BGS
Monitor Well Construction	DEPTH (feet)	SAMPLE INTERVAL PID Reading (ppm)	Screen: 10'of 2" S-40 PVC - 32' RGS Borehole Dia.: 6 inch Driller ID: TETCO SOIL CLASSIFICATION
	0		TOP SOIL & DARK BROWN CLAY
	20		CALICHE, CLAY & SAND (I)
	- 35 - 49 - 45 - 50		SILTY CLAY
		h on Drilling = 30.19	ft. BGS TOTAL DEPTH = 42 feet

'CITY OF KINGSVILLE MSWLF-PERMIT 235-B 'X-SECTION LOCATION MAP', PAGE 68 FROM PERMIT 235-B AMENDMENT VOLUME II OF V

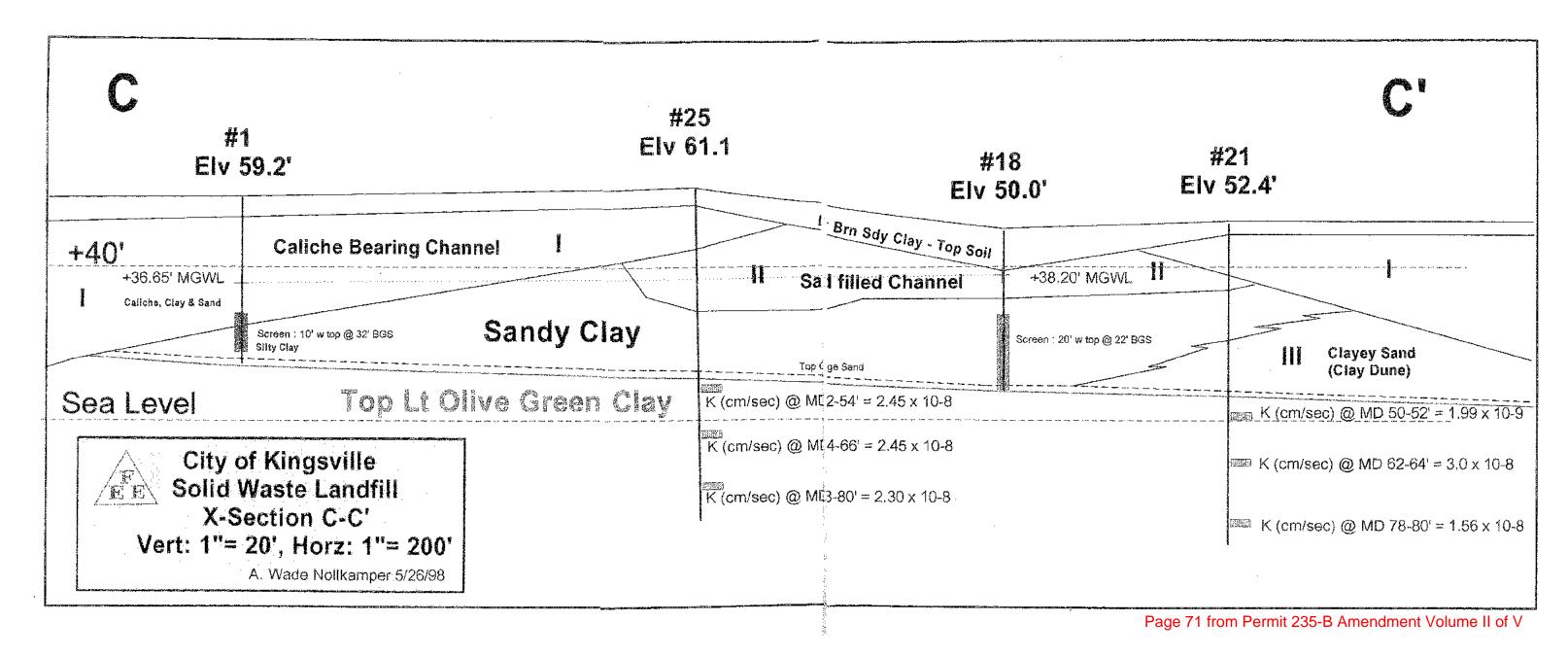




Page 68 from Permit 235-B Amendment Volume II of V REVISION 1

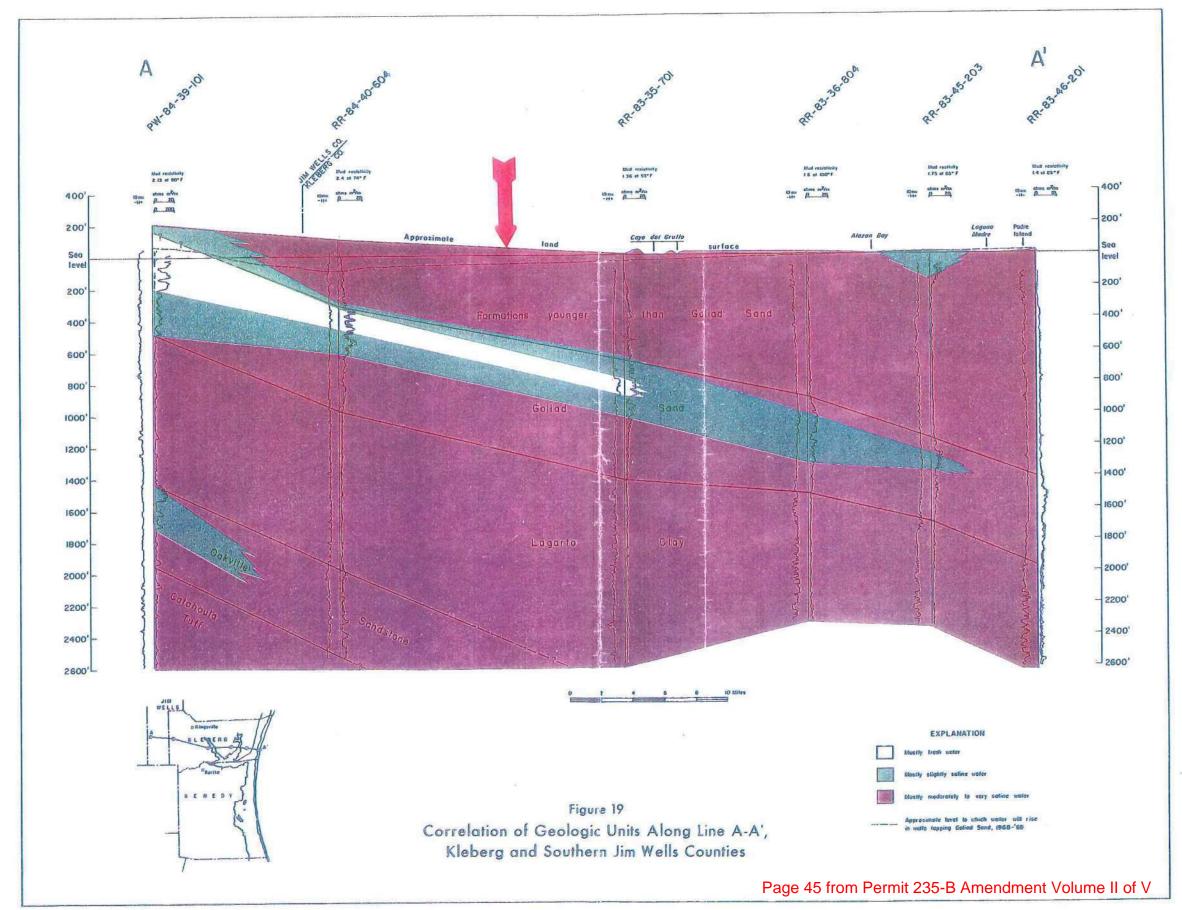
'CITY OF KINGSVILLE MSWLF-PERMIT 235-B 'X-SECTION C-C", PAGE 71 FROM PERMIT 235-B AMENDMENT VOLUME II OF V





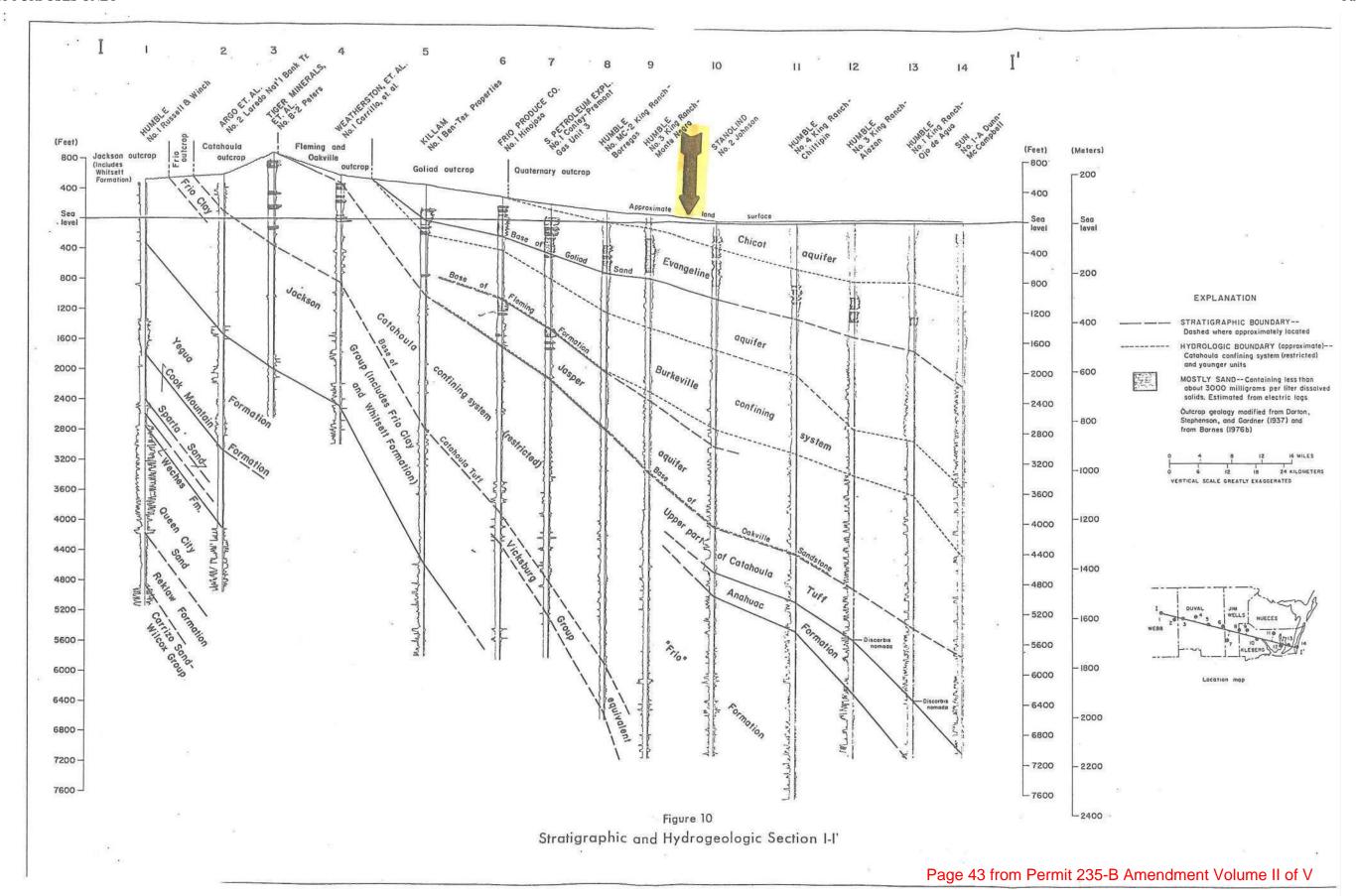
'CITY OF KINGSVILLE MSWLF-PERMIT 235-B 'CORRELATION OF GEOLOGIC UNITS ALONG A-A KLEBERG AND SOUTHERN JIM WELLS COUNTIES", PAGE 45 FROM PERMIT 235-B AMENDMENT VOLUME II OF V





'CITY OF KINGSVILLE MSWLF-PERMIT 235-B 'STRATIGRAPHIC AND HYDROGEOLOGIC SECTION I-I", PAGE 43 FROM PERMIT 235-B AMENDMENT VOLUME II OF V





Part III

APPENDIX D CALCULATIONS OF THE DILUTION ATTENUATION FACTOR (DAF)



CALCULATIONS OF THE DILUTION ATTENUATION FACTOR

Example Calculation for the Interim Case with Alternative Liner

Result from MULTIMED model:

Chemical concentration at the point of compliance = $0.2943 \times 10^{-4} \text{ mg/l}$ (see MULTIMED model output)

To find the resulting DAF, take the recipricol:

DAF= 1/0.2943 x 10⁻⁴ mg/1

DAF= 33,979

Table 1

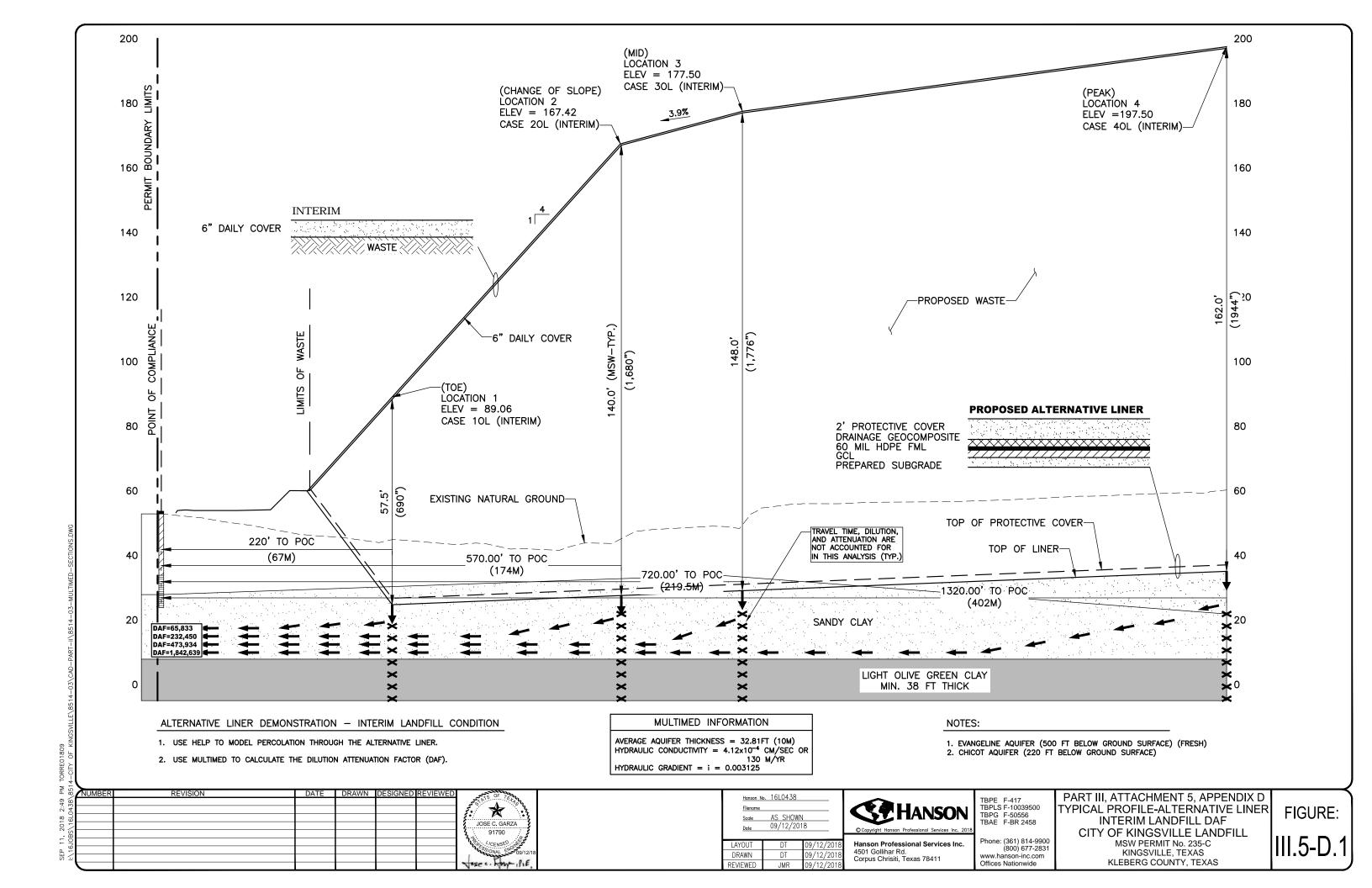
Location	Interim Case DAF	Closed Case DAF
Alternative Liner Location 1	33,979	85,106
Alternative Liner Location 2	57,471	201,288
Alternative Liner Location 3	80,645	282,566
Alternative Liner Location 4	286,533	1,003,814

Location	Interim Case DAF	Closed Case DAF
Overliner Location 1	18,797	65,833
Overliner Location 2	77,640	232,450
Overliner Location 3	158,253	473,934
Overliner Location 4	615,385	1,842,639

APPENDIX D.1 TYPICAL PROFILE-ALTERNATIVE LINER INTERIM LANDFILL DAF

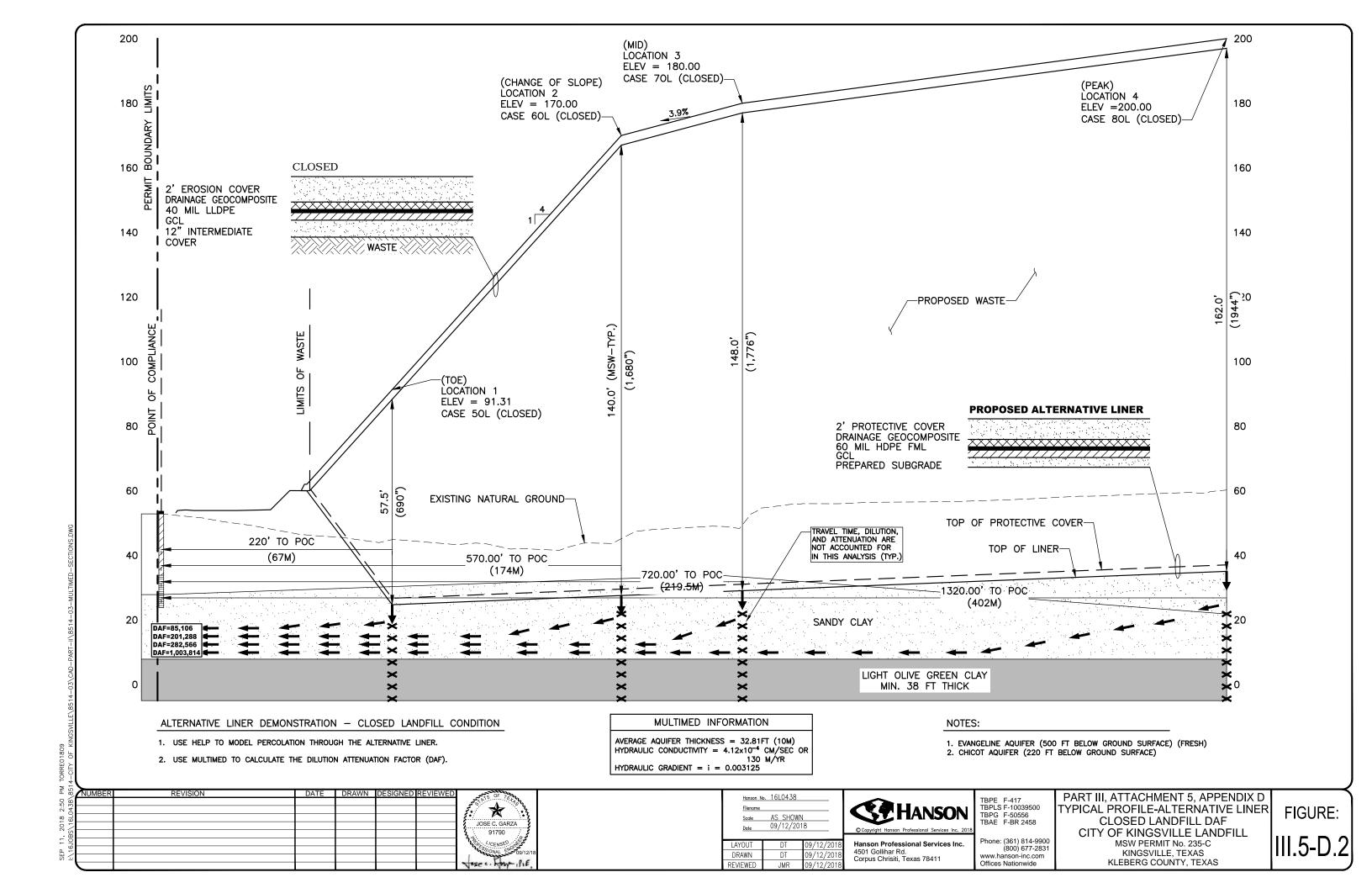
FOR PERMIT PURPOSES ONLY





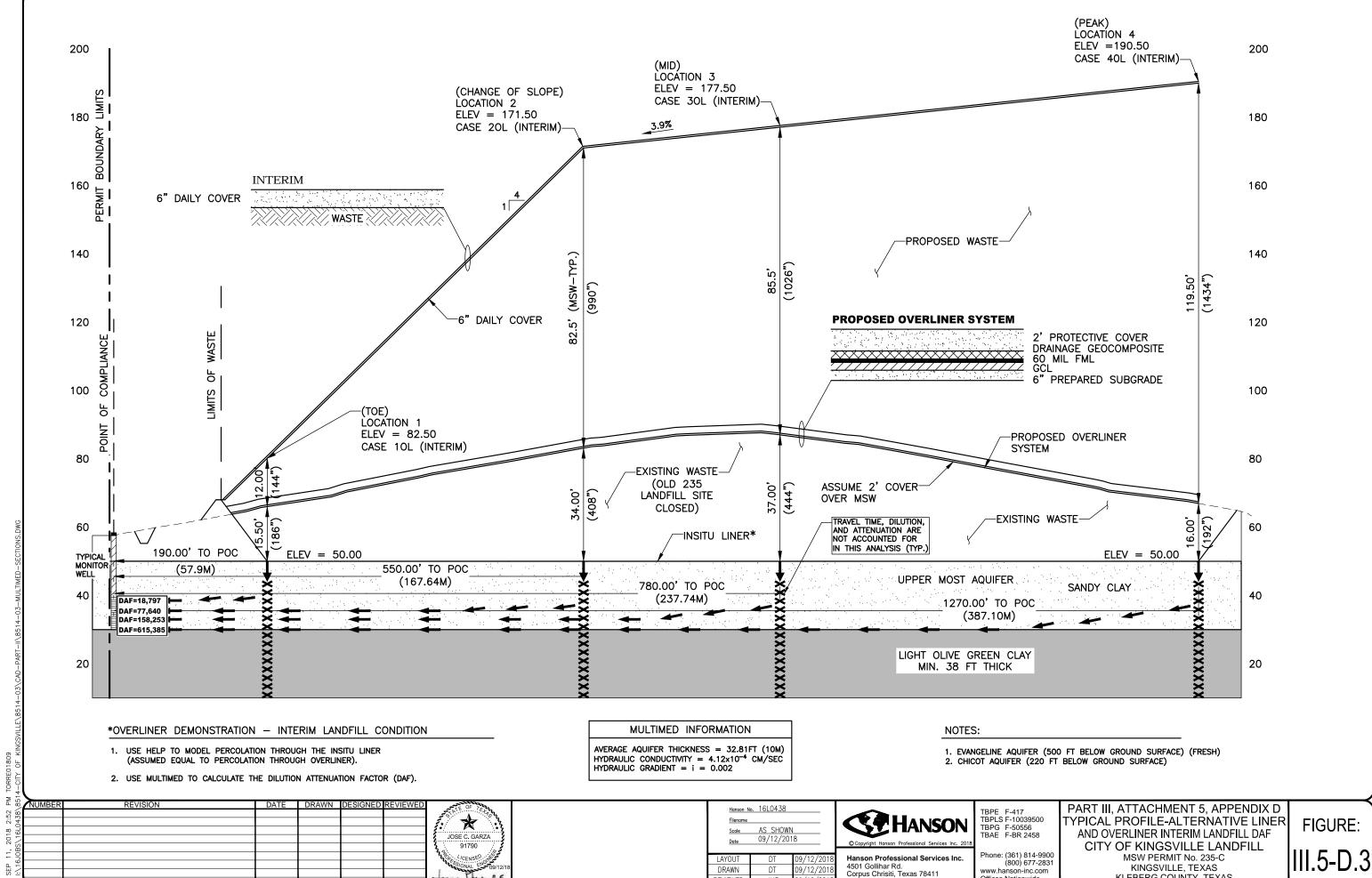
APPENDIX D.2 TYPICAL PROFILE-ALTERNATIVE LINER CLOSED LANDFILL DAF





APPENDIX D.3 TYPICAL PROFILE-ALTERNATIVE LINER AND OVERLINER INTERIM LANDFILL DAF





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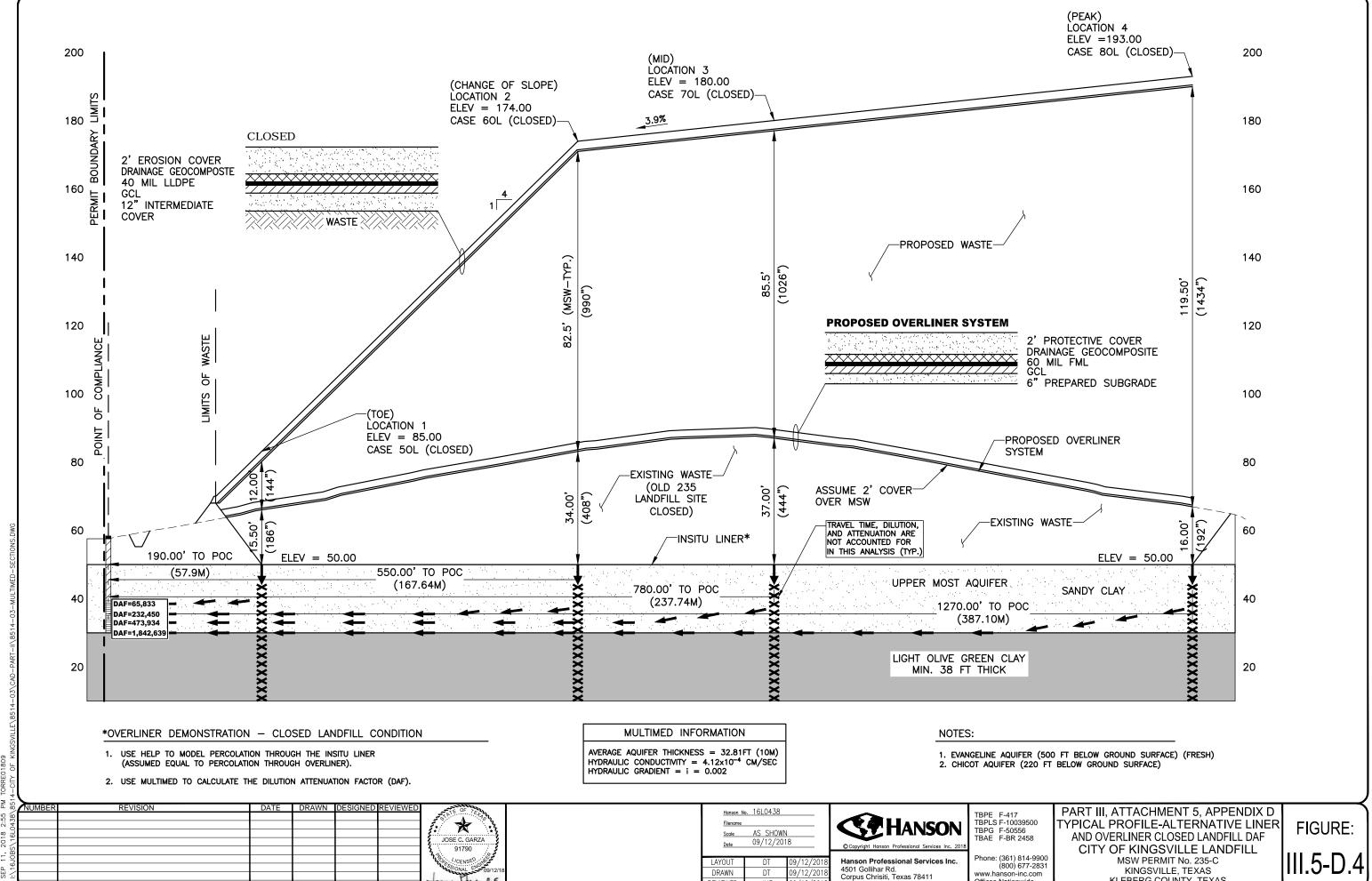
DT

KLEBERG COUNTY, TEXAS

Offices Nationwide

APPENDIX D.4 TYPICAL PROFILE-ALTERNATIVE LINER AND OVERLINER CLOSED LANDFILL DAF





DRAWN

KLEBERG COUNTY, TEXAS

Offices Nationwide

APPENDIX E LEACHATE DATA



LEACHATE DATA

An initial concentration (C_0) equal to 1.0 mg/L was used for MULTIMED modeling, as detailed in Input Leachate Requirements (page 23) of the TCEQ's Alternate Liner Design Handbook (1993).

APPENDIX F MULTIMED MODEL OUTPUT



APPENDIX F.1 MULTIMED OUTPUT FOR ALTERNATIVE LINER INTERIM CASE 1LOCATION 1



	A G E
CASE1	PROTECTION
	ENVIRONMENTAL
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E N S S M ASS EXPOSURE

MODEL MULTIMEDIA

(Version 1.01, June 1991)

MULTIMED

Case 1

1 Run options

Location 1 Chemical simulated is DEFAULT CHEMICAL

Saturated zone model DETERMIN Option Chosen

Reject runs if Y coordinate outside plume Reject runs if Z coordinate outside plume Gaussian source used in saturated zone model Run was Infiltration input by user Run was steady-state

CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	TERS	LIMITS	TS
			MEAN	STD DEV	MIN	MAX
Solid phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-999.	0.000E+00	0.100E+11
Dissolved phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	0.100E+11
Overall chemical decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	0.100E+11
Acid catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Base catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Reference temperature	U	CONSTANT	20.0	-666-	0.000E+00	100.
Normalized distribution coefficient	m1/g	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Distribution coefficient	1	DERIVED	-666-	-666-	0.000E+00	0.100E+11
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	10.0
Reference temperature for air diffusion	U	CONSTANT	0.000E+00 -999	-666-	0.000E+00	100.
Molecular weight	M/B	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-
Mole fraction of solute	I	CONSTANT	0.000E+00 -999	-666-	0.100E-08	1.00
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00 -999	-666-	0.000E+00	100.
	atm-m^3/M	CONSTANT	0.000E+00 -999.	-666-	0.100E-09	1.00
cay sat. zone	1/yr	DERIVED	0.000E+00	0.000E+00 0.000E+00	0.000E+00	1.00
Not currently used		CONSTANT	-666-	-666-	0.000E+00	1.00

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Not currently used		CASE1 CONSTANT	*666-	.666-	0.000E+00	1.00	
	SOURCI	SOURCE SPECIFIC VARIABLES					
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	ETERS	LIMITS	TS	1
	6		MEAN	STD DEV	MIN	MAX	
Infiltration rate	m/yr	CONSTANT	0.128E-06	-999.	0.100E-09	0.100E+11	
Area of waste disposal unit	m^2	CONSTANT	0.486E+06	-666-	0.100E-01	-666-	
Duration of pulse	yr	CONSTANT	-666-	-666-	0.100E-08	-666-	
Spread of contaminant source	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11	
Recharge rate	m/yr	CONSTANT	0.368E-01	-666-	0.000E+00	0.100E+11	
Source decay constant	1/yr	CONSTANT	0.000E+00	-666-	0.000E+00	-666-	
Initial concentration at landfill	mg/1	CONSTANT	1.00	-666-	0.000E+00	-666-	
Length scale of facility	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11	
Width scale of facility	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11	
Near field dilution		DERIVED	1.00	0.000E+00	0.000E+00	1.00	
	AQUIFE	AQUIFER SPECIFIC VARIABLES	10				
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	ETERS	LIMITS	TS	1 1 1
			MEAN	STD DEV	MIN	MAX	
Particle diameter	E B	CONSTANT	0.381E-01	-999.	0.100E-08	100.	!
Aquifer porosity	3	CONSTANT	0.430	-666-	0.100E-08	0.990	
Bulk density	g/cc	CONSTANT	1.65	-666-	0.100E-01	5.00	
	E	CONSTANT	10.0	-666-	0.100E-08	0.100E+06	
Source thickness (mixing zone depth)	E	DERIVED	-666-	-666-	0.100E-08	0.100E+06	
Conductivity (hydraulic)	m/yr	CONSTANT	130.	-666-	0.100E-06	0.100E+09	
Gradient (hydraulic)	•	CONSTANT	0.310E-02	-999.	0.100E-07	-999,	
Groundwater seepage Velocity	m/yr	DEKIVED	-888-	-888-	0.100E-09	0.100E+09	
Retardation coefficient	1		-999	-666-	1.00	0.100E+09	
Longitudinal dispersivity	W	9	-666-	-666-	- 666-	-666-	
Transverse dispersivity	E	OF.	-666-	-666-	-666-	-666-	
Vertical dispersivity	E	FUNCTION OF X	-666-	-666-	-666-	-666-	
Temperature of aquifer	U	CONSTANT	21.0	-666-	0.000E+00	100.	
	ł	CONSTANT	7.20	-666-	0.300	14.0	
Organic carbon content (fraction)		CONSTANT	0.300E-02	-666-	0.100E-05	1.00	
Well distance from site	E	CONSTANT	67.0		1.00	-666-	
Angle off center	degree	CONSTANT	0.000E+00		0.000E+00	360.	
Well vertical distance	E	CONSTANT	0.000E+00	-666-	0.000E+00	1.00	

CONCENTRATION AFTER SATURATED ZONE MODEL 0.2943E-04

APPENDIX F.2 MULTIMED OUTPUT FOR ALTERNATIVE LINER INTERIM CASE 2LOCATION 2



AGENCY ECTION PR0 ENVIRONMENTAL Š

'n.

EN Σ E S S S A ш EXPOSUR

MODEL MULTIMEDIA

(Version 1.01, June 1991) MULTIMED

1 Run options

Case 2

Location 2 Chemical simulated is DEFAULT CHEMICAL

Run was Infiltration input by user Option Chosen

Saturated zone model DETERMIN

Reject runs if Y coordinate outside plume Reject runs if Z coordinate outside plume Gaussian source used in saturated zone model Run was steady-state

CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN STD	TERS STD DEV	LIMITS	TS MAX
Solid phase decay coefficient	1/vr	CONSTANT	0.000E+00 -999.	-966-	0.000E+00	0.100E+11
Dissolved phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-999.	0.000E+00	0.100E+11
Overall chemical decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	0.100E+11
Acid catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Base catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Reference temperature	, U	CONSTANT	20.0	-666-	0.000E+00	100.
Normalized distribution coefficient	m1/g	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Distribution coefficient	1	DERIVED	-666-	-666-	0.000E+00	0.100E+11
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00 -999.	-666	0.000E+00	-666-
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	10.0
Reference temperature for air diffusion	u	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	100.
Molecular weight	B/M	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Mole fraction of solute	1	CONSTANT	0.000E+00 -999.	-666-	0.100E-08	1.00
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	100.
	atm-m^3/M	CONSTANT	0.000E+00 -999.	-666-	0.100E-09	1.00
cay sat. zone	1/yr	DERIVED	0.000E+00	9.000E+00 0.000E+00	0.000E+00	1.00
Not currently used	9)	CONSTANT	-666-	-666-	0.000E+00	1.00

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Not currently used		CASE2	-666-	-666-	0.000E+00	1.00	
	SOURCE	SOURCE SPECIFIC VARIABLES	S				
	1			; ; ; ; ; ;	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	TERS	LIMITS	TS	
			MEAN	STD DEV	MIN	MAX	
Infiltration rate	m/yr	CONSTANT	0.179E-06	-999.	0.100E-09	0.100E+11	
Area of waste disposal unit	m^2	CONSTANT	0.486E+06	-666-	0.100E-01	-666-	
Duration of pulse	yr	CONSTANT	-666-	-666-	0.100E-08	-666-	
Spread of contaminant source	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11	
Recharge rate	m/yr	CONSTANT	0.368E-01	-666-	0.000E+00	0.100E+11	
Source decay constant	1/yr	CONSTANT	0.000E+00	-666-	0.000E+00	-666-	
Initial concentration at landfill	mg/1	CONSTANT	1.00	-666-	0.000E+00	-666-	
Length scale of facility	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11	
Width scale of facility	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11	
Near field dilution		DERIVED	1.00	0.000E+00	0.000E+00	1.00	
	AÇOIFE	AQUIFEK SPECIFIC VAKIABLES	n				
VARTABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	TERS	LIMITS	TS	E E E E E E E E E E E E E E E E E E E
			MEAN	STD DEV	MIN	MAX	
Particle diameter	85	CONSTANT	0.381E-01	-999.	0.100E-08	100.	1
Aquifer porosity	;	CONSTANT	0.430	-666-	0.100E-08	0.990	
Bulk density	g/cc	CONSTANT	1.65	-666-	0.100E-01	5.00	
kness	E	CONSTANT	10.0	-666-	0.100E-08	0.100E+06	
Source thickness (mixing zone depth)	E	DERIVED	-666-	-666-	0.100E-08	0.100E+06	
Conductivity (hydraulic)	m/yr	CONSTANT	130.	-666-	0.100E-06	0.100E+09	
Gradient (hydraulic)		CONSTANT	0.310E-02	-666-	0.100E-07	-666-	
Groundwater seepage velocity	m/yr	DERIVED	-666-	-666-	0.100E-09	0.100E+09	
Retardation coefficient	1	DERIVED	-666-	-666-	1.00	0.100E+09	
Longitudinal dispersivity	ш		-666-	-666-	-666-	-666-	
Transverse dispersivity	E	OF	-666-	-666-	-666-	-666-	
Vertical dispersivity	E	FUNCTION OF X	-666-	-666-	-666-	-666-	
Temperature of aquifer	U	CONSTANT	21.0	-666-	0.000E+00	100.	
Hd	i	CONSTANT	7.20	-666-	0.300	14.0	
Organic carbon content (fraction)		CONSTANT	0.300E-02	-666-	0.100E-05	1.00	
Well distance from site	E	CONSTANT	174.	-666-	1.00	-666-	
Angle off center	degree	CONSTANT	0.000E+00		0.000E+00	360.	
Well vertical distance	E	CONSTANT	0.000E+00	-666-	0.000E+00	1.00	

CONCENTRATION AFTER SATURATED ZONE MODEL 0.1740E-04

APPENDIX F.3 MULTIMED OUTPUT FOR ALTERNATIVE LINER INTERIM CASE 3LOCATION 3



AGENCY ECTION PROT NVIRONMENTAL s. 'n.

MEN MODEL S E S S MULTIMEDIA S A ш EXPOSUR

(Version 1.01, June 1991)

MULTIMED

1 Run options

Location 3 Chemical simulated is DEFAULT CHEMICAL

Case 3

Saturated zone model DETERMIN Run was Infiltration input by user Option Chosen

Gaussian source used in saturated zone model Reject runs if Y coordinate outside plume Reject runs if Z coordinate outside plume Run was steady-state

CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN STD	ETERS STD DEV	LIMITS	TS MAX
Solid phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-966-	0.000E+00	0.100E+11
Dissolved phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	0.100E+11
Overall chemical decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	0.100E+11
Acid catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Base catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Reference temperature	U	CONSTANT	20.0	-666-	0.000E+00	100.
Normalized distribution coefficient	m1/g	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Distribution coefficient	Ĭ	DERIVED	-666-	-666-	0.000E+00	0.100E+11
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	10.0
Reference temperature for air diffusion	U	CONSTANT	0.000E+00 -999.	.666-	0.000E+00	100.
Molecular weight	B/M	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Mole fraction of solute	1	CONSTANT	0.000E+00 -999.	-666-	0.100E-08	1.00
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00 -999	-666-	0.000E+00	100.
	atm-m^3/M	CONSTANT	0.000E+00 -999.	-666-	0.100E-09	1.00
cay sat. zone	1/yr	DERIVED	0.000E+00	0.000E+00 0.000E+00	0.000E+00	1.00
Not currently used		CONSTANT	-666-	-666-	0.000E+00	1.00

Page 1

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	SOURC	SOURCE SPECIFIC VARIABLES			LIMITS	
		ŭ.			£31	
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	TERS	MIM	
			MEAN	STD DEV	100000000	MAX
Infiltration rate	m/yr	CONSTANT	0.179E-06	-966-	0.100E-09	0.100E+11
Area of waste disposal unit	m^2	CONSTANT	0.486E+06	-666-	0.100E-01	-999.
Duration of pulse	۸L	CONSTANT	-999	-666-	0.100E-08	-666-
Spread of contaminant source	, E	DERTVED	666-	666-	9.100F-08	0.100F+11
Recharge rate	m/vr	CONSTANT	0.368E-01	-999.	0.000E+00	0.100E+11
Source decay constant	1/vr	CONSTANT	0.000E+00	-666-	0.000E+00	-666-
Triffial concentration at landfill	L/am	CONSTANT	1 88	- 666-	B BBBE+BB	-666-
	1 0 E	DERTVED	000-	- 666	0 100E-08	0 100F+11
LATE COST OF BOARDS	≣ 8	DEBTYED	.000	. 000	0 100E 00	0 1005-11
Middle Scale Of Tacilly	E	DERIVED	-999.	999.	O GOOF GO	1 99
	AQUIFE	AQUIFER SPECIFIC VARIABLES				
VARTABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	TERS	LIMITS	TS
			MEAN	STD DEV	MIN	MAX
Particle diameter	E	CONSTANT	0.381E-01	-989.	0.100E-08	100.
Adulter noposity	ì	TONSTANT	0 430	666-	9 100F-08	866 8
Bulk density	9/60	CONSTANT	1.65	-666-	0.100E-01	5.00
Aguifer thickness	ĎE	CONSTANT	10.0	-666-	0.100E-08	0.100E+06
Source thickness (mixing zone depth)	E	DERIVED	-999.	-666-	0.100E-08	0.100E+06
raulic)	m/yr	CONSTANT	130.	-666-	0.100E-06	0.100E+09
Gradient (hydraulic)	(i)	CONSTANT	0.310E-02	-666-	0.100E-07	-999.
Groundwater seepage velocity	m/yr	DERIVED	-999.	-666-	0.100E-09	0.100E+09
Retardation coefficient	1	DERIVED	-666-	-666-	1.00	0.100E+09
Longitudinal dispersivity	E	FUNCTION OF X	-666-	-666-	-666-	-666-
Transverse dispersivity	E	FUNCTION OF X	-666-	-666-	-666-	-666-
Vertical dispersivity	E	FUNCTION OF X	-666-	-666-	-666-	-666-
Temperature of aquifer	U	CONSTANT	21.0	-666-	0.000E+00	100.
. Ho	1	CONSTANT	7.20	-666-	0.300	14.0
Organic carbon content (fraction)		CONSTANT	0.300E-02	-666-	0.100E-05	1.00
Well distance from site	E	CONSTANT	219.	-666-	1.00	-666-
Angle off center	degree	CONSTANT	0.000E+00	-666-	0.000E+00	360.

APPENDIX F.4 MULTIMED OUTPUT FOR ALTERNATIVE LINER INTERIM CASE 4LOCATION 4



	AGENCY
CASE4	PROTECTION
	ENVIRONMENTAL
	'n

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ASSESSMENT MULTIMEDIA EXPOSURE

(Version 1.01, June 1991) MULTIMED

1 Run options

Case 4

Location 4 Chemical simulated is DEFAULT CHEMICAL

Saturated zone model DETERMIN Option Chosen

Infiltration input by user

Reject runs if Y coordinate outside plume Reject runs if Z coordinate outside plume

CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DIŞTRIBUTION	PARAMETERS MEAN STD	TERS STD DEV	LIMITS	TS MAX
Solid phase decay coefficient	1/yr	CONSTANT	9.000E+00 -999.	-999,	0.690E+00	0.100E+11
Dissolved phase decay coefficient	1/yr	CONSTANT	9.000E+00 -999.	-666-	9.680E+06	0.100E+11
Overall chemical decay coefficient	1/yr	CONSTANT	9.880E+88 -999,	-666-	9.686E+66	0.1005+11
Acid catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -939.	-989.	0.600E+00	-666-
Meutral hydrolysis rate constant	1/yr	CONSTANT	9.000E+00 -999	-666-	0.696E+66	-666-
Base catalyzed hydrolysis rate	1/M-yr	CONSTANT	6.000E+00 -999,	-999.	0.600E+08	-686-
Reference temperature	U	CONSTANT	20.0	.999.	9.880E+08	199.
Normalized distribution coefficient	m1/g	CONSTANT	6.666E+88 -889.	-666-	9-896E+88	-999-
Distribution coefficient	;	DERIVED	-686-	-989.	9-696E+66	0.100E+11
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.086E+00 -999.	-666-	9.880E+88	-666-
Air diffusion coefficient	cm2/s	CONSTANT	6.000E+00 -999.	-999.	0-600E+60	10.0
Reference temperature for air diffusion	υ	CONSTANT	0.000E+00 -999	.999.	0.800E+90	100.
Molecular weight	8/M	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666°
Mole fraction of solute	1	CONSTANT	8.886E+88 -999,	-666-	9.190E-08	1.00
Vapor pressure of solute	man Tage	CONSTANT	0.000E+80 -999.	-666-	9.888E+88	160.
Henry's law constant an	tm-m^3/M	CONSTANT	6.080E+08 -999.	-666-	0.180E-09	1.90
Overall 1st order decay sat. zone	1/yr	DERIVED	9.000E+00	0.000E+00	9.090E+08	1.99
Not currently used		CONSTANT	.666-	-999.	9.888E+88	1.00

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	SOURC	SOURCE SPECIFIC VARIABLES	- 10			
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VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	TERS	LIMITS	TS
			MEAN	STD DEV	MIN	MAX
Infiltration rate	m/yr	CONSTANT	0.179E-06	-999.	0.100E-09	0.100E+11
Area of waste disposal unit	CVM	CONSTANT	0.486F+06	-666-	0.100E-01	-666-
Dination of miles	1 1/2	TNATANO	- 999	- 666	9 100F-08	666-
מבוסו ס	Š				2001.0	1000
Spread of contaminant source	E	DERIVED	-999.	-888-	0.100E-08	0.100E+11
Recharge rate	m/yr	CONSTANT	0.368E-01	-666-	0.000E+00	0.100E+11
Source decay constant	1/vr	CONSTANT	0.000E+00	-666-	0.000E+00	-666-
Tritial concentration at landfill	L/0m	TUNCTANT	1 00	-000	A BABETAB	-000
	1 /0 1	divited of	0 0		200000000000000000000000000000000000000	1000.11
Length scale of facility	E	DEKIVED	- 777	. 777.	D. TODE-05	O. LOGE+II
Width scale of facility	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11
Near field dilution		DERIVED	1.00	0.000E+00	0.000E+00	1.00
VARTABLE NAME	LINTTS	DISTRIBITION	PARAMETERS	TERS	STIMII	TS
	1	0		1		
	1 1 1 1 1 1 1 1 1		MEAN	STD DEV	MIN	MAX
Particle diameter	E	CONSTANT	0.381E-01	-666-	0.100E-08	100.
Aguifer porosity	1	CONSTANT	0.430	-666-	0.100E-08	0.990
Bulk density	27/0	CONSTANT	1.65	- 666	0.100F-01	5.00
Admiter thickness)) E	TONSTANT	10.01	- 666	0 100F-08	0 100F+06
Compared the Control of the control		DEBTVED	000	000	a 100E-00	A 100E±06
	I .	CONCTANT			1001.0	1001.00
conductivity (nyaraulic)	m/yr	CONSTANT	130.	.999.	0.100E-00	0.100E+09
Gradient (hydraulic)		CONSTANT	0.310E-02	-888-	0.100E-0/	-888-
Groundwater seepage velocity	m/yr	DERIVED	-666-	-666-	0.100E-09	0.100E+09
Retardation coefficient	i	DERIVED	-666-	-666-	1.00	0.100E+09
Longitudinal dispersivity	E	FUNCTION OF X	-666-	-666-	-999	-999.
Transverse dispersivity	E	AO.	666-	666-	-999	-666
Vostanol Annooniet		2 0	000	000	-000	- 000
cicai urspel sivicy	≣ (5				
Temperature of aquiter	ں	CONSTANT	71.6	-888-	D. BODE+DD	100.
Hd	1	CONSTANT	7.20	-666-	0.300	14.0
Organic carbon content (fraction)		CONSTANT	0.300E-02	-666-	0.100E-05	1.00
Well distance from site	E	CONSTANT	402.	-999.	1.00	-666-
Angle off center	degree	CONSTANT	9.000E+00	-999	A ARAFTAR	360
			֡		200000	
		1	1 0 0		0.0001.00	

CONCENTRATION AFTER SATURATED ZONE MODEL 0.3490E-05

APPENDIX F.5 MULTIMED OUTPUT FOR ALTERNATIVE LINER CLOSED CASE 5LOCATION 1



S. ENVIRONMENTAL PROTECTION AGENCY

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EXPOSURE ASSESSMENT

MULTIMEDIA MODEL

MULTIMED (Version 1.01, June 1991)

1 Run options

Case 5

Location 1 Chemical simulated is DEFAULT CHEMICAL Option Chosen Saturated zone model Run was

nul was Infiltration input by user Run was steady-state

Reject runs if Y coordinate outside plume Reject runs if Z coordinate outside plume Gaussian source used in saturated zone model CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	ETERS	LIMITS	TS
			MEAN	STD DEV	MIN	MAX
Solid phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-966-	0.000E+00	0.100E+11
Dissolved phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-999.	0.000E+00	0.100E+11
Overall chemical decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	0.100E+11
Acid catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00 -999	-999.	0.000E+00	-666-
Base catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Reference temperature	U	CONSTANT	20.0	-666-	0.000E+00	100.
Normalized distribution coefficient	m1/g	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Distribution coefficient	i	DERIVED	-666-	-666-	0.000E+00	0.100E+11
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00 -999	-666-	0.000E+00	10.0
Reference temperature for air diffusion	U	CONSTANT	0.000E+00 -999	*666-	0.000E+00	100.
Molecular weight	M/B	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Mole fraction of solute	1	CONSTANT	0.000E+00 -999	-666-	0.100E-08	1.00
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00 -999	-666-	0.000E+00	100.
	atm-m^3/M	CONSTANT	0.000E+00 -999	-666-	0.100E-09	1.00
Overall 1st order decay sat. zone	1/yr	DERIVED	0.000E+00	9.000E+00 0.000E+00	0.000E+00	1.00
Not currently used		CONSTANT	-666-	-666-	0.000E+00	1.00

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	SOURC	SOURCE SPECIFIC VARIABLES				
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	ETERS	LIMITS	
			MEAN	STD DEV	MIN	MAX
Infiltration rate	m/yr	CONSTANT	0.511E-07	-999.	0.100E-09	0.100E+11
Area of waste disposal unit	m^2	CONSTANT	0.486E+06	-666-	0.100E-01	-666-
Duration of pulse	yr	CONSTANT	-666-	-666-	0.100E-08	-666-
Spread of contaminant source	. E	DERIVED	-666-	-666-	0.100E-08	0.100E+11
Recharge rate	m/yr	CONSTANT	0.368E-01	-999.	0.000E+00	0.100E+11
Source decay constant	1/yr	CONSTANT	0.000E+00		0.000E+00	-666-
Initial concentration at landfill	mg/l	CONSTANT	1.00	-666-	0.000E+00	-666-
Length scale of facility	E	DERIVED	-666-	-999	0.100E-08	0.100E+11
Width scale of facility	8	DERIVED	-989.	-999.	0.100E-08	0.100E+11
Near field dilution		DERIVED	1.00	0.000E+00	0.000E+00	1.00
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	ETERS	LIMITS	TS
			MEAN	STD DEV	MIN	MAX
Particle diameter	Ð	CONSTANT	0.381E-01	-999.	0.100E-08	100.
Aquifer porosity	1	CONSTANT	0.430	-999.	0.100E-08	0.990
Bulk density	g/cc	CONSTANT	1.65	-666-	0.100E-01	5.00
Aquifer thickness) E	CONSTANT	10.0	-666-	0.100E-08	0.100E+06
Source thickness (mixing zone depth)	E	DERIVED	-666-	-666-	0.100E-08	0.100E+06
	m/yr	CONSTANT	130.	-999.	0.100E-06	0.100E+09
Gradient (hydraulic)		CONSTANT	0.310E-02	-666-	0.100E-07	-666-
Groundwater seepage velocity	m/yr	DERIVED	-666-	-666-	0.100E-09	0.100E+09
Retardation coefficient	1	DERIVED	-666-	-666-	1.00	0.100E+09
Longitudinal dispersivity	Е	FUNCTION OF X	-666-	-999.	-666-	-666-
Transverse dispersivity	E	FUNCTION OF X	-666-	-666-	-666-	-666-
Vertical dispersivity	Ε	OF	-666-	-666-	-666-	-666-
Temperature of aquifer	U	CONSTANT	21.0	-666-	0.000E+00	100.
	1	CONSTANT	7.20	-666-	0.300	14.0
Organic carbon content (fraction)		CONSTANT	0.300E-02	-999.	0.100E-05	1.00
Well distance from site	E	CONSTANT	67.0	-666-	1.00	-666-
Anala off center	donnah	TNATZNOO	a gagetog	000	O OOOE O	000
100 100 100 100 100 100 100 100 100 100	acgi cc		O. COOFTOO		D. DOOL TOO	.000

APPENDIX F.6 MULTIMED OUTPUT FOR ALTERNATIVE LINER CLOSED CASE 6LOCATION 2



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EXPOSURE ASSESSMENT

MULTIMEDIA MODEL

MULTIMED (Version 1.01, June 1991)

1 Run options

Case 6

Location 2 Chemical simulated is DEFAULT CHEMICAL Option Chosen Saturated zone model Run was

Infiltration input by user Infiltration input by user Run was steady-state Reject runs if Y coordinate outside

Reject runs if Y coordinate outside plume Reject runs if Z coordinate outside plume Gaussian source used in saturated zone model CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN STD	ETERS STD DEV	LIMITS	TS
			100	2		
Solid phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-999.	0.000E+00	0.100E+11
Dissolved phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	0.100E+11
Overall chemical decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	0.100E+11
Acid catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999	-999.	0.000E+00	-666-
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-
Base catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Reference temperature	U	CONSTANT	20.0	-666-	0.000E+00	100.
Normalized distribution coefficient	m1/g	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Distribution coefficient	ŀ	DERIVED	-666-	-666-	0.000E+00	0.100E+11
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	10.0
Reference temperature for air diffusion	U	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	100.
Molecular weight	B/M	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Mole fraction of solute	1	CONSTANT	0.000E+00 -999	-666-	0.100E-08	1.00
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00 -999,	-666-	0.000E+00	100.
	atm-m^3/M	CONSTANT	0.000E+00 -999.	-666-	0.100E-09	1.00
Overall 1st order decay sat. zone	1/yr	DERIVED	0.000E+00	8.000E+00 0.000E+00	0.000E+00	1.00
Not currently used		CONSTANT	-666-	-666-	0.000E+00	1.00

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	SOURCE	SOURCE SPECIFIC VARIABLES	10			
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VARIABLE NAME	SITIO	DISTRIBUTION	PAKAMETEKS MEAN STD	STD DEV	NIN	I.S MAX
Infiltration rate	m/yr	CONSTANT	0.511E-07	-999.	0.100E-09	0.100E+11
Area of waste disposal unit	m^2	CONSTANT	0.486E+06	-666-	0.100E-01	-999.
Duration of pulse	٧٢	CONSTANT	-666-	-666-	0.100E-08	-666-
Spread of contaminant source	E	DERTVED	-999	-666	9.100F-08	0.100F+11
Recharge rate	m/vn	TNOTANT	A 368F-01	666-	B BBBE+BB	0.100F+11
Source decay constant	1/vr	CONSTANT	0.000F+00	-666-	0.000E+00	-666-
Triffial concentration at landfill	L/om	CONSTANT	1.88	- 666	A BABE+BB	-999.
)) E	DERTVED	666-	- 666	0.100F-08	0.100F+11
	Ε Ε	DEPTVED	000	000	0 100E-08	0 100E±11
Near field dilution	1	DERIVED	1.00	0.000E+00	0.000E+00	1.00
VADTADI C MAME	IMTTC	MATTIETOTOTO	DADTHANADAD	CTEBS	OTTMT	TC
VANTABLE NAME	CITNO	MOTIOGTVICTO	IL FUFL		370	
			MEAN	STD DEV	NIW	MAX
Particle diameter	CM	CONSTANT	0.381E-01	-999.	0.100E-08	100.
Aquifer porosity	1	CONSTANT	0.430	-666-	0.100E-08	0.60.0
Bulk density	g/cc	CONSTANT	1.65	-666-	0.100E-01	5.00
Aguifer thickness	E	CONSTANT	10.0	-666-	0.100E-08	0.100E+06
urce thickness (mixing zone depth)	E	DERIVED	-666-	-666-	0.100E-08	0.100E+06
Conductivity (hydraulic)	m/yr	CONSTANT	130.	-666-	0.100E-06	0.100E+09
Gradient (hydraulic)		CONSTANT	0.310E-02	-666-	0.100E-07	-666-
Groundwater seepage velocity	m/yr	DERIVED	-999.	-666-	0.100E-09	0.100E+09
Retardation coefficient	· -	DERIVED	-986	-666-	1.00	0.100E+09
Longitudinal dispersivity	E	FUNCTION OF X	-986-	-666-	-666-	-999.
Transverse dispersivity	Е	FUNCTION OF X	-666-	-666-	-666-	-666-
Vertical dispersivity	E		-999.	-666-	-666-	-666-
Temperature of aquifer	U		21.0	-666-	0.000E+00	100.
-		CONSTANT	7.20	-999	0.300	14.0
Organic carbon content (fraction)		CONSTANT	0.300E-02	-999.	0.100E-05	1.00
Well distance from site	E	CONSTANT	174.	-999	1.00	-666-
Angle off center	degree	CONSTANT	0.000E+00	-666-	0.000E+00	360.

CONCENTRATION AFTER SATURATED ZONE MODEL 0.4968E-05

APPENDIX F.7 MULTIMED OUTPUT FOR ALTERNATIVE LINER CLOSED CASE 7LOCATION 3



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ESSMENT A S S EXPOSURE

MODEL MULTIMEDIA

(Version 1.01, June 1991)

MULTIMED

Location 3 Chemical simulated is DEFAULT CHEMICAL 1 Run options

Case 7

Saturated zone model DETERMIN Run was Infiltration input by user Option Chosen

Reject runs if Y coordinate outside plume Reject runs if Z coordinate outside plume Gaussian source used in saturated zone model Run was steady-state

CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	TERS	LIMITS	TS
			MEAN	STD DEV	MIN	MAX
Solid phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-999.	0.000E+00	0.100E+11
Dissolved phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	0.100E+11
Overall chemical decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	0.100E+11
Acid catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-
Base catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Reference temperature	U	CONSTANT	20.0	-666-	0.000E+00	100.
Normalized distribution coefficient	m1/g	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Distribution coefficient	1	DERIVED	-666-	-666-	0.000E+00	0.100E+11
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	10.0
Reference temperature for air diffusion	U	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	100.
Molecular weight	B/M	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Mole fraction of solute	;	CONSTANT	0.000E+00 -999.	-666-	0.100E-08	1.00
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	100.
	atm-m^3/M	CONSTANT	0.000E+00 -999.	-666-	0.100E-09	1.00
Overall 1st order decay sat, zone	1/yr	DERIVED	0.000E+00	9.000E+00 0.000E+00	0.000E+00	1.00
Not currently used	Ø.	CONSTANT	-666-	-666-	0.000E+00	1.00

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	SOURCE	SOURCE SPECIFIC VARIABLES	12		ŭ	
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN STD	TERS STD DEV	LIMITS	TS MAX
Tofiltoation rate	m/vr	CONSTANT	0 511E_07	000	D 100F-00	0 100E±11
יון דדרו מרדסון ומרב	16/11	HAY HUNGO			0.100L-02	000
Area or waste disposal unit	7.,Ш	CONSTANT	1400	. 77	D. TODE-OI	. 222
Duration of pulse	yr	CONSTANT	-666-	-666-	0.100E-08	-666-
Spread of contaminant source	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11
Recharge rate	m/vr	CONSTANT	0.368E-01	-666-	0.000E+00	0.100E+11
Source decay constant	1/vr	CONSTANT		-666-	8.800F+88	-666-
Tritial concentration at landfill	1/2	TIVETANI	1 00	000	O DOOL TOO	- 000
	T /SIII	CONSTANT	0000		0 1001 00	1007
Length scale of facility	E	DEKIVED	- 222.	-222.	0.100E-08	0.100E+11
Width scale of facility	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11
Near field dilution		DERIVED	1.00	0.000E+00	0.000E+00	1.00
	AQUIFE	AQUIFER SPECIFIC VARIABLES		1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	TERS	LIMITS	TS
			MEAN	STD DEV	MIN	MAX
Particle diameter	E	CONSTANT	0.381E-01	-989.	0.100E-08	100.
Aguifen poposity	1	TONSTANT	02 / 20	-000	A 100F-08	000
Addition policiation	2/20	FINATONO	מין ני	.000	0 100E 00	0000
bulk density	8/ cc	CONSTANT	T.03	. 000	0.1005-01	00.00
	E	CONSTANT	10.0	-888-	9.100E-08	0.100F+05
Source thickness (mixing zone depth)	Е	DERIVED	-666-	-666-	0.100E-08	0.100E+06
Conductivity (hydraulic)	m/yr	CONSTANT	130.	-666-	0.100E-06	0.100E+09
Gradient (hydraulic)		CONSTANT	0.310E-02	-666-	0.100E-07	-666-
Groundwater seepage velocity	m/yr	DERIVED	-999.	-666-	0.100E-09	0.100E+09
Retardation coefficient	1	DERIVED	-666-	-666-	1.00	0.100E+09
Longitudinal dispersivity	E	FUNCTION OF X	-666-	-666-	-666-	-666-
Transverse dispersivity	E	OF	-999	- 666	-999	- 666
Vertical dispersivity	E		-666	-666-	-666	-666
Temperature of addition	١ ر	i	21.0	- 666	A ABAFTAR	188
ביייוליני מינמי כי מקמדייני	, ¦	CONSTANT	7 20	- 666	9 388	14.0
Juneania control (Lucation)		THATCHOO	רט שממר מ	. 000	1001 0	000
Organic carbon content (traction)		CONSTANT	0.388E-82	.888-	0.100E-05	T.00
Well distance from site	E	CONSTANT	219.	-666-	1.00	-666-
Angle off center	degree	CONSTANT	0.000E+00	-666-	0.000E+00	360.
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APPENDIX F.8 MULTIMED OUTPUT FOR ALTERNATIVE LINER CLOSED CASE 8LOCATION 4



AGENCY PROTECTION NVIRONMENTA S

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MODEL MULTIMEDIA MULTIMED (Version 1.01, June 1991)

Case 8

Run options

Location 4 Chemical simulated is DEFAULT CHEMICAL

Saturated zone model DETERMIN Option Chosen

Infiltration input by user Run was steady-state

Reject runs if Y coordinate outside plume Reject runs if Z coordinate outside plume Gaussian source used in saturated zone model

CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	ETERS	LIMITS	TS
			MEAN	STD DEV	MIN	MAX
Solid phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-999.	0.000E+00	0.100E+11
Dissolved phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	0.100E+11
Overall chemical decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	0.100E+11
Acid catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-
Base catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Reference temperature	U	CONSTANT	20.0	-666-	0.000E+00	100.
Normalized distribution coefficient	m1/g	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Distribution coefficient	I	DERIVED	-666-	-666-	0.000E+00	0.100E+11
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00 -999.	-999.	0.000E+00	10.0
Reference temperature for air diffusion	U	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	100.
Molecular weight	B/M	CONSTANT	0.000E+00 -999.	-999.	0.000E+00	-666-
Mole fraction of solute	1	CONSTANT	0.000E+00 -999.	-666-	0.100E-08	1.00
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00 -999.	-999.	0.000E+00	100.
Henry's law constant	atm-m^3/M	CONSTANT	0.000E+00 -999.	-666-	0.100E-09	1.00
Overall 1st order decay sat, zone	1/yr	DERIVED	0.000E+00	0.000E+00 0.000E+00	0.000E+00	1.00
Not currently used	2000	CONSTANT	666-	666-	A BRAFTON	1 88

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	SOURC	SOURCE SPECIFIC VARIABLES	992			
VARTABLE NAME	LINTTS	DISTRIBITION	PARAMETERS	TERS	STIMI	
			MEAN	STD DEV	MIN	MAX
Infiltration rate	m/vr	CONSTANT	0.511E-07	-966-	0.100E-09	0.100E+11
Area of waste disposal unit	CVM	CONSTANT	0.486F+06	- 666	B 188F-81	- 999
Duration of pulse	1 2	CONSTANT	-666-	-666-	0 100F-08	-666-
The second of th	5 1	CLATAGO			1001	2001
predu or contaminant source	■	CONCEANT	-999.	.666-	0.100E-08	0.100E+11
Recharge rate	m/yr	CONSTANT	0.358E-01	-888-	D. DODE+DO	0.100E+11
Source decay constant	1/yr	CONSTANT	0.000E+00	-666-	0.000E+00	-666-
Initial concentration at landfill	mg/1	CONSTANT	1.00	-666-	0.000E+00	-666-
	E	DERTVED	-666	-666	8-100F-08	0.100F+11
Width scale of facility	Ε	DERTVEN	000	000	a 100E-08	O TOOF 11
Noon field dilition		DEBTVED	.00	a aggerage	O TOOK OO	1 99
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	ETERS	LIMITS	
			MEAN	STD DEV	MIN	MAX
Particle diameter	CM	CONSTANT	0.381E-01	-999.	0.100E-08	100.
Aquifer porosity	1	CONSTANT	0 430	666-	0 100F-08	866
Bully donnists	2/20	THATSHOO	200	.000	0.100E 00	000
יייי אויייי	1 P	HIS HUNGO	1.00	.000	0.1005-01	2001.00
	E	CONSTANT	10.0	-888-	0.100E-08	0.100E+00
Source thickness (mixing zone depth)	E	DERIVED	-666-	-666-	0.100E-08	0.100E+06
Conductivity (hydraulic)	m/yr	CONSTANT	130.	-666-	0.100E-06	0.100E+09
Gradient (hydraulic)		CONSTANT	0.310E-02	-666-	0.100E-07	-666-
Groundwater seepage velocity	m/vr	DERIVED	-986-	-666-	0.100E-09	0.100E+09
Retardation coefficient	· ;	DERTVED	-999	- 666	1.00	0.100F+09
opentudinal dispersivity	Ε	FINCTION OF X	- 000	-000	- 000	- 999
מופורממיומי מוחלים מדגדר)		5 6				
Iransverse dispersivity	E	5	-888-	-888-	-888-	-888-
Vertical dispersivity	E	FUNCTION OF X	-666-	-666-	-666-	-666-
Temperature of aquifer	U	CONSTANT	21.0	-666-	0.000E+00	100.
-	1	CONSTANT	7.20	-666-	0.300	14.0
Organic carbon content (fraction)		CONSTANT	0.300E-02	-999.	0.100E-05	1.00
Well distance from site	E	CONSTANT	402.	- 666	1.00	-666
Angle off center	dograp	TNATANT	D DODETOD		00. TOOO C	
ווצדר כון ככווכנו					2221+22	722
::	4-8-6		0.0005+00		0.000E+00	300.

APPENDIX F.9 MULTIMED OUTPUT FOR ALTERNATIVE LINER/OVERLINER INTERIM CASE 10L-LOCATION 1



U.S. ENVIRONMENTAL PROTECTION AGENCY

EXPOSURE ASSESSMENT

MULTIMEDIA MODEL

MULTIMED (Version 1.01, June 1991)

1 Run options

CASE10L

Location 1 Chemical simulated is DEFAULT CHEMICAL Option Chosen Saturated zone model Run was

Infiltration input by user Run was steady-state

Reject runs if Y coordinate outside plume Reject runs if Z coordinate outside plume Gaussian source used in saturated zone model CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN STD	STD DEV	LIMITS	TS MAX
Solid phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-999.	0.000E+00	0.100E+11
Dissolved phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	0.100E+11
Overall chemical decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	0.100E+11
Acid catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-
Base catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Reference temperature	U	CONSTANT	20.0	-666-	0.000E+00	100.
Normalized distribution coefficient	ml/g	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Distribution coefficient	!	DERIVED	-666-	-666-	0.000E+00	0.100E+11
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	10.0
Reference temperature for air diffusion	U	CONSTANT	0.000E+00 -999	-666-	0.000E+00	100.
Molecular weight	B/M	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-
Mole fraction of solute	1	CONSTANT	0.000E+00 -999.	-666-	0.100E-08	1.00
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	100.
Henry's law constant	atm-m^3/M	CONSTANT	0.000E+00 -999.	-666-	0.100E-09	1.00
Overall 1st order decay sat. zone	1/yr	DERIVED	0.000E+00	0.000E+00 0.000E+00	0.000E+00	1.00
Not currently used		CONSTANT	-666-	-666-	0.000E+00	1.00

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TANA TI GATONY	SOURCE	SOLIBCE SPECTETS WARTABLES				
VADTADI E NAME		SPECIFIC VANIABLES				
VANTABLE IVALIE	UNITS	DISTRIBUTION	PARAMETERS	TERS	LIMITS	rs Ts
			MEAN	STD DEV	MIN	MAX
Infiltration rate	m/yr	CONSTANT	0.179E-06	-999.	0.100E-09	0.100E+11
Area of waste disposal unit	m^2	CONSTANT	0.486E+06	-666-	0.100E-01	-666-
Duration of pulse	yr	CONSTANT	-666-	-666-	0.100E-08	-666-
Spread of contaminant source	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11
Recharge rate	m/yr	CONSTANT	0.368E-01	-666-	0.000E+00	0.100E+11
Source decay constant	1/vr	CONSTANT	0.000E+00	-666-	0.000E+00	-666-
Initial concentration at landfill	me/l	CONSTANT	1.00	-666-	0.000E+00	-666-
	Ë	DERTVED	-666-	-999.	0.100F-08	0.100F+11
Width scale of facility	E	DERTVED	666-	- 999	0 100F-08	0 100F+11
Near field dilution		DERIVED	1.00	0.000F+00	0.000E+00	1.00
	AQUIFER	AQUIFER SPECIFIC VARIABLES				
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	ETERS	LIMITS	LS
			MEAN	STD DEV	MIN	MAX
Particle diameter	Cm	CONSTANT	0.381E-01	-999.	0.100E-08	100.
Aquifer porosity	3	CONSTANT	0.430	-666-	0.100E-08	0.990
Bulk density	g/cc	CONSTANT	1.65	-999.	0.100E-01	5.00
Aquifer thickness	E	CONSTANT	10.0	-666-	0.100E-08	0.100E+06
Source thickness (mixing zone depth)	E	DERIVED	-986-	-666-	0.100E-08	0.100E+06
	m/vr	CONSTANT	130.	-666-	0.100E-06	0.100E+09
Gradient (hydraulic)		CONSTANT	0.200E-02	-999.	0.100E-07	-999.
Groundwater seepage velocity	m/yr	DERIVED	-666-	-666-	0.100E-09	0.100E+09
Retardation coefficient	١	DERIVED	-666-	-666-	1.00	0.100E+09
Longitudinal dispersivity	Е	FUNCTION OF X	-989.	-666-	-989.	-999.
Transverse dispersivity	В	FUNCTION OF X	-666-	-666-	-989.	-666-
Vertical dispersivity	8	FUNCTION OF X	-999.	-666-	-999.	-666-
Temperature of aquifer	U	CONSTANT	21.0	-666-	0.000E+00	100.
	1	CONSTANT	7.20	-666-	0.300	14.0
Organic carbon content (fraction)		CONSTANT	0.300E-02	-666-	0.100E-05	1.00
		THE POST OF	(0		000
ll distance from site	E	CONSTANT	58.8	-888-	1.00	-888-
Well distance from site Angle off center d	degree	CONSTANT	58.8 0.000E+00		1.00 0.000E+00	-999. 360.

CONCENTRATION AFTER SATURATED ZONE MODEL 0.5320E-04

APPENDIX F.10 MULTIMED OUTPUT FOR ALTERNATIVE LINER/OVERLINER INTERIM CASE 2OL-LOCATION 2



A G CASE2OL T E C T I O N P R O IRONMENTAL ENV s.

MODEL MULTIMEDIA

SESSMENT

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EXPOSURE

MULTIMED (Version 1.01, June 1991)

Run options

CASE20L

Location 2 Chemical simulated is DEFAULT CHEMICAL

Saturated zone model DETERMIN Option Chosen

Reject runs if Y coordinate outside plume Infiltration input by user Run was steady-state

Reject runs if Z coordinate outside plume Gaussian source used in saturated zone model

CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN STD	STD DEV	LIMITS	TS MAX
Solid phase decay coefficient	1/vr	CONSTANT	0.000E+00 -999	-999.	0.000E+00	0.100E+11
Dissolved phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	
Overall chemical decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	0.100E+11
Acid catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-
Base catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-
Reference temperature	U	CONSTANT	20.0	-666-	0.000E+00	100.
Normalized distribution coefficient	m1/g	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Distribution coefficient	-	DERIVED	-666-	-666-	0.000E+00	0.100E+11
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	10.0
Reference temperature for air diffusion	U	CONSTANT	0.000E+00 -999	-666-	0.000E+00	100.
Molecular weight	B/M	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-
Mole fraction of solute	i	CONSTANT	0.000E+00 -999	-666-	0.100E-08	1.00
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	100.
	atm-m^3/M	CONSTANT	0.000E+00 -999.	-666-	0.100E-09	1.00
Overall 1st order decay sat. zone	1/yr	DERIVED	0.000E+00	9.000E+00 0.000E+00	0.000E+00	1.00
Not currently used		CONSTANT	-666-	-666-	0.000E+00	1.00

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Not currently used	K ::	CASE20L CONSTANT	-666-	-666-	0.000E+00	1.00	
	SOURCE	SOURCE SPECIFIC VARIABLES					
				•			
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	TERS	LIMITS	TS	
			MEAN	STD DEV	MIN	MAX	
Infiltration rate	m/yr	CONSTANT	0.153E-06	-999.	0.100E-09	0.100E+11	¥2
Area of waste disposal unit	m^2	CONSTANT	0.486E+06		0.100E-01	-666-	
Duration of pulse	yr	CONSTANT	-666-	-666-	0.100E-08	-666-	
Spread of contaminant source	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11	
Recharge rate	m/yr	CONSTANT	0.368E-01	-999.	0.000E+00	0.100E+11	
Source decay constant	1/yr	CONSTANT	0.000E+00	-666-	0.000E+00	-666-	
Initial concentration at landfill	mg/1	CONSTANT	1.00	-999.	0.000E+00	-666-	
Length scale of facility	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11	
Width scale of facility	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11	
Near field dilution		DERIVED	1.00	0.000E+00	0.000E+00	1.00	
	AQUIFER	AQUIFER SPECIFIC VARIABLES	10				
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	ETERS	LIMITS	TS	
			MEAN	STD DEV	MIN	MAX	
Particle diameter	W)	CONSTANT	0.381E-01	-999.	0.100E-08	100.	
Aquifer porosity	1	CONSTANT	0.430	-666-	0.100E-08	0.990	
Bulk density	g/cc	CONSTANT	1.65	-666-	0.100E-01	5.00	
	8	CONSTANT	10.0	-666-	0.100E-08	0.100E+06	
Source thickness (mixing zone depth)	E	DERIVED	-666-	-666-	0.100E-08	0.100E+06	
Conductivity (hydraulic)	m/yr	CONSTANT	130.	-999.	0.100E-06	0.100E+09	
Gradient (hydraulic)		CONSTANT	0.200E-02	- 666-	0.100E-07	-999.	
Groundwater seepage Velocity	m/yr	DEKIVED	- 666	. 666	0.100E-09	0.100E+09	
constitution dispositivity		ELINCTION OF Y	.000	.000	000	-000	
Transverse dispersivity	≣	2 9	-666	-666-	-666-	-666-	
Vertical dispersivity	. ∈	FUNCTION OF X	-666	-666	-666-	-666	
Temperature of aquifer	U		21.0	-666-	0.000E+00	100.	
Hd	1	CONSTANT	7.20	-666-	0.300	14.0	
Organic carbon content (fraction)		CONSTANT	0.300E-02		0.100E-05	1.00	
Well distance from site	E	CONSTANT	168.		1.00	.666-	
Angle off center	degree	CONSTANT	0.000E+00		0.000E+00	360.	
Well vertical distance	E	CONSTANT	0.000E+00	*666-	0.000E+00	1.00	

APPENDIX F.11

MULTIMED OUTPUT FOR ALTERNATIVE LINER/OVERLINER INTERIM CASE 3OL-LOCATION 3



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ASSESSMENT EXPOSURE

MODEL MULTIMEDIA MULTIMED (Version 1.01, June 1991)

CASE30L

Run options

Location 3 Chemical simulated is DEFAULT CHEMICAL

Saturated zone model DETERMIN Reject runs if Y coordinate outside plume Reject runs if Z coordinate outside plume Gaussian source used in saturated zone model Infiltration input by user Run was steady-state Option Chosen Run was

CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	ETERS	LIMITS	TS	
			MEAN	STD DEV	MIN	MAX	
Solid phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-999.	0.000E+00	0.100E+11	
Dissolved phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-989.	0.000E+00	0.100E+11	
Overall chemical decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-999.	0.000E+00	0.100E+11	
Acid catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-	
Base catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-	
Reference temperature	U	CONSTANT	20.0	-999.	0.000E+00	100.	
Normalized distribution coefficient	m1/g	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Distribution coefficient	1	DERIVED	-666-	-666-	0.000E+00	0.100E+11	
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	10.0	
Reference temperature for air diffusion	U	CONSTANT	0.000E+00 -999	-666-	0.000E+00	100.	
Molecular weight	B/M	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-	
Mole fraction of solute	E	CONSTANT	0.000E+00 -999	-666-	0.100E-08	1.00	
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	100.	
Henry's law constant	atm-m^3/M	CONSTANT	0.000E+00 -999.	-666-	0.100E-09	1.00	
Overall 1st order decay sat, zone	1/yr	DERIVED	0.000E+00	0.000E+00 0.000E+00	0.000E+00	1.00	
Not currently used		CONSTANT	-666-	- 666-	0.00E+00	1.00	

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VARIBLE NAME NULLS DISTRIBUTION PARAMETERS NULLS	Not currently used		CASE30L CONSTANT	.999.		0.000E+00	1.00	
International Distribution Datameters Distribution Distrib		SOURC	SPECIFIC VARIABLES					
E UNITS DISTRIBUTION PARAMETERS LIMIT Machine								
#EAM STD DEV MIN ##AM STD DEV 100E-09 ##AM STD DEV 100E-09 ##AM STD DEV 0.100E-09 ##AM STD DEV 0.100E-08 ##AM STD DEV 0.100E-08 ##AM STD DEV MIN VARIABLE NAME	UNITS	DISTRIBUTION	RAMET	; ; ; ;	1	1	I I I	
nit m/yr CONSTANT 0.153E-06 -999. 0.100E-09 o.00STANT 0.486E+06 -999. 0.100E-08 o.00STANT 0.486E+06 -999. 0.100E-08 o.00STANT 0.999. 0.999. 0.100E-08 o.00STANT 0.368E-01 -999. 0.100E-08 o.00STANT 0.00STANT 0.368E-01 -999. 0.100E-08 o.00STANT 0.00STANT 0.368E-01 -999. 0.100E-08 o.00STANT 0.00STANT 0.999. 0.999. 0.100EE-08 o.00STANT 0.999. 0.999. 0.100E-08 o.00STANT 0.999. 0.999. 0.100E-08 o.00STANT 0.999. 0.999. 0.100E-08 o.00STANT 0.430 0.999. 0.100E-08 o.00STANT 0.20G-099. 0.100E-09 o.100E-09 o.00STANT 0.20G-0-999. 0.100E-09 o.00STANT 0.00STANT 0						NIN	MAX	
The continue contin	Infiltration rate	m/yr	CONSTANT			100E-09	0.100E+11	
The constraint 1999, 199	Area of waste disposal unit	m^2	CONSTANT			100E-01	-666-	
DERIVED 0.999. 0.100E-08 0.100E-08 0.100E-08 0.100E+00 1/yr CONSTANT 0.000E+00 0.999. 0.000E+00 0.000E	Duration of pulse	y	CONSTANT			100E-08	-666-	
March	Spread of contaminant source	E	DERIVED			100E-08	0.100E+11	
Tandfill	Recharge rate	m/yr	CONSTANT			999E+99	0.100E+11	
Jandfill mg/l CONSTANT 1.00 -999. 0.000E+00	Source decay constant	1/vr	CONSTANT			999E+99	-999.	
DERIVED -999. -999. 0.100E-08 DERIVED -999. -999. 0.100E-08 DERIVED -999. -999. 0.100E-08 O.000E+00		me/l	CONSTANT			999E+99	-999.	
DERIVED 1.00 0.000E+00 0.000E+00 0.000E+00 DERIVED 1.00 0.000E+00 0.000E+00 DERIVED 1.00 0.000E+00 0.000E+00 DERIVED DISTRIBUTION PARAMETERS LIMIT		E	DERIVED			100E-08	0.100E+11	
DERIVED 1.00 0.000E+00 0.000E+00 0.000E+00	width scale of facility	E	DERIVED			100E-08	0.100E+11	
AQUIFER SPECIFIC VARIABLES AQUIFER SPECIFIC VARIABLES MEAN STD DEV MIN	Wear field dilution		DERIVED		E+00	999E+99	1.00	
CONSTANT		AQUIFE	R SPECIFIC VARIABLES	10				
units distribution Parameters Limit Limit Constraint 0.381E-01-999 MIN MEAN STD DEV MIN CONSTANT 0.430 -999, 0.100E-08 G/C CONSTANT 10.0 -999, 0.100E-08 0.100E-08 m/yr CONSTANT 130999, 0.100E-08 0.100E-07 m/yr CONSTANT 130999, 0.100E-07 0.00STANT 0.200E-02-999, 0.100E-07 0.00STANT 0.299, -999, 0.100E-07 0.00STANT 0.299, -999, 0.100E-07 0.00STANT 0.300E-02-999, 0.999, 0.999, 0.100E-05 0.00STANT 0.300E-02-999, 0.100E-05 0.00STANT 0.300E-02-999, 0.100E-05 0.00STANT 0.300E-02-999, 0.000SE+00 0.00STANT 0.000E+00 0.000E+00 0.00STANT 0.00STANT 0.000E+00 0.000E+00 0.00STANT 0.00STANT 0.000E+00 0.000E+00 0.00STANT 0.00STANT 0.000E+00 0.000E+00 0.00STANT 0.00STANT 0.000E+00 0.00SE+00 0.00STANT 0.00STA								
Cm CONSTANT 0.381E-01 -999. MIN cm CONSTANT 0.430 -999. 0.100E-08 CONSTANT 0.430 -999. 0.100E-08 g/cc CONSTANT 1.65 -999. 0.100E-08 m CONSTANT 130999. 0.100E-08 m/yr CONSTANT 130999. 0.100E-09 DERIVED -999999. 0.100E-09 DERIVED -999999. 0.100E-09 m/yr DERIVED -999999. 0.100E-09 constant 7.20 -999999999. c CONSTANT 7.20 -999. 0.100E-05 m CONSTANT 7.20 -999. 0.100E-05 m CONSTANT 0.000E+00 -999. 0.000E+00 degree CONSTANT 0.000E+00 -999. 0.000E+00								
mean STD DEV MIN Cm CONSTANT 0.381E-01 -999. 0.100E-08 CONSTANT 1.65 -999. 0.100E-08 g/cc CONSTANT 1.65 -999. 0.100E-08 m CONSTANT 130999. 0.100E-08 m/yr CONSTANT 0.200E-02 -999. 0.100E-07 CONSTANT 0.200E-02 -999. 0.100E-07 m/yr DERIVED -999999. 0.100E-09 DERIVED -999999. 0.100E-09 m FUNCTION OF X -999999. 0.100E-09 m FUNCTION OF X -999999. 0.909. C CONSTANT 21.0 -999. 0.300E-00 C CONSTANT 21.0 -999. 0.100E-05 C CONSTANT 21.0 -999. 0.100E-05 C CONSTANT 23.0 -999. 0.100E-05 CONSTANT 23.0 -999. 0.000E+00 GONSTANT 0.000E+00 -999. 0.000E+00 CONSTANT 0.000E+00 -999. 0.000E+00	VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMI	TS.	
cm CONSTANT 0.381E-01 -999. 0.100E-08 CONSTANT 1.65 -999. 0.100E-08 CONSTANT 1.65 -999. 0.100E-08 CONSTANT 1.65 -999. 0.100E-08 CONSTANT 10.0 -999. 0.100E-08 CONSTANT 130999. 0.100E-08 CONSTANT 0.200E-02 -999. 0.100E-07 DERIVED -999999. 0.100E-07 DERIVED -999999. 0.100E-09 DERIVED -999999. 0.100E-09 DERIVED -999999. 0.100E-09 CONSTANT 7.20 -999. 0.999. 0.999. 0.100E-09 CONSTANT 7.20 -999. 0.100E-05 CONSTANT 7.20 -999. 0.000E+00 CONSTANT 0.000E+00 -999. 0.000E+00								
e depth) m CONSTANT 1.65 -999. 0.100E-08 CONSTANT 1.65 -999. 0.100E-08 CONSTANT 1.65 -999. 0.100E-08 CONSTANT 1.65 -999. 0.100E-08 0.100E-08 CONSTANT 130999. 0.100E-08 CONSTANT 130999. 0.100E-08 0.100E-08 0.100E-07 0.00STANT 0.999999. 0.100E-09 0.000E+00 0.	Particle diameter	CM	CONSTANT	1		100E-08	100.	! ! ! !
g/cc CONSTANT 1.65 -999. 0.100E-01 m CONSTANT 10.0 -999. 0.100E-08 m/yr CONSTANT 130999. 0.100E-08 constant 0.200E-02 -999. 0.100E-08 constant 0.200E-02 -999. 0.100E-07 constant 0.299999. 0.100E-09 m/yr DERIVED -999999. 0.100E-09 m FUNCTION OF X -999999999. c CONSTANT 2.00 -999999. c CONSTANT 2.00 -999999. c CONSTANT 2.00 -999. 0.100E-05 c CONSTANT 2.00 -999. 0.000E+00 degree CONSTANT 2.38999. 0.000E+00 c CONSTANT 0.000E+00 -999. 0.000E+00	Aquifer porosity	1	CONSTANT			100E-08	0.990	
e depth) m CONSTANT 10.0 -999. 0.100E-08 m/yr CONSTANT 130999. 0.100E-08 m/yr CONSTANT 130999. 0.100E-08 0.100E-08 constant berner 130999. 0.100E-06 0.100E-07 0.999. 0.100E-07 0.999. 0.100E-09 0.000E+00 0.00	Bulk density	g/cc	CONSTANT			100E-01	5.00	
e depth) m DERIVED -999999. 0.100E-08 CONSTANT 130999. 0.100E-08 CONSTANT 130999. 0.100E-06 CONSTANT 130999. 0.100E-06 0.100E-07 0.200E-02 -999. 0.100E-07 0.200E-07 0.999. 0.100E-07 0.999. 0.100E-09 0.100E-09 0.100E-09 0.999. 0.100E-09 0.999. 0.999. 0.999. 0.999. 0.999. 0.999. 0.999. 0.999. 0.999. 0.100E-09 0.200STANT 7.20 0.999. 0.100E-05 CONSTANT 7.20 0.999. 0.100E-05 CONSTANT 7.20 0.999. 0.100E-05 0.000E+00 0.000STANT 0.999. 0.999. 0.000E+00 0.000STANT 0.999. 0.000E+00 0.000E+	Aquifer thickness	E	CONSTANT			100E-08	0.100E+06	
m/yr CONSTANT 130999. 0.100E-06 CONSTANT 0.200E-02 -999. 0.100E-07 -999. 0.100E-07 -999. 0.100E-07 -999. 0.100E-07 -999. 0.100E-07 -999. 0.100E-09 0.000E+00 0.000E		E	DERIVED			100E-08	0.100E+06	
CONSTANT 0.200E-02 -999. 0.100E-07 m/yr DERIVED -999999. 0.100E-09 DERIVED -999999. 1.00 m FUNCTION OF X -999999999. m FUNCTION OF X -999999999. C CONSTANT 21.0 -999. 0.000E+00 CONSTANT 0.300E-02 -999. 0.100E-05 CONSTANT 238999. 0.100E-05 CONSTANT 238999. 0.100E-05 CONSTANT 0.000E+00 -999. 0.000E+00 degree CONSTANT 0.000E+00 -999. 0.000E+00 CONSTANT 0.000E+00 -999. 0.000E+00		m/yr	CONSTANT			100E-06	0.100E+09	
m/yr DERIVED -999, -999, 0.1006-09 DERIVED -999, -999, 1.00 FUNCTION OF X -999, -999, -999, FUNCTION OF X -999, -999, -999, CONSTANT 21.0 -999, 0.000E+00 CONSTANT 7.20 -999, 0.300E CONSTANT 7.20 -999, 0.100E-05 CONSTANT 7.20 -999, 0.100E-05 CONSTANT 238, -999, 0.000E+00 CONSTANT 238, -999, 0.000E+00 CONSTANT 238, -999, 0.000E+00 CONSTANT 0.000E+00 -999, 0.000E+	Gradient (hydraulic)		CONSTANT			100E-07	-666-	
DERIVED -999, -999, 1.00 m FUNCTION OF X -999, -999	Groundwater seepage velocity	m/yr	DERIVED			100E-09	0.100E+09	
Densivity m FUNCTION OF X -999, -999	Retardation coefficient	i i	DERIVED			.00	0.100E+09	
raivity m FUNCTION OF X -999.	Longitudinal dispersivity	E	OF			.66	-666-	
ivity m FUNCTION OF X -996=+09 -9999999999=+09 -9999999=+0999999=+099=+099=+099=+099=+099=+099=+099	Transverse dispersivity	E	OF			.66	-666-	
quifer C CONSTANT 21.0 -999. 0.000E+00 ontent (fraction) CONSTANT 7.20 -999. 0.300 om site CONSTANT 0.300E-02 -999. 0.100E-05 om site CONSTANT 238. -999. 1.00 degree CONSTANT 0.000E+00 -999. 0.000E+00 stance m CONSTANT 0.000E+00 -999. 0.000E+00	Vertical dispersivity	E	OF			.66	-666-	
CONSTANT 7.20 -999. 0.300 -0300 -	Temperature of aquifer	U	CONSTANT			000E+00	100.	
Ontent (fraction) CONSTANT 0.300E-02 -999. 0.100E-05 on site CONSTANT 238999. 1.00 odegree CONSTANT 0.000E+00 -999. 0.000E+00 stance m CONSTANT 0.000E+00 -999. 0.000E+00	Hd	1	CONSTANT			300	14.0	
om site m CONSTANT 238999. 1.00 - degree CONSTANT 0.000E+00 -999. 0.000E+00 stance m CONSTANT 0.000E+00 -999. 0.000E+00	Organic carbon content (fraction)		CONSTANT			100E-05	1.00	
degree CONSTANT 0.000E+00 -999. 0.000E+00 stance m CONSTANT 0.000E+00 -999. 0.000E+00	Well distance from site	ш	CONSTANT			.00	-666-	
stance m CONSTANT 0.000E+00 -999. 0.000E+00	Angle off center	degree	CONSTANT			000E+00	360.	
	Well vertical distance	E	CONSTANT		VE	000E+00	1.00	

APPENDIX F.12

MULTIMED OUTPUT FOR ALTERNATIVE LINER/OVERLINER INTERIM CASE 40L-LOCATION 4



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U. S.

ESSMENT MODEL ASS MULTIMEDIA EXPOSURE

(Version 1.01, June 1991)

MULTIMED

CASE40L

1 Run options

Location 4 Chemical simulated is DEFAULT CHEMICAL

Saturated zone model DETERMIN Run was Infiltration input by user Option Chosen

Run was steady-state

Reject runs if Y coordinate outside plume Reject runs if Z coordinate outside plume Gaussian source used in saturated zone model

CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN STD	STD DEV	LIMITS	TS MAX	2 oğ
Solid phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-999.	0.000E+00	0.100E+11	
Dissolved phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	0.100E+11	
Overall chemical decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	0.100E+11	
Acid catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-	
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-	
Base catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Reference temperature	U	CONSTANT	20.0	-666-	0.000E+00	100.	
Normalized distribution coefficient	m1/g	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Distribution coefficient	i	DERIVED	-666-	-666-	0.000E+00	0.100E+11	
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	10.0	
Reference temperature for air diffusion	U	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	100.	
Molecular weight	B/M	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-	
Mole fraction of solute	1	CONSTANT	0.000E+00 -999.	-666-	0.100E-08	1.00	
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00 -999	-666-	0.000E+00	100.	
Henry's law constant	atm-m^3/M	CONSTANT	0.000E+00 -999.	-666-	0.100E-09	1.00	
Overall 1st order decay sat. zone	1/yr	DERIVED	0.000E+00	0.000E+00 0.000E+00	0.000E+00	1.00	
Not currently used	æ	CONSTANT	-666-	-666-	0.000E+00	1.00	

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SOURCE SPECIFIC VARIABLES NATION NEAR STD DEV MIN	SOURCE SPECIFIC VARIABLES SIE NAME			E SPECIFIC VARIABLES	10				
NET	NET		SOURC						
STATE STRIBUTION PARAMETERS LINITY STD DEV MIN	NEANE UNITS DISTRIBUTION PARAMETERS LINUTION NEAN STD DEV MIN MIN MIN CONSTANT 0.153E-06 -999. 0.100E-09 0.100								
Name	Name	VARIABLE NAME	UNITS	DISTRIBUTION	PARAMI	TERS	1		
March	March		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		NICOTO I	200	NOTE	SCI.	
March	March	filtration rate	m/yr	CONSTANT	0.153E-06	-666-	0.100E-09	0.100E+11	
yr CONSTANT -999999. 0.100E-08 m DERIVED -999999. 0.000E-08 1/yr CONSTANT 0.000E+00 -999. 0.000E+00 mg/l CONSTANT 1.000 -999. 0.000E+00 mg/l CONSTANT 1.000 -999. 0.000E+00 DERIVED -999. 0.000E+00 0.000E+00 0.000E+00 DERIVED -999999. 0.100E-08 cm CONSTANT 0.381E-01 -999. 0.100E-08 m/yr CONSTANT 10.0 0.999. 0.100E-09 m/yr CONSTANT 0.200E-02 -999. 0.100E-09 m/yr CONSTANT 0.200-999. 0.100E-09 m/yr DERIVED -999999. 0.100E-09 m FUNCTION OF X -999999. 0.100E-09 m FUNCTION OF X -999999. 0.100E-09 m FUNCTION OF X -999999. 0.100E-09 m CONSTANT 7.20 -999. 0.300E-09 m CONSTANT 837999. 0.100E-09	yr CONSTANT -999999. 0.100E-08 m		m^2	CONSTANT	0.486E+06	-666-	0.100E-01	-666-	
m DERIVED -999999. 0.100E-08 (17/yr CONSTANT 0.000E+00 -999. 0.000E+00 0.	m DERIVED -999999. 0.100E-08 (17/yr CONSTANT 0.000E+00 -999. 0.000E+00 0.	ration of pulse	yr	CONSTANT	-666-	-666-	0.100E-08	-666-	
March	m/yr CONSTANT 0.368E-01 -999. 0.000E+00 1/yr CONSTANT 0.000E+00 -999. 0.000E+00 m DERIVED -999999. 0.000E+00 m DERIVED -999999. 0.100E-08 DERIVED -999999. 0.100E-08 1.00 0.000E+00 DERIVED -999. 0.100E-08 1.00 0.000E+00 DERIVED -999. 0.100E-08 0.100E-08 1.00 0.381E-01 -999. 0.100E-08 CM CONSTANT 0.381E-01 -999. 0.100E-08 CONSTANT 10.0 0.999. 0.100E-08 1.00 0.300E-09 1.00 0.	read of contaminant source	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11	
1/yr CONSTANT 0.000E+00 -999. 0.000E+00 mg/l CONSTANT 1.00 -999. 0.100E+00 0.000E+00 0	1/yr CONSTANT 0.000E+00 -999. 0.000E+00 mg/l CONSTANT 1.00 -999. 0.100E+00 0.000E+00 mg/l CONSTANT 1.00 -999. 0.100E-08 0.000E+00 0.000E	charge rate	m/yr	CONSTANT	0.368E-01	-666-	0.000E+00	0.100E+11	
mg/1 CONSTANT 1.00 -999. 0.000E+00	March	urce decay constant	1/yr	CONSTANT	0.000E+00	-666-	0.000E+00	-666-	
M	Main	itial concentration at landfill	mg/1	CONSTANT	1.00	-666-	0.000E+00	-666-	
DERIVED	DERIVED	ngth scale of facility	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11	
AQUIFER SPECIFIC VARIABLES AQUIFER SPECIFIC VARIABLES UNITS DISTRIBUTION PARAMETERS LIMIT Cm CONSTANT 0.381E-01 -999. 0.100E-08 CONSTANT 1.65 -999. 0.100E-08 CONSTANT 1.65 -999. 0.100E-08 CONSTANT 1.65 -999. 0.100E-08 m CONSTANT 1.69 -999. 0.100E-08 m/yr CONSTANT 0.200E-02 -999. 0.100E-09 CONSTANT 0.200E-02 -999. 0.100E-09 DERIVED -999999. 0.100E-09 DERIVED -999. 0.100E-09 DERIV	DERIVED 1.00 0.000E+00 0.000E+00 0.000E+00 O.000E+00 O.000E+00 O.000E+00 O.000E+00 O.000E+00 O.000E+00 O.00TS DESTRIBUTION PARAMETERS LIMIT MEAN STD DEV MIN STD DEV MIN O.00STANT 0.430 0.999. 0.100E-08 O.00STANT 0.430 0.999. 0.100E-08 O.00STANT 0.20E-0999. 0.100E-08 O.00STANT 0.20E-0999. 0.100E-08 O.00STANT 0.20E-0999. 0.100E-08 O.00STANT 0.20E-0999. 0.100E-09 O.00STANT 0.20E-0999. 0.100E-09 O.00STANT 0.20E-0999. 0.100E-09 O.00SE-099 O.00SE-0999. 0.100E-09 O.00SE-0999. 0.20E-0999. 0.20E-09999. 0.20E-09999	Ath scale of facility	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11	
AQUIFER SPECIFIC VARIABLES UNITS DISTRIBUTION PARAMETERS LIMIT Com CONSTANT 0.381E-01 -999. 0.100E-08 0.00STANT 0.430 -999. 0.100E-08 0.100E-09	AQUIFER SPECIFIC VARIABLES UNITS DISTRIBUTION PARAMETERS LIMIT Cm CONSTANT 0.381E-01 -999. 0.100E-08 CONSTANT 1.65 -999. 0.100E-08 g/cc CONSTANT 1.65 -999. 0.100E-08 m CONSTANT 10.0 -999. 0.100E-08 m/yr CONSTANT 130999. 0.100E-09 CONSTANT 130999. 0.100E-09 DERIVED -999999. 0.100E-09 CONSTANT 2.20 -999. 0.300E-09 CONSTANT 387999. 0.300E-09 CONSTANT 8387999. 0.000E+00 CONSTANT 8387999. 0.000E+00 CONSTANT 8387999. 0.000E+00 CONSTANT 0.000E+00 -999. 0.000E+00	ar field dilution		DERIVED	1.00	0.000E+00	0.000E+00	1.00	
cm CONSTANT 0.381E-01 -999. MIN CONSTANT 0.430 -999. 0.100E-08 0.100E-09 0.1	cm CONSTANT 0.381E-01 -999. MIN CONSTANT 0.381E-01 -999. 0.100E-08 0.005TANT 0.430 -999. 0.100E-08 0.100E-08 0.005TANT 0.430 -999. 0.100E-08 0.100E-09 0.000E+00 0.000	VADTABLE MAME	INTTC	MOTERIAL	MAGAG	ETEDC	TMT	TC	
cm CONSTANT 0.381E-01-999. 0.100E-08 constant constant 0.430 -999. 0.100E-08 constant constant 1.65 -999. 0.100E-08 constant m CONSTANT 1.65 -999. 0.100E-08 constant m/yr constant 0.200E-02 -999. 0.100E-08 constant m/yr constant 0.200E-02 -999. 0.100E-09 constant berick of constant constant 21.0 -999. 0.999. 0.100E-09 constant constant 0.300E-09 consocration) m FUNCTION OF X -999999. 0.900E+09 constant 0.300E-09 0.999. 0.900E+09 0.900E+09 0.909. 0.900E+09 0.909. 0.900E+09 0.999. 0.900E+09 0.999. 0.900E+09 0.900E+09 0.999. 0.900E+09 0.900E+09 0.999. 0.900E+09 0.900E+09 0.900E+09 0.999. 0.900E+09 0.900E+09 0.900E+09 0.999. 0.900E+09 0.900E+09 0.900E+09 0.900E+09 0.900E+09 0.900E+09 0.999. 0.900E+09 0.	Constant	VAKIABLE NAME	ONTIS	DISTRIBUTION	PAKAM	ELEKS			
cm CONSTANT 0.381E-01-999. 0.100E-08 CONSTANT 1.65 -999. 0.100E-08 zone depth) m DERIVED -999999. 0.100E-08 m/yr CONSTANT 130999. 0.100E-08 constant 0.200E-02-999. 0.100E-08 constant 0.200E-02-999. 0.100E-08 constant 0.200E-02-999. 0.100E-07 DERIVED -999999. 0.100E-09 m/yr DERIVED -999. 0.100E-09 DERIVED -999999. 0.100E-09 m FUNCTION OF X -999999999. c C CONSTANT 21.0 -999. 0.000E+00 c CONSTANT 7.20 -999. 0.300 constant 0.300E-09 constant 0.300E-09 degree CONSTANT 8.387999. 0.000E+00	cm CONSTANT 0.381E-01-999. 0.100E-08 CONSTANT 1.65 -999. 0.100E-08 zone depth) m DERIVED -999. 0.100E-08 m/yr CONSTANT 130999. 0.100E-08 constant 0.200E-02-999. 0.100E-08 constant berived -999. 0.100E-08 constant 0.200E-02-999. 0.100E-07 constant 0.200E-02-999. 0.100E-07 m/yr DERIVED -999999. 0.100E-07 DERIVED -999999. 0.100E-07 m FUNCTION OF X -999999999. c CONSTANT 21.0 -999. 0.000E+00 c CONSTANT 21.0 -999. 0.000E+00 constant 0.300E-02-999. 0.100E-05 constant 0.300E-02-999. 0.100E-05 constant 0.300E-02-999. 0.000E+00 constant 0.300E+00 constant 0.000E+00 constan				MEAN	STD DEV	MIN	MAX	
g/cc CONSTANT 0.430 -999. 0.100E-08 consTANT 1.65 -999. 0.100E-08 consTANT 1.65 -999. 0.100E-08 consTANT 1.65 -999. 0.100E-08 consTANT 10.0 -999. 0.100E-08 consTANT 130999. 0.100E-08 consTANT 130999. 0.100E-08 consTANT 0.200E-02 -999. 0.100E-09 consTANT 0.200E-02 -999. 0.100E-09 consTANT 0.999999. 0.100E-09 consTANT 0.999999. 0.100E-09 consTANT 0.300E-09 consTANT 0.000E+00 consT	CONSTANT 0.430 -999 0.100E-08	rticle diameter	8	CONSTANT	0.381E-01	-666-	0.100E-08	100.	
g/cc CONSTANT 1.65 -999. 0.100E-01 zone depth) m DERIVED -999. 0.100E-08 zone depth) m DERIVED -999. 0.100E-08 CONSTANT 130999. 0.100E-08 CONSTANT 0.200E-02 -999. 0.100E-06 CONSTANT 0.200E-02 -999. 0.100E-07 DERIVED -999999. 0.100E-09 m FUNCTION OF X -999999. 0.999. m FUNCTION OF X -999999999. C CONSTANT 21.0 -999. 0.300E-00 C CONSTANT 7.20 -999. 0.300 C CONSTANT 7.20 -999. 0.100E-05 C CONSTANT 7.20 -999. 0.100E-05 CONSTANT 7.20 -999. 0.100E-05 CONSTANT 7.20 -999. 0.100E-05 CONSTANT 7.20 -999. 0.100E-05 CONSTANT 387999. 0.000E+00	g/cc CONSTANT 1.65 -999. 0.100E-01 constant 10.0 -999. 0.100E-08 constant 10.0 -999. 0.100E-08 constant 10.0 -999. 0.100E-08 constant 10.0 -999. 0.100E-08 constant 0.200E-02 -999. 0.100E-09 iity m/yr DERIVED -999999. 0.100E-09 m FUNCTION OF X -999999. 1.00 c CONSTANT 21.0 -999999. c CONSTANT 21.0 -999. 0.000E+00 c CONSTANT 21.0 -999. 0.000E+00 constant 0.300E-02 -999. 0.100E-05 constant 0.300E-02 -999. 0.000E+00 constant 0.300E-02 -999. 0.000E+00 constant 0.300E+00 -999. 0.000E+00 constant 0.000E+00 -999. 0.000E+00 constant 0.000E+00 -999. 0.000E+00	uifer porosity	1	CONSTANT	0.430	-666-	0.100E-08	066.0	
zone depth) m CONSTANT 10.0 -999. 0.100E-08 0.100E-08 m/yr CONSTANT 130999. 0.100E-08 0.100E-08 0.100E-08 0.100E-08 0.100E-08 0.100E-09 0.100E-09 0.100E-09 0.100E-09 0.100E-07 0.200E-02 -999. 0.100E-07 0.100E-07 0.200E-09 0.100E-09 0.000E+00 0	zone depth) m CONSTANT 10.0 -999. 0.100E-08 CONSTANT 13.0 -999. 0.100E-08 0.100E-08 0.00STANT 13.0 -999. 0.100E-08 0.100E-08 0.00STANT 13.0 -999. 0.100E-08 0.100E-07 0.20STANT 0.200E-02 -999. 0.100E-07 0.100E-07 0.20STANT 0.999. 0.999. 0.100E-09 0.1000E-09 0.100E-09	1k density	g/cc	CONSTANT	1.65	-666-	0.100E-01	5.00	
zone depth) m DERIVED -999999. 0.100E-08 CONSTANT 130999. 0.100E-08 0.100E-08 0.100E-08 0.100E-08 0.100E-08 0.100E-09 0.000E+00 0.	zone depth) m DERIVED -999999. 0.100E-08 CONSTANT 130999. 0.100E-08 CONSTANT 130999. 0.100E-08 CONSTANT 130999. 0.100E-06 CONSTANT 0.200E-02 -999. 0.100E-07 OF X -999. 0.999. 0.100E-09 OF X -999. 0.999. 0.100E-09 OF X -999. 0.999. 0.999. 0.999. 0.999. 0.999. 0.999. 0.999. 0.000E+00 CONSTANT 21.0 0.300E-09 OF X -999. 0.300 OF X ONSTANT 387. 0.999. 0.000E+00 ONSTANT 387. 0.999. 0.000E+00 ONSTANT 387. 0.999. 0.000E+00 ONSTANT 0.000E+00 OF X -999. 0.000E+00 ONSTANT 0.000E+00 OF X -999. 0.000E+00 ONSTANT 0.000E+00 OF X -999. 0.000E+00 OF X -9	uifer thickness	E	CONSTANT	10.0	-666-	0.100E-08	0.100E+06	
ity CONSTANT 130999. 0.100E-06 CONSTANT 0.200E-02 -999. 0.100E-07 CONSTANT 0.200E-02 -999. 0.100E-07 CONSTANT 0.200E-02 -999. 0.100E-09 0.100E-	ity CONSTANT 130999. 0.100E-06 CONSTANT 0.200E-02 -999. 0.100E-07 CONSTANT 0.200E-02 -999. 0.100E-07 CONSTANT 0.200E-02 -999. 0.100E-09 0.000E+00 0.000E+	urce thickness (mixing zone depth)	E	DERIVED	-666-	-666-	0.100E-08	0.100E+06	
ity m/yr DERIVED -999999. 0.100E-07 DERIVED -999999. 1.00 DERIVED -999999. 1.00 DERIVED -999999. 1.00 FUNCTION OF X -999999999. C CONSTANT 21.0 -999999. CONSTANT 7.20 -999. 0.300E-08 CONSTANT 7.20 -999. 0.100E-05 C CONSTANT 7.20 -999. 0.100E-05 CONSTANT 8.30E-02-999. 0.100E-05 CONSTANT 8.30E-02-999. 0.000E+00 CONSTANT 8.30F999. 0.000E+00	ity m/yr DERIVED -999999. 0.100E-07	nductivity (hydraulic)	m/yr	CONSTANT	130.	-666-	0.100E-06	0.100E+09	
unndwater seepage velocity m/yr DERIVED -999. -999. -999. 0.100E-09 -ardation coefficient DERIVED -999. -999. 1.00 DERIVED -999. -999. 1.00 -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -999. -9	unndwater seepage velocity m/yr DERIVED -999. -999. -999. -100E-09 -ardation coefficient DERIVED -999. -999. -999. 1.00 nn FUNCTION OF X -999. -999. -999. nn FUNCTION OF X -999. -999. -999. constant C CONSTANT 21.0 -999. -999. constant C CONSTANT 7.20 -999. -999. constant C CONSTANT 7.20 -999. -999. constant Constant 0.300E-02 -999. 1.00E-05 constant constant 0.000E+00 9.99. 0.000E+00 degree constant 0.000E+00 999. 0.000E+00 constant 0.000E+00 999. 0.000E+00 0.000E+00	adient (hydraulic)		CONSTANT	0.200E-02	-666-	0.100E-07	-666-	
DERIVED999, -999, 1.00 gitudinal dispersivity m FUNCTION OF X -999, -999, -999, -999, nnsverse dispersivity m FUNCTION OF X -999, -	CONSTANT	oundwater seepage velocity	m/yr	DERIVED	-999.	-666-	0.100E-09	0.100E+09	
FUNCTION OF X -999, -990, -999, -999, -999, -999, -999, -999, -999, -990, -990, -990, -990, -990, -990, -990, -990, -990, -990, -990, -990, -990, -990, -990, -990, -990	Heat dispersivity m	tardation coefficient	1	DERIVED	-666-	-666-	1.00	0.100E+09	
insverse dispersivity m FUNCTION OF X -999	Total dispersivity	ngitudinal dispersivity	E	OF	-666-	-666-	-666-	-666-	
tical dispersivity	tical dispersivity	ansverse dispersivity	ш	OF	-999.	-999.	-666-	-666-	
perature of aquifer C CONSTANT 21.0 -999. 0.000E+00 0.300 0.300 0.300 0.300 0.300 0.300 0.300 0.300 0.300 0.300 0.300 0.0010 0.300 0.0010 0.300 0.0010 0.300 0.0010 0.300 0.0010 0.300 0.0010 0.300 0.0010 0.300 0.0010 0.0	perature of aquifer	rtical dispersivity	Ε	OF	-999.	-666-	-666-	-666-	
CONSTANT 7.20 -999. 0.380	CONSTANT 7.20 -999. 0.380	mperature of aquifer	U	CONSTANT	21.0	-666-	0.000E+00	100.	
(fraction) m CONSTANT 0.300E-02 -999. 0.100E-05 consTANT 387999. 1.00 degree CONSTANT 0.000E+00 -999. 0.000E+00	(fraction) m CONSTANT 0.300E-02 -999. 0.100E-05 constant 387999. 1.00 degree CONSTANT 0.000E+00 -999. 0.000E+00 m CONSTANT 0.000E+00 -999. 0.000E+00		1	CONSTANT	7.20	-666-	0.300	14.0	
degree CONSTANT 387999. 1.80 -0005+00 -999. 0.000E+00	degree CONSTANT 387, -999, 1.00 - CONSTANT 0.000E+00 -999, 0.000E+00 m CONSTANT 0.000E+00 -999, 0.000E+00			CONSTANT	0.300E-02	-666-	0.100E-05	1.00	
degree CONSTANT 0.000E+00 -999. 0.000E+00	degree CONSTANT 0.000E+00 -999. 0.000E+00 m CONSTANT 0.000E+00 -999. 0.000E+00		E	CONSTANT	387.	-666-	1.00	-666-	
	m CONSTANT 0.000E+00 -999. 0.000E+00	gle off center	degree	CONSTANT	0.000E+00		0.000E+00	360.	
m CONSTANT 0.000E+00 -999. 0.000E+00		ll vertical distance	E	CONSTANT	0.000E+00		0.000E+00	1.00	

APPENDIX F.13 MULTIMED OUTPUT FOR ALTERNATIVE LINER/OVERLINER CLOSED CASE 5OL-LOCATION 1



AGEN ECTION PROT NVIRONMENTAL s

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MEN S E S S S A ш EXPOSUR

MODEL MULTIMEDIA

(Version 1.01, June 1991)

MULTIMED

1 Run options

CASESOL

Location 1 Chemical simulated is DEFAULT CHEMICAL

Saturated zone model DETERMIN Run was Infiltration input by user Option Chosen

Reject runs if Y coordinate outside plume Reject runs if Z coordinate outside plume Gaussian source used in saturated zone model Run was steady-state

CHEMICAL SPECIFIC VARIABLES

		DISTRIBUTION	PARAMETERS MEAN STD	STD DEV	LIMITS	TS MAX	- 3
Solid phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-999.	0.000E+00	0.100E+11	Ö
Dissolved phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	0.100E+11	
Overall chemical decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	0.100E+11	
Acid catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-	
Base catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-	
Reference temperature	·	CONSTANT	20.0	-666-	0.000E+00	100.	
Normalized distribution coefficient	m1/g	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Distribution coefficient	1	DERIVED	-666-	-666-	0.000E+00	0.100E+11	
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00 -999	-666-	0.000E+00	10.0	
Reference temperature for air diffusion	Ú	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	100.	
Molecular weight	B/M	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Mole fraction of solute	. !	CONSTANT	0.000E+00 -999.	-666-	0.100E-08	1.00	
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	100.	
	atm-m^3/M	CONSTANT	0.000E+00 -999.	-666-	0.100E-09	1.00	
Overall 1st order decay sat. zone	1/yr	DERIVED	0.000E+00	3.000E+00 0.000E+00	0.000E+00	1.00	
Not currently used	8	CONSTANT	-666-	-999.	0.000E+00	1.00	

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NARIABLE NAME	VARIABLE NAME							
UNITS DISTRIBUTION PARAMETERS LIMIT MEAN STD DEV MIN MIN	VARIABLE NAME	SOURC	E SPECIFIC VARIABLES	-				
MILTS DISTRIBUTION PARAMETERS LIMITITY DISTRIBUTION PARAMETERS LIMITITY DISTRIBUTION PARAMETERS LIMITITY DISTRIBUTION	VARIABLE NAME							
m/yr CONSTANT 0.511E-07-999. 0.100E-09 m/2 CONSTANT 0.486E+06-999. 0.100E-01 m/yr CONSTANT 0.999999. 0.100E-08 m/yr CONSTANT 0.999999. 0.100E-08 m/yr CONSTANT 0.600E+00 -999. 0.000E+00 mg/l CONSTANT 0.600E+00 -999. 0.000E+00 mg/l CONSTANT 1.00 -999. 0.100E-08 m DERIVED -999. 0.100E-08 m DERIVED -999. 0.100E-08 m DERIVED -999. 0.100E-08 cm DERIVED -999. 0.100E-08 m DERIVED -999. 0.100E-08 m CONSTANT 0.381E-01-999. 0.100E-08 m CONSTANT 1.65 -999. 0.100E-08 m M/yr CONSTANT 1.65 -999. 0.100E-08 m M/yr CONSTANT 0.381E-01-999. 0.100E-08 m M/yr CONSTANT 0.200E-02-999. 0.100E-09 m M/yr DERIVED -999. 0.100E-09 m FUNCTION OF X -999999. 0.100E-09 m CONSTANT 0.200E-02-999. 0.100E-09 m FUNCTION OF X -999999. 0.100E-09 m CONSTANT 0.200E-02-999. 0.100E-09		UNITS	DISTRIBUTION	PARAM	ETERS STD DEV	1	1	
Mark	filtration rate	m/yr	CONSTANT	0.511E-07		0.100E-09	0.100E+11	
yr CONSTANT -999999. 0.100E-08 m/yr CONSTANT 0.368E-01 -999. 0.100E-08 1/yr CONSTANT 0.000E+00 -999. 0.000E+00 mg/l CONSTANT 0.000E+00 -999. 0.000E+00 mg/l CONSTANT 0.000E+00 -999. 0.000E+00 mm DERIVED -999. 0.100E-08 DERIVED -999. 0.100E-08 AQUIFER SPECIFIC VARIABLES cm CONSTANT 0.381E-01 -999. 0.100E-08 g/cc CONSTANT 0.381E-01 -999. 0.100E-08 m/yr CONSTANT 0.200E-02 -999. 0.100E-08 m/yr DERIVED -999. 0.100E-08 m/yr DERIVED -999. 0.100E-08 m/yr DERIVED -999. 0.100E-08 m/yr DERIVED -999. 0.100E-09 m FUNCTION OF X -999999. 0.100E-09 m CONSTANT 0.300E-02 -999. 0.100E-09 m FUNCTION OF X -999999. 0.100E-09 m CONSTANT 0.300E-02 -999. 0.100E-09 m CONSTANT 0.000E+00 -999. 0.100E-09 m CONSTANT 0.000E+00 -999. 0.100E-09 m CONSTANT 0.000E+00 -999. 0.000E+00		m^2	CONSTANT	0.486E+06		0.100E-01	.666-	
March	ration of pulse	y	CONSTANT	-666-	-666-	0.100E-08	-666-	
Mily	read of contaminant source	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11	
1/yr	charge rate	m/yr	CONSTANT	0.368E-01		0.000E+00	0.100E+11	
Miles	nurce decay constant	1/yr	CONSTANT	0.000E+00		0.000E+00	-666-	
Mark	nitial concentration at landfill	mg/1	CONSTANT	1.00	-666-	0.000E+00	-666-	
DERIVED	ngth scale of facility	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11	
AQUIFER SPECIFIC VARIABLES AQUIFER SPECIFIC VARIABLES UNITS DISTRIBUTION PARAMETERS LIMIT CONSTANT 0.381E-01-999. 0.100E-08 CONSTANT 1.65 -999. 0.100E-08 CONSTANT 1.65 -999. 0.100E-08 M/yr CONSTANT 0.200E-02-999. 0.100E-08 m/yr DERIVED -999. 0.100E-08 m/yr DERIVED -999. 0.100E-08 m/yr DERIVED -999. 0.100E-08 m/yr DERIVED -999. 0.100E-09 m FUNCTION OF X -999999. 0.100E-09 m FUNCTION OF X -999999. 0.100E-09 c CONSTANT 21.0 -999. 0.100E-09 m FUNCTION OF X -999999. 0.100E-09 c CONSTANT 21.0 -999. 0.300E-09 degree CONSTANT 0.300E-02-999. 0.100E-09 m CONSTANT 0.300E-02-999. 0.100E-05 m CONSTANT 0.300E-02-999. 0.100E-05 m CONSTANT 0.300E-02-999. 0.000E+00 m CONSTANT 0.000E+00 -999. 0.000E+00	dth scale of facility	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11	
AQUIFER SPECIFIC VARIABLES UNITS DISTRIBUTION PARAMETERS LIMIT CCM CONSTANT 0.381E-01 -999. 0.100E-08 CCNSTANT 1.65 -999. 0.100E-08 CCNSTANT 10.0 -999. 0.100E-08 m/yr CONSTANT 130999. 0.100E-08 m/yr CONSTANT 0.200E-02 -999. 0.100E-09 m/yr DERIVED -999. 0.100E-09 m/yr DERIVED -999. 0.100E-09 m FUNCTION OF X -999999. 0.100E-09 m FUNCTION OF X -999999. 0.100E-09 CC CONSTANT 21.0 -999999. m FUNCTION OF X -999999. 0.100E-09 C CONSTANT 21.0 -999. 0.300 C CONSTANT 21.0 -999. 0.300 degree CONSTANT 8.80 -999. 0.300 m CONSTANT 58.0 -999. 0.100E-05 m CONSTANT 8.80 -999. 0.000E+00 degree CONSTANT 8.000E+00 -999. 0.000E+00	ear field dilution		DERIVED	1.00	0.000E+00	0.000E+00	1.00	
CMITS DISTRIBUTION PARAMETERS LIMIT CM CONSTANT 0.381E-01 -999. 0.100E-08 CONSTANT 1.65 -999. 0.100E-08 g/cc CONSTANT 1.65 -999. 0.100E-08 m/yr CONSTANT 130999. 0.100E-08 m/yr CONSTANT 130999. 0.100E-08 m/yr CONSTANT 0.200E-02 -999. 0.100E-09 DERIVED -999. 0.100E-09 m/yr DERIVED -999. 0.100E-09 m/yr DERIVED -999999. 0.100E-09 m FUNCTION OF X -999999. 0.999. C CONSTANT 2.40 -999. 0.300E-00 C CONSTANT 7.20 -999. 0.100E-09 m CONSTANT 0.300E-02 -999. 0.100E-09 degree CONSTANT 0.300E-02 -999. 0.100E-09 m CONSTANT 5.80 -999. 0.100E-09 m CONSTANT 5.80 -999. 0.100E-09 m CONSTANT 0.300E-09 0.100E-09 m CONSTANT 0.300E-09 0.000E+00 m CONSTANT 0.000E+00 -999. 0.000E+00 m CONSTANT 0.000E+00 -999. 0.000E+00		AQUIFE	R SPECIFIC VARIABLES	10				
UNITS DISTRIBUTION PARAMETERS LIMIT Cm CONSTANT 0.381E-01 -999. 0.100E-08 - CONSTANT 0.430 -999. 0.100E-08 m CONSTANT 1.65 -999. 0.100E-08 m CONSTANT 10.0 -999. 0.100E-08 m/yr CONSTANT 130. -999. 0.100E-08 m/yr CONSTANT 0.200E-02 -999. 0.100E-08 m/yr DERIVED -999. 0.100E-09 m FUNCTION OF X -999. -999. m FUNCTION OF X -999. -999. m FUNCTION OF X -999. -999. c CONSTANT 7.20 -999. m FUNCTION OF X -999. -999. m FUNCTION OF X -999. -999. c CONSTANT 0.300E-02 -999. m CONSTANT 0.300E-02 m CONSTANT 0.000E+00 -999.								
CCM CONSTANT 0.381E-01 -999. 0.100E-08 0.100E-09 0.000E+00 0.000E+	VARTABLE NAME	UNITS	DISTRIBUTION	PARAM	ETERS	IMIT	TS	1
Cm CONSTANT 0.381E-01 -999. 0.100E-08 CONSTANT 1.65 -999. 0.100E-08 g/cc CONSTANT 1.65 -999. 0.100E-08 m DERIVED -999. 0.100E-08 m/yr CONSTANT 180999. 0.100E-08 m/yr CONSTANT 0.200E-02 -999. 0.100E-07 m/yr DERIVED -999. 0.100E-09 DERIVED -999. 0.100E-09 m FUNCTION OF X -999999. 0.100E-09 m FUNCTION OF X -999999. 0.999. 0.000E+00 C CONSTANT 0.300E-02 -999. 0.300 CONSTANT 0.300E-02 -999. 0.000E+00 CONSTANT 0.300E-02 -999. 0.000E+00 CONSTANT 0.300E-02 -999. 0.000E+00 CONSTANT 0.300E-02 -999. 0.000E+00 CONSTANT 0.000E+00 -999. 0.000E+00 CONSTANT 0.000E+00 -999. 0.000E+00 CONSTANT 0.000E+00 -999. 0.000E+00				MEAN	STD DEV			
	ırticle diameter	W5	CONSTANT	0.381E-01	1	0.100E-08	100.	
g/cc CONSTANT 1.65 -999, 0.100E-01 m CONSTANT 10.0 -999, 0.100E-08 m/yr CONSTANT 0.200E-02 -999, 0.100E-06 constant 0.200E-02 -999, 0.100E-07 m/yr DERIVED -999, -999, 0.100E-09 m FUNCTION OF X -999, -999, 0.100E-09 m FUNCTION OF X -999, -999, 0.100E-09 c CONSTANT 21.0 -999, -999, 0.000E+00 c CONSTANT 0.300E-02 -999, 0.100E-05 c CONSTANT 0.300E-02 -999, 0.100E-05 c CONSTANT 0.300E-02 -999, 0.100E-05 m CONSTANT 0.300E-02 -999, 0.000E+00 c CONSTANT 0.000E+00 -999, 0.000E+00 degree CONSTANT 0.000E+00 -999, 0.000E+00 m CONSTANT 0.000E+00 -999, 0.000E+00	quifer porosity	1	CONSTANT	0.430	-666-	0.100E-08	0.66.0	
m CONSTANT 10.0 -999. 0.100E-08 m/yr CONSTANT 130999. 0.100E-08 CONSTANT 0.200E-02 -999. 0.100E-06 CONSTANT 0.200E-02 -999. 0.100E-07 DERIVED -999999. 1.00 FUNCTION OF X -999999. 1.00 CONSTANT 21.0 -999999. C CONSTANT 21.0 -999999999 CONSTANT 7.20 -999. 0.000E+00 C CONSTANT 7.20 -999. 0.100E-05 C CONSTANT 7.20 -999. 0.100E-05 C CONSTANT 7.20 -999. 0.100E-05 C CONSTANT 0.300E-02 -999. 0.100E-05 C CONSTANT 0.000E+00 -999. 0.000E+00 C CONSTANT 0.000E+00 -999. 0.000E+00	alk density	g/cc	CONSTANT	1.65	-666-	0.100E-01	2.00	
m/yr CONSTANT 130999. 0.100E-08 CONSTANT 130999. 0.100E-08 CONSTANT 0.200E-02 -999. 0.100E-06 CONSTANT 0.200E-02 -999. 0.100E-07 -999. 0.100E-09 CONSTANT 0.2009999. 0.100E-09 CCCONSTANT 0.300E-02 -999999999. 0.999. 0.999. 0.999. 0.300 CCCONSTANT 7.20 -999. 0.300 CCCONSTANT 7.20 -999. 0.100E-05 CCCONSTANT 7.20 -999. 0.100E-05 CCCONSTANT 0.300E-02 -999. 0.100E-05 CCONSTANT 0.300E-02 -999. 0.000E+00 CCNSTANT 0.000E+00 -999. 0.000E+00 CCNSTANT 0.000E+00 -999. 0.000E+00 CONSTANT 0.000E+00 -9999. 0.000E+00 CONSTANT 0.000E+00 -9999. 0.000E+00 CONSTANT 0.000E+00 -9999. 0.000E+00 CONSTANT 0.000E+00 -9999. 0.000E+0	quifer thickness	E	CONSTANT	10.0	-666-	0.100E-08	0.100E+06	
m/yr CONSTANT 130999. 0.100E-06 CONSTANT 0.200E-02 -999. 0.100E-07 -999. 0.100E-07 -999. 0.100E-07 -999. 0.100E-09 -999. 0.100E-09 -999. 0.100E-09 -999. 0.100E-09 -999. 0.999. 0.999. 0.999. 0.999. 0.999. 0.999. 0.999. 0.999. 0.000E+00 -999. 0.100E-05 CONSTANT 0.300E-02 -999. 0.100E-05 CONSTANT 0.300E-02 -999. 0.100E-05 CONSTANT 0.300E-02 -999. 0.100E-09 0.000E+00 0.000E+00 -999. 0.000E+00 0	ource thickness (mixing zone depth	E	DERIVED	-666-	-666-	0.100E-08	0.100E+06	
CONSTANT 0.200E-02 -999. 0.100E-07 m/yr DERIVED -999999. 0.100E-09 DERIVED -999999. 1.00 m FUNCTION OF X -999999999. C CONSTANT 21.0 -999999. CONSTANT 7.20 -999. 0.000E+00 CONSTANT 0.300E-02 -999. 0.100E-05 CONSTANT 0.300E-02 -999. 0.100E-05 CONSTANT 0.300E-02 -999. 0.100E-05 CONSTANT 0.300E-02 -999. 0.000E+00 CONSTANT 0.000E+00 -999. 0.000E+00 CONSTANT 0.000E+00 -999. 0.000E+00	anductivity (hydraulic)	m/yr	CONSTANT	130.	-666-	0.100E-06	0.100E+09	
m/yr DERIVED -999999. 0.100E-09 DERIVED -999999. 1.00 -999999. 1.00 -999999. 1.00 -999999999. -999999999. C CONSTANT 21.0 -999999. C CONSTANT 7.20 -999. 0.000E+00 C CONSTANT 0.30E-02 -999. 0.100E-05 m CONSTANT 58.0 -999. 1.00 degree CONSTANT 0.000E+00 -999. 0.000E+00 m CONSTANT 0.000E+00 -999. 0.000E+00	'adient (hydraulic)		CONSTANT	0.200E-02		0.100E-07	-666-	
DERIVED -999999. 1.00 m FUNCTION OF X -999999999. m FUNCTION OF X -999999999. C CONSTANT 21.0 -999999. C CONSTANT 7.20 -999. 0.000E+00 CONSTANT 58.0 -999. 0.100E-05 m CONSTANT 58.0 -999. 0.000E+00 degree CONSTANT 0.000E+00 0.000E+	oundwater seepage velocity	m/yr	DERIVED	-666-	-666-	0.100E-09	0.100E+09	
m FUNCTION OF X -999	standation coefficient	1	DERIVED	-666-	-666-	1.00	0.100E+09	
m FUNCTION OF X -999999999999. CONSTANT 21.0 -999. 0.000E+00 0.300 0.300E-02 -999. 0.100E-05 0.300E-02 -999. 0.100E-05 0.300E-02 -999. 0.100E-05 0.00STANT 8.80 -999. 0.000E+00 0.000E+00 0.000E+00 -999. 0.000E+00 0.000	ungitudinal dispersivity	E	N OF	-666-	-666-	-666-	-666-	
C CONSTANT 21.0 -999	ansverse dispersivity	E	OF	-666-	-666-	-666-	-666-	
C CONSTANT 21.0 -999. 0.000E+00 CONSTANT 7.20 -999. 0.300 CONSTANT 0.300E-02 -999. 0.100E-05 CONSTANT 58.0 -999. 1.00 degree CONSTANT 0.000E+00 -999. 0.000E+00 m CONSTANT 0.000E+00 -999. 0.000E+00	ertical dispersivity	E	OF	-666-	-666-	-666-	-666-	
CONSTANT 7.20 -999. 0.300 CONSTANT 0.300E-02 -999. 0.100E-05 CONSTANT 58.0 -999. 1.00 degree CONSTANT 0.000E+00 -999. 0.000E+00 m CONSTANT 0.000E+00 -999. 0.000E+00	emperature of aquifer	U	CONSTANT	21.0	-666-	0.000E+00	100.	
CONSTANT 0.300E-02 -999. 0.100E-05 CONSTANT 58.0 -999. 1.00 1.00 CONSTANT 0.000E+00 -999. 0.000E+00 CONSTANT 0.000E+00 -999. 0.000E+00		1	CONSTANT	7.20	-666-	0.300	14.0	
degree CONSTANT 58.0 -999. 1.00 degree CONSTANT 0.000E+00 -999. 0.000E+00 m CONSTANT 0.000E+00 -999. 0.000E+00	'ganic carbon content (fraction)		CONSTANT	0.300E-02		0.100E-05	1.00	
degree CONSTANT 0.000E+00 -999. 0.000E+00 m CONSTANT 0.000E+00 -999. 0.000E+00	all distance from site	E	CONSTANT	58.0		1.00	-666-	
m CONSTANT 0.000E+00 -999. 0.000E+00	ngle off center	degree	CONSTANT	0.000E+00		0.000E+00	360.	
	ell vertical distance	E	CONSTANT	0.000E+00		0.000E+00	1.00	
					*			

APPENDIX F.14

MULTIMED OUTPUT FOR ALTERNATIVE LINER/OVERLINER CLOSED CASE 6OL-LOCATION 2



AGENCY PROTECTION ENVIRONMENTAL U. S.

MODEL MULTIMEDIA

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EXPOSUR

(Version 1.01, June 1991) MULTIMED

> Location 2 Chemical simulated is DEFAULT CHEMICAL CASEGOL

Run options

Saturated zone model DETERMIN Run was Infiltration input by user Run was steady-state Option Chosen

Reject runs if Y coordinate outside plume Reject runs if Z coordinate outside plume Gaussian source used in saturated zone model

CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN STD	TERS STD DEV	LIMITS	TS MAX	
Solid phase decay coefficient	1/vr	CONSTANT	0.000E+00 -999	-999.	0.000E+00	0.100E+11	1
Dissolved phase decay coefficient	1/vr	CONSTANT	0.000E+00 -999.	-999.	0.000E+00		
Overall chemical decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	0.100E+11	
Acid catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-	
Base catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-	
Reference temperature	, U	CONSTANT	20.0	-666-	0.000E+00	100.	
Normalized distribution coefficient	m1/g	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Distribution coefficient	1	DERIVED	-666-	-666-	0.000E+00	0.100E+11	
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-	
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	10.0	
Reference temperature for air diffusion	U	CONSTANT	0.000E+00 -999	-666-	0.000E+00	100.	
Molecular weight	B/M	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Mole fraction of solute	1	CONSTANT	0.000E+00 -999.	-666-	0.100E-08	1.00	
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00 -999	-666-	0.000E+00	100.	
	atm-m^3/M	CONSTANT	0.000E+00 -999	-666-	0.100E-09	1.00	
cay sat, zone	1/yr	DERIVED	0.000E+00	0.000E+00	0.000E+00	1.00	
Not currently used	8	CONSTANT	-666-	-999.	0.000E+00	1.00	
00/08/07/06/08/09/09/09/09/09/09/09/09/09/09/09/09/09/							

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	SOURCE	SOURCE SPECIFIC VARIABLES				
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN STD	TERS STD DEV	LIMITS	rs MAX
Infiltration rate	m/yr	CONSTANT	0.511E-07	-966-	0.100E-09	0.100E+11
Area of waste disposal unit	m^2	CONSTANT	0.486E+06	-666-	0.100E-01	-666-
Duration of pulse	yr	CONSTANT	-666-	-666-	0.100E-08	-666-
Spread of contaminant source	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11
Recharge rate	m/yr	CONSTANT	0.368E-01	-666-	0.000E+00	0.100E+11
Source decay constant	1/yr	CONSTANT	0.000E+00	-666-	0.000E+00	-666-
Initial concentration at landfill	mg/1	CONSTANT	1.00	-666-	0.000E+00	-666-
	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11
Width scale of facility	E	DERIVED	-999	-999.	0.100E-08	0.100E+11
Near field dilution		DERIVED	1.00	0.000E+00	0.000E+00	1.00
	AQUIFER	AQUIFER SPECIFIC VARIABLES	10			
			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	111111111	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	ETERS	LIMITS	TS
			MEAN	STD DEV	MIN	MAX
Particle diameter	E	CONSTANT	0.381E-01	-666-	0.100E-08	100.
Aquifer porosity	1	CONSTANT	0.430	-666-	0.100E-08	0.990
Bulk density	g/cc	CONSTANT	1.65	-666-	0.100E-01	5.00
Aguifer thickness	E	CONSTANT	10.0	-666-	0.100E-08	0.100E+06
Source thickness (mixing zone depth)	E	DERIVED	-666-	-666-	0.100E-08	0.100E+06
	m/yr	CONSTANT	130.	-666-	0.100E-06	0.100E+09
Gradient (hydraulic)		CONSTANT	0.200E-02	-666-	0.100E-07	-666-
Groundwater seepage velocity	m/yr	DERIVED	-666-	-666-	0.100E-09	0.100E+09
Retardation coefficient	1	DERIVED	-666-	-666-	1.00	0.100E+09
Longitudinal dispersivity	E	FUNCTION OF X	-666-	-999.	-666-	-666-
Transverse dispersivity	E	FUNCTION OF X	-666-	-666-	-666-	-666-
Vertical dispersivity	E	FUNCTION OF X	-666-	-666-	-666-	-666-
Temperature of aquifer	U	CONSTANT	21.0	-999.	0.000E+00	100.
HO	ŀ	CONSTANT	7.20	-666-	0.300	14.0
Organic carbon content (fraction)		CONSTANT	0.300E-02		0.100E-05	1.00
Well distance from site	E	CONSTANT	168.	-666-	1.00	-666-
Angle off center	dagnap	CONSTANT	B BBBE+BB	- 666	9.888F+88	360.
	2000		00000		1	

APPENDIX F.15 MULTIMED OUTPUT FOR ALTERNATIVE LINER/OVERLINER CLOSED CASE 7OL-LOCATION 3



S. ENVIRONMENTAL PROTECTION AGENCY

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EXPOSURE ASSESSMENT

MULTIMEDIA MODEL

MULTIMED (Version 1.01, June 1991)

1000

Run options

CASE70L

Location 3 Chemical simulated is DEFAULT CHEMICAL Option Chosen Saturated zone model Run was

Run was Infiltration input by user

Run was steady-state Reject runs if Y coordinate outside plume Reject runs if Z coordinate outside plume

Gaussian source used in saturated zone model

CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN STD	STD DEV	LIMITS	TS MAX	=
Solid phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-966-	0.000E+00	0.100E+11	
Dissolved phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	0.100E+11	
	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	0.100E+11	
Acid catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-	
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-	
Base catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00	-666-	0.000E+00	-666-	
	·	CONSTANT	20.0	-666-	0.000E+00	100.	
Normalized distribution coefficient	ml/g	CONSTANT	0.000E+00	-666-	0.000E+00	-666-	
Distribution coefficient	1	DERIVED	-666-	-666-	0.000E+00	0.100E+11	
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00	-666-	0.000E+00	-666-	
	cm2/s	CONSTANT	0.000E+00	-666-	0.000E+00	10.0	
Reference temperature for air diffusion	U	CONSTANT	0.000E+00	-666-	0.000E+00	100.	
Molecular weight	M/B	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-	
Mole fraction of solute	1	CONSTANT	0.000E+00 -999	-666-	0.100E-08	1.00	
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00 -999	-666-	0.000E+00	100.	
	atm-m^3/M	CONSTANT	0.000E+00 -999	-666-	0.100E-09	1.00	
Overall 1st order decay sat, zone	1/yr	DERIVED	0.000E+00	0.000E+00 0.000E+00	0.000E+00	1.00	
Not currently used	83	CONSTANT	-666-	-666-	0.000E+00	1.00	

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	SOURCE	SOURCE SPECIFIC VARIABLES				
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN STD	TERS STD DEV	LIMITS	rs MAX
		FINALONCO	122	000	0 4007 00	1000000
Infiltration rate	m/yr	CONSTANT	0.511E-0/	- 888.	0.100E-09	0.100E+11
Area of Waste disposal unit	7.1	CONSTANT	0.4005+00	. 666	0 1001 0	. 666
Duration of pulse	yr	CONSTANT		.666	0 1001 00	- 999.
Spread of contaminant source	E	DEKIVED		-888-	0.100E-08	O. TOOE+II
Recharge rate	m/yr	CONSTANT		-666-	0.000E+00	0.100E+11
Source decay constant	1/yr	CONSTANT	0.000E+00	-666-	0.000E+00	-666-
Initial concentration at landfill	mg/1	CONSTANT	1.00	-999.	0.000E+00	-666-
) E	DERIVED	-666-	-999.	0.100E-08	0.100E+11
Width scale of facility	E	DERTVED	-666-	-666-	0.100E-08	0.100E+11
Near field dilution		DERIVED	1.00	0.000E+00	0.000E+00	1.00
	AQUIFER	AQUIFER SPECIFIC VARIABLES	750/936			
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1					1
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	TERS	LIMITS	
			MEAN	STD DEV	MIN	MAX
Particle diameter	8	CONSTANT	0.381E-01	-966-	0.100E-08	100.
Aquifer porosity	1	CONSTANT	0.430	-666-	0.100E-08	0.990
Bulk density	g/cc	CONSTANT	1.65	-666-	0.100E-01	5.00
Aguifer thickness	É	CONSTANT	10.0	-999.	0.100E-08	0.100E+06
Source thickness (mixing zone depth)	E	DERIVED	-666-	-666-	0.100E-08	0.100E+06
	m/yr	CONSTANT	130.	-666-	0.100E-06	0.100E+09
Gradient (hydraulic)	The state of the s	CONSTANT	0.200E-02	-666-	0.100E-07	-666-
Groundwater seepage velocity	m/yr	DERIVED	-666-	-666-	0.100E-09	0.100E+09
Retardation coefficient	· ;	DERIVED	-666-	-666-	1.00	0.100E+09
Longitudinal dispersivity	E	FUNCTION OF X	-666-	-666-	-666-	-666-
Transverse dispersivity	E	FUNCTION OF X	-666-	-666-	-666-	-666-
Vertical dispersivity	E		-666-	-666-	-666-	-666-
Temperature of aquifer	U		21.0	-999.	0.000E+00	100.
	ļ	CONSTANT	7.20	-999.	0.300	14.0
Organic carbon content (fraction)		CONSTANT	0.300E-02	-999.	0.100E-05	1.00
Wall distance from site	Ε	CONSTANT	238	666-	1.88	-999
Andle off center	dagnee	TNATANT	a agantaga	- 666	A BABETON	360
Wigge of center	ac61 cc	CONSTANT	O DOOF TOO		0.000E+00	1.00
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CONCENTRATION AFTER SATURATED ZONE MODEL 0.2110E-05

APPENDIX F.16

MULTIMED OUTPUT FOR ALTERNATIVE LINER/OVERLINER CLOSED CASE 80L-LOCATION 4



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EXPOSURE ASSESSMENT

MODEL

MULTIMEDIA

MULTIMED (Version 1.01, June 1991)

1 Run options

CASE80L

Location 4 Chemical simulated is DEFAULT CHEMICAL Option Chosen Saturated zone model Run was

Run was Infiltration input by user Run was steady-state

Reject runs if Y coordinate outside plume Reject runs if Z coordinate outside plume Gaussian source used in saturated zone model CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN STD	STD DEV	LIMITS	TS MAX	
Solid phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-966-	0.000E+00	0.100E+11	
Dissolved phase decay coefficient	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	0.100E+11	
Overall chemical decay coefficient	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	0.100E+11	
Acid catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00 -999	-666-	0.000E+00	-666-	
Base catalyzed hydrolysis rate	1/M-yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Reference temperature	U	CONSTANT	20.0	-666-	0.000E+00	100.	
Normalized distribution coefficient	m1/g	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Distribution coefficient	ì	DERIVED	-666-	-666-	0.000E+00	0.100E+11	
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	10.0	
Reference temperature for air diffusion	U	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	100.	
Molecular weight	g/M	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	-666-	
Mole fraction of solute	1	CONSTANT	0.000E+00 -999	-999.	0.100E-08	1.00	
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00 -999.	-666-	0.000E+00	100.	
	atm-m^3/M	CONSTANT	0.000E+00 -999	-999.	0.100E-09	1.00	
Overall 1st order decay sat. zone	1/yr	DERIVED	0.000E+00	0.000E+00 0.000E+00	0.000E+00	1.00	
Not currently used		CONSTANT	-666-	-666-	0.000E+00	1.00	

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	SOUR	SOURCE SPECIFIC VARIABLES					
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN STD	TERS STD DEV	LIMITS	TS MAX	
							1 1 1
Infiltration rate	m/yr	CONSTANT	0.511E-0/	-999.	0.100E-09	0.100E+11	
Area or waste disposal unit	7	CONSTANT	0.4005+00	.666	0.1005-01	-999.	
Duration of pulse	yr	CONSTANT	-999	-888-	0.100E-08	-888-	
Spread of contaminant source	E	DERIVED	-666-	-666-	0.100E-08	0.100E+11	
Recharge rate	m/yr	CONSTANT	0.368E-01	-666-	0.000E+00	0.100E+11	
Source decay constant	1/yr	CONSTANT	0.000E+00	-666-	0.000E+00	-666-	
Initial concentration at landfill	mg/1	CONSTANT	1.00	-666-	0.000E+00	-666-	
	Ē	DERTVED	-666-	-666-	0.100E-08	0.100E+11	
15:11 3:44: 01 13:44:1	: 1	DEBINED	000	000	O TOOL O	D 100ET1	
Width Stale of Tacility	=	DERIVED		. 666-	O. TOOE -OO	O. TOOLTIT	
wear Tield dilucion		DENTAED	00.1	0.0000000	0.000000	T.00	
	AQUIF	AQUIFER SPECIFIC VARIABLES	1				
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	TERS	LIMITS	TS	I I
			MEAN	STD DEV	NIW	MAX	
Danticle diameter	1 50	CONSTANT	0.381E-01	-999.	0.100E-08	100.	!
Aguifer noposity	;	TONSTANT	0.430	-666-	0.100F-08	0.990	
Dill donniti	4/00	FNATANOO	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	.000	0 100E-01	200	
Duin delisity) (2)	TNATANO	2 6	.000	0 100E-08	D 100E+06	
	3 1	NE LONG	10.00	.000	0 100E 00	0 100E100	
Source chickness (Mixing Zone depon)	III V	CONSTANT	130	.000	0 100E 06	a 1885,60	
Colluctivity (Hydraulic)	11/ /11	CONSTANT	2000		0 1001 0	000	
Gradient (nydraulic)	000000000000000000000000000000000000000	CONSTANT	0.200E-02	-222.	0.100E-0/	.222	
Groundwater seepage velocity	m/yr	DERIVED	-666-	-666-	0.100E-09	0.100E+09	
Retardation coefficient	1	DERIVED	-666-	-666-	1.00	0.100E+09	
Longitudinal dispersivity	E	FUNCTION OF X	-666-	-666-	-666-	-666-	
Transverse dispositify	8	O.	-999	666-	- 999	-999	
Vestinal dispersivity	: E		666-	-666	-666	-666	
בייקביייי יצי ייייקנייי	i c	5	. 0		מ מממבים	100	
emperature of aquiter	ر	CONSTANT	0.12	-999.	0.300E+00	100.	
A Description of the Control of the	1	CONSTANT	1.20	- 666-	0.300	14.6	
Organic carbon content (fraction)		CONSTANT	0.300E-02	-666-	0.100E-05	1.00	
Well distance from site	E	CONSTANT	387.	-666-	1.00	-666-	
Angle off center	degree	CONSTANT	0.000E+00	-666-	0.000E+00	360.	

CITY OF KINGSVILLE LANDFILL PART III ATTACHMENT 6 FACILITY SURFACE WATER

DRAINAGE REPORT

ATTACHMENT 6 FACILITY SURFACE WATER DRAINAGE REPORT



CONTENTS

- 1. INTRODUCTION
- 2. EXISTING SURFACE WATER DRAINAGE
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INTRODUCTION 1.0

The City of Kingsville Landfill (Kingsville Landfill) is located in Kleberg County, Texas, at the northeast corner of the intersection of Farm to Market Road 2619 and County Road 2130. The northern boundary of the property is approximately 2,811 feet from FM 1717, while the eastern boundary is approximately 1,300 feet from N. County Road 1070 (See Part I, Attachment 2, Figure I.1 - Site Location Map).

The Kingsville Landfill has been in existence since February 1977 and is intended to provide waste disposal for residences and businesses in Kleberg County and surrounding Texas counties. The nearest community is the City of Kingsville, whose city limits are approximately 1.45 miles from the northeast corner of the landfill boundary. The facility has undergone two permit amendments to date allowing it to extend its initial permit boundaries, and increase the permitted maximum elevation (Refer to Part I, Attachment 1, Section 1.2 – Permit History).

The existing Kingsville Landfill includes a scale house, an office building, a maintenance shop, enclosed within a perimeter fence. These facilities will continue to be operational for the life of the landfill. No new buildings or infrastructure improvements will be constructed as part of the proposed permit amendment.

This Facility Surface Water Drainage Report (FSWDR) for the City of Kingsville Landfill TCEQ Permit MSW 235-C has been designed to collect, route, retain, and detain stormwater runoff from the facility. The Plan for the landfill contains design features that follow best management practices that meet or exceed the regulations applicable to stormwater management outlined in Title 30 of the Texas Administrative Code (30 TAC), Section 330, Municipal Solid Waste as follows;

Rule §330.63 Contents of Part III of the Application

(c) Facility surface water drainage report. The owner or operator of a municipal solid waste (MSW) facility shall include a statement that the facility design complies with the requirements of §330.303 of this title (relating to Surface Water Drainage for Municipal Solid Waste Facilities). Additionally, applications for landfill and compost units shall include a surface water drainage report to satisfy the requirements of Subchapter G of this chapter (relating to Surface Water Drainage)...

Rule §330.303 Surface Water Drainage for Municipal Solid Waste Facilities

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- (a) A facility must be constructed, maintained, and operated to manage run-on and runoff during the peak discharge of a 25-year rainfall event and must prevent the off-site discharge of waste and feedstock material, including, but not limited to, in-process and/or processed materials.
- (b) Surface water drainage in and around a facility shall be controlled to minimize surface water running onto, into, and off treatment area.

Rule §330.305 Additional Surface Water Drainage Requirements for Landfills

- (a) Existing or permitted drainage patterns must not be adversely altered.
- (b) The owner or operator shall design, construct, and maintain a run-on control system capable of preventing flow onto the active portion of the landfill during peak discharge from at least a 25-year rainfall event.
- (c) The owner or operator shall design, construct, and maintain a runoff management system from the active portion of the landfill to collect and control at least the water volume resulting from a 24-hour, 25-year storm.
- (d) The landfill design must provide effective erosional stability on top dome surfaces and external embankment side slopes during all phases of landfill operation, closure, and post-closure care in accordance with the following.
- (e) Dikes, embankments, drainage structures, or diversion channels sized and graded to handle the design runoff must be provided. The slopes of the sides and toe will be graded in such a manner as to minimize the potential for erosion. The surface water protection and erosion control practices must maintain low non-erodible velocities, minimize soil erosion losses below permissible levels, and provide long-term, low maintenance geotechnical stability to the final cover.

Rule §330.307 Flood Protection for Landfills

- (a) The facility shall be protected from flooding by suitable levees constructed to provide protection from a 100-year frequency flood and in accordance with the rules of the commission relating to levee improvement districts and approval of plans for reclamation projects or the rules of the county or city having jurisdiction under Texas Water Code, §16.236, as implemented by Chapter 301, Subchapter C of this title (relating to Approval of Levees and Other Improvements).
- (b) Flood protection levees must be designed and constructed to prevent the washout of solid waste from the facility.

Hanson Professional Services Inc. Submittal Date: September 2018 The property boundary is 196.88 acres, the proposed updated Permit boundary is 176.33 acres, and the proposed waste footprint is 121.30 acres.

The pre-development calculations represent conditions at the site prior to any landfill development. The post-developed condition calculations represent conditions at the site after the landfill has been closed, final cover has been placed, and all components of the designed drainage system have been established. The existing City of Kingsville Landfill TCEQ Permit MSW 235-B has been referenced and utilized to evaluate the site predevelopment conditions and the site post-development conditions in Appendices 6A and 6B, respectively.

Stormwater modeling has been completed with the software program HydroCAD. HydroCAD is a computer aided design program used to model hydrology and hydraulics of stormwater using either TR-20 or TR-55 procedures developed by the Soil Conservation Service (now the Natural Resource Conservation Service). HydroCAD was selected for the modeling software due to the large number of drainage areas and stormwater control devices at the landfill facility.

2.0 EXISTING SURFACE WATER DRAINAGE

The City of Kingsville Landfill TCEQ Permit MSW 235-C (existing City of Kingsville Landfill TCEQ Permit MSW 235-B) is located on uplands south of Santa Gertrudis Creek. The overall property consists of gently undulating grasslands with limited forest cover. The property generally slopes to the northeast with no major topographic features. The nearest 100-year floodplain is located to the northeast of the site along Santa Gertrudis Creek. The existing Kingsville Landfill is not located within the 100-year floodplain as designated by the Federal Emergency Management Agency (FEMA) Firm Community Panel Numbers 48273C03205E and 48273C0325E included in Appendix 6B.17. Surrounding land use is predominantly agricultural.

3.0 PROPOSED SURFACE WATER MANAGEMENT SYSTEM

The proposed surface water management system will utilize stormwater best management practices (BMPs). The landfill will be developed as an above ground hill and designed to allow stormwater runoff to be collected in diversion berms or swales located near the upper grade break and on the landfill slopes. Stormwater will then be conveyed to let-down structures or chutes down the side slopes to the perimeter channel system and into either a retention pond or detention pond. The perimeter channels will be constructed prior to placing fill above ground in each adjacent landfill sector. The

Hanson Professional Services Inc. Submittal Date: September 2018 perimeter channels will be vegetated. Erosion protection will be provided at critical discharge locations where velocities are five feet per second (5 ft./sec.) or greater such as chutes or culvert discharges. These areas will be lined with concrete articulated block or flexible revetment system. Energy dissipaters will be required downstream of the chutes within the final cover area where flow enters unlined channels.

During landfilling operations, stormwater controls will be implemented to minimize run-on from flowing into the active portion of the site. Contaminated runoff from the working face will be contained with stormwater controls as well. This is shown in Appendix 6B.15.14 Working Face Containment and Diversion Berms.

The SWPPP has been 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. The MSGP classifies industrial activities by Sectors containing various Standard Industrial Classification (SIC) Codes. The City of Kingsville Landfill falls under Sector L: Landfills and Land Application Sites under Activity Code LF – Landfills, Land Application Sites, and Open Dumps that Receive or Have Previously Received Industrial Waste under subtitle C of RCRA and including those that are subject to regulation under subtitle D of RCRA. Stormwater discharges at the facility were previously authorized by the submittal of a Notice of Intent (NOI) filed on November 26, 2001 and renewed on October 10, 2006 and November 3, 2011. Currently, discharges are authorized by an NOI submitted in November 2016. A copy of the current NOI and the MSGP are included in Appendix A. Discharges from the facility are not received by a Municipal Separate Storm Sewer System (MS4). Eventually stormwater discharges from outfalls on the west side of the facility flow into Santa Gertrudis Creek, then San Fernando Creek (TCEQ Classified Segment 2492A), and then Baffin Bay/Alazan Bay/Cayo del Grulla/Laguna Salada (TCEQ Classified Segment 2492A). Eventually stormwater discharges from outfalls on the south side of the facility flow into Baffin Bay/Alazan Bay/Cayo del Grulla/Laguna Salada (TCEQ Classified Segment 2492A).

The facility has been designed to prevent discharge of pollutants into the waters of the State or waters of the United States, as defined by the Texas Water Code and the Federal Clean Water Act.

All onsite surface drainage features are designed to collect and route stormwater through diversion berms, chutes, perimeter channels, and into three storage ponds. The three storage ponds are Pond A, Pond B, and Pond C. Pond A and Pond C are retention ponds and Pond B is a detention pond. The only stormwater discharge from the site will be at

Part III

Pond B via two drainage culverts. This is further discussed in Section 5.0 Site Post-Development Conditions.

4.0 SITE PRE-DEVELOPMENT CONDITIONS

The pre-development drainage characteristics of the landfill site are described in Appendix 6A-Site Pre-Development conditions. A summary of the pre-development conditions is summarized in Appendix 6A.1, 25 Year Pre-Development Conditions Summary Table. Pre-development drainage information from the City of Kingsville Landfill Permit Amendment 235-B, Attachment 6, Appendix 6A Pre-Development Conditions (Table of Contents and Pages 1-32) contained in Appendix 6A.2.1, Pre-Development Drainage Map Solid Waste Landfill Permit 235-B Amendment Figure 1 contained in Appendix 6A.2.2, and Pre-Development Slope Map Solid Waste Landfill Permit 235-B Amendment Figure A-2 contained in Appendix 6A.2.3 were all used to develop the summary table in Appendix 6A.1.

The City of Kingsville Landfill Permit Amendment 235-B illustrates that Watershed A contains drainage areas PA1, PA2, and PA3; Watershed B contains drainage areas PB1, PB2, and PB3; and Watershed C contains areas PC1, PC2, and PC3 for existing permitted conditions. A HydroCad model was developed to simulate the results from the pre-development drainage conditions using the same data. Results using HydroCAD were similar. HydroCAD results are shown in Appendix 6A.2.4 (HydroCAD Model Pre-Development Conditions 25 Year Existing Permitted Conditions). In addition, a separate HydroCAD model was developed to include a proposed updated boundary as shown in Appendix 6A.2.7 (Pre-Development Drainage Map Solid Waste Landfill Permit 235-B Amendment Figure A-1 (Updated Permitted Conditions)). The proposed updated permit boundary introduces drainage area PB4 located near the east boundary of the permit boundary. HydroCAD results are shown in Appendix 6A.2.5 (HydroCAD Model Pre-Development Conditions 25 Year Updated Permitted Conditions).

Results contained in the Appendix 6A.1 summary table illustrate that the combined total for the 25 year pre-development condition at the northwest corner of the landfill site adjacent to F.M. 2619 in the roadside ditch is approximately 49.3 cubic feet per second (cfs) to 51.1 cfs for both the existing permitted conditions and proposed updated conditions. The only stormwater discharge from the permit boundary will be at this northwest location (Pond B) via two (2) 21" x 128' reinforced concrete pipe (RCP) culverts with a discharge of 33.7 cfs for the 24 hr duration-25 year frequency storm and 42.5 cfs for the 24 hr duration-100 year frequency storm which is less than the combined 25 year pre-development flows as described in this section and in section 5.0 Site Post-Development Conditions.

Part III, Attachment 6, p.g.-5

5.0 SITE POST-DEVELOPMENT CONDITIONS

The post-development surface water management system design will include landfill final cover, a system of diversion berms or swales, let-down structures or chutes, perimeter channels, drainage culverts, two retention ponds and one detention pond. Onsite stormwater surface runoff from final cover will sheet flow to the diversion berms constructed at vertical intervals down the slope of the landfill. The diversion berms will convey runoff into the chutes that will convey the stormwater runoff down the slope of the landfill and into the perimeter channel drainage system. The chutes will be lined with concrete articulated block or flexible revetment system. Channels that exhibit velocities of 5 ft/sec or more will be also be lined with the same system. Collector channels along the landfill perimeter road at the northeast will collect landfill surface stormwater runoff not collected in the chutes. The stormwater will be conveyed to post inlets which will direct it across the road to Pond C via drainage culverts. In other areas to the east and south of the landfill, stormwater runoff not collected by the chutes will sheetflow into the adjacent perimeter channels which will in turn be directed into either Pond A or Pond C. At the north and northwest areas of the landfill, runoff not collected in the chutes will sheetflow into Pond B. The perimeter landfill channel system is divided into four segments; East, South, North, and West. The East channel system flows into Pond C, the South and West flow into Pond A, and the North flows into Pond C. Surface water from outside the boundary of the landfill will continue to be collected or directed as shown in Section 4.0 Site Pre-Development Conditions via existing roadside ditches along FM 2619 and C.R. 2130 that border the property. All surface stormwater runoff will be contained onsite with retention Ponds A and C with the exception of a discharge at Pond B. This discharge is less than the pre-development condition and post-development condition as shown in Appendices 6B.8.1 (Portion of Attachment 6 Groundwater and Surface Water Protection Plan (Pre-Development/Post Development Drainage Conditions and Design [Annotated], 6B.8.2 (Portion of Appendix 6A-Pre-Development Conditions (Figure A-1 Pre-Development Drainage Map) [Annotated]), 6B.8.3 (Portion of Appendix 6B-Final Development Conditions (Figure B-1 Final Development Drainage Map) [Annotated]), and 6B.8.4 (Portion of Appendix 6C Detention Ponds and Discharge Culverts (25-Year Storm Strategy/Comparative Summary of Peak Flow) [Annotated].

5.1 RAINFALL

Appendix 6B.1 USGS Atlas of Depth-Duration Frequency of Precipitation Annual Maxima for Texas-Depth of Precipitation for 25 Yr-24 Hr and 100 Yr-24 Hr [Annotated] was used to determine the rainfall depth at the site location. 8.7 inches and 11.5 inches was selected for the 25 Yr-24 Hr and 100 Yr-24 storms, respectively. These values were used for modeling purposes.

5.2 SOIL GROUPS AND FINAL DRAINAGE AREAS

Appendix 6B.2 contains Table 6B-1 Hydrologic Soils Groups for On-Site Soils (from NRCS, 2015) that was used to determine the hydrologic soil group. This Table indicates that the soil is predominantly a clay loam and sandy loam. It also lists the drainage area designations and areas in acres. The total onsite drainage areas are approximately 164.60 acres.

5.3 Time of Concentration (Tc) Values for Landfill Top/Slope Drainage Areas

Appendix 6B.3 illustrates values for the time of concentration (tc) at the top and slope drainage areas of the landfill. A conservative value of tc=10 min was used at the slopes.

5.4 HYDROCAD MODEL

The computer model HydroCAD was used to develop discharge rates, volumes, and velocities for the 24-hour duration, 25-year and 100-year storm frequencies. All drainage elements were modeled using HydroCAD. The HydroCAD stormwater model used the following analysis methods:

Runoff Calculation Method: SCS TR-20

Reach Routing Method: Storage-Indication Routing Method (also known

as Modified-Puls Method)

Pond Routing Method: Storage-Indication Routing Method (also known

as Modified-Puls Method)

Storm Distribution: SCS Type III-24-hour storm

Unit Hydrograph: SCS

The post-development models are in Appendices 6B.4 (HydroCad Model Post Development-25 Year) and Apppendix 6B.5 (HydroCAD Model Post Development-100 Year). Cross sections are shown in the models for perimeter channels, collector channels, and chutes with average depths at peak storage. Peak elevations and storage are shown for Pond A, Pond B, and Pond C. A summary of the results are described below in sections 5.5 PONDS AND 5.7 PERIMETER CHANNELS, COLLECTOR CHANNELS, AND CHUTES. Typical drainage cross sections are shown in Appendix 6B.18. The analyses meet or exceed state and federal requirements for landfills.

5.5 PONDS

A HydroCAD pond results summary for the post-development 24-hour duration, 25-year & 100-year storm frequencies are in Appendices 6B.6 (HydroCAD Model

Post Development 25 Year Pond Summary) and 6B.7 (HydroCAD Model Post Development 100 Year Pond Summary). The post-development drainage plan for the 25 year and the 100 year are in Appendices 6B.6.1 (Post Development Drainage Plan-25 Year) and 6B.7.1 (Post Development Drainage Plan-100 Year). The landfill surface stormwater runoff will be routed to three ponds, Pond A, Pond B, and Pond C. Pond A is a retention pond (no discharge) located at the southwest corner, Pond B is a detention pond (33.70 cfs/42.46 cfs discharge for 25-Year/100-Year) located at the northwest corner, and Pond C is a retention pond (no discharge) located at the northeast corner of the permit boundary. All ponds will have adequate freeboard.

5.6 CITY OF KINGSVILLE MSW 235-B PERMIT

Information from the Kingsville MSW 235-B Permit is contained in Appendix 6B.8 (Kingsville Landfill Permit Amendment 235-B). It was utilized to make the comparative analysis between pre-development conditions and post-development conditions. Modeling results demonstrate that the peak discharge flow for the 24-hour duration, 25-year frequency is 33.70 cfs via two (2) 21" x 128 ft. RCP culverts at Pond B after detention. The discharge is to an existing roadside ditch along FM 2619. Pre-development flow in this ditch is approximately 50 cfs. The post-development flow in this ditch will be 33.70 cfs for the 25-year storm and 42.46 cfs for the 100-year storm which is lower than the pre-development flows. The velocities will range between 7-9 ft/sec and therefore the receiving ditch will require erosion protection as discussed in previous sections.

5.7 PERIMETER CHANNELS, COLLECTOR CHANNELS, AND CHUTES

A summary of perimeter channels, collector channels, and chutes are located in Appendices 6B.9 (Perimeter Channels, Collector Channels, and Chutes-25 Year Summary Table) and 6B.10 (Perimeter Channels, Collector Channels, and Chutes-100 Year Summary Table). The table illustrates the geometry as well as peak flows, velocities, slopes, hydraulic grade line elevations, and freeboard for all identified channels and chutes.

5.8 SOUTHERN DRAINAGE PLAN

Appendix 6B.11 Figure 1 illustrates the overall southern drainage plan. Appendix 6B.11.1 Figure 2 is the Enlarged Southern Drainage Plan, and Appendix 6B.11.2 Figure 3 is the Cross Sections that illustrates the drainage channels relative to the existing waste locations. As shown the drainage channels will be articulated concrete block or flexible revetment placed over 60 mil HDPE geomembrane on prepared subgrade.

5.9 POST DEVELOPMENT CHUTES-HYDROCAD MODEL

The drainage chutes have been modeled using HydroCAD as shown in Appendices 6B.12 (HydroCAD Model 25 Year Post Development Chutes) and 6B.13 (HydroCAD Model 100 Year Post Development Chutes). Chute cross sections are shown. The chutes will be no more than 2 ft. deep, 5 ft. wide, at 4:1 side slopes. All chutes will accommodate the 24-hour duration 25 year and 100 year storm frequencies with adequate freeboard. Appendix 6B.14 (Engineering Handbook Chute-Spillways-Chute Spillway Design) was used to design the SAF stilling basin criteria at the bottom of the chute. As discussed in previous sections, articulated concrete blocks or flexible revetment will be used for the chutes and high velocity areas. Included is manufacturer data and specifications for the block and geotextile. Chute details are located in Appendices 6B.14.1 and 6B.14.2 (Chute Details).

5.10 DIVERSION BERMS OR SWALES

The diversions berms (swales) have been modeled using HydroCAD as shown in Appendix 6B.15 (HydroCAD Model Post Development Diversion Berms (Swales) NRCS & Rational Methods). The post-development plan for the diversion berms is shown in Appendix 6B.15.1 (Post Development Typical Diversion Berm Drainage Plan). This plan illustrates the proposed layout of the diversion berms. The largest drainage area was used to design a typical diversion berm and flow will be conveyed to a corresponding chute as shown on the drawing. The National Engineering Handbook (NEH) was used to determine the velocity versus slope for shallow concentrated flow using short grass criteria. This is shown in Appendix 6B.15.2 (National Engineering Handbook (NEH) Figure 15-4 Velocity Versus Slope for Shallow Concentrated Flow [Annotated]).

Swales were analyzed with a 0.5% slope and a 1.0% slope. The HydroCAD swales input data for 0.5% diversion berm slope (along the 25% slope of the landfill) is contained in Appendix 6B.15.3 (HydroCAD-Swales Input Data (Swale B1S-0.5% Slope). The HydroCAD swales input data for 1.0% diversion berm slope (along the 25% slope of the landfill) is contained in Appendix 6B.15.4 (HydroCAD-Swales Input Data (Swale B1S-1.0% Slope)). The HydroCAD swales input data for the largest drainage area at the top of the landfill (B1T) is shown in Appendix 6B.15.5 (HydroCAD-Swales Input Data (Swale B1T-0.5% & 1.0% Slope)). The HydroCAD input data for drainage area B1S and B1T is in Appendices 6B.15.6 (HydroCAD-Swales Input Data (Drainage Area B1S) and 6B.15.7 (HydroCAD-Swales Input Data (Drainage Area B1T)), respectively. Both the 0.5% slope and 1.0% diversion berm slopes were modeled with HydroCAD using the NRCS method and the Rational Method. The NRCS method is shown in Appendices 6B.15.8 (HydroCAD-Model 25 Year Post Development Diversion Berms (NRCS

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Method) and 6B.15.11 (HydroCAD Model 100 Year Post Development Diversion Berms (NRCS Method). The Rational Method is shown in Appendices 6B.16.9 (HydroCAD-Model 25 Year Post Development Diversion Berms (Rational Method)) and 6B.15.12 (HydroCAD Model 100 Year Post Development Diversion Berms (Rational Method)). A summary of the results is in Appendix 6B.15.10 (Summary of 25 Year Intensity Flow Rates By Rational Method and NRCS Method for Swale Design) and Appendices 6B.15.11 (Summary of 100 Year Intensity Flow Rates by Rational Method and NRCS Method for Swale Design) and 6B.15.13 (Summary of 100 Year Intensity Flow Rates by Rational Method and NRCS Method for Swale Design). Cross sections are shown in the model. The analyses demonstrates that a typical diversion berm (swale) 3 ft. tall with 2:1 side slopes flowing at a 1% slope into the chute will suffice for both the 24-hr duration/25 year storm and 100 year storm frequencies with an acceptable velocity of approximately 3.7 ft./sec. (below 5 ft./sec) to prevent erosion and allowable freeboard of at least one foot (1 ft.).

5.11 SOIL LOSS ESTIMATE FOR FINAL COVER

The Revised Universal Soil Loss Equation (RUSLE) for top of slope (4%) and side slope (25%) interim cover and post closure is in Appendix 6B.16.1. The RUSLE is described as follows:

A= computed soil loss (tons/acre/year)

R= the rainfall and runoff factor (unitless)

K= the soil erodibility factor (unitless)

LS= the topographic factor (unitless)

C= the cover and management factor (unitless)

P= the support practice factor (unitless)

Detailed calculations and assumptions are provided in Appendix 6B.16.1 (Revised Universal Soil Loss Equation (RUSLE) for Top of Slope (4%) and Side Slope (25%) Interim Cover & Post Closure. The RUSLE calculation results show that the soil loss is 0.36 tons/acre/year for final conditions at top of slope and 2.39 tons/acre/year at the side slope and are both below the allowable 3 tons/acre/year. Also, the soil loss is 2.52 tons/acre/year for interim conditions at top of slope and 18.61 tons/acre/year at the side slope and are both below the allowable 50 tons/acre/year.

6.0 CONCLUSION

The following conclusions summarize the results of the Facility Surface Water **Drainage Report:**

- The surface water management system for the proposed City of Kingsville Landfill TCEQ Permit MSW 235-C meets or exceeds the regulations applicable to stormwater management outlined in Title 30 of the Texas Administrative Code (30 TAC), Section 330, Municipal Solid Waste as outlined in section 1.0 INTRODUCTION.
- The surface water management plan system provides the required conveyance with a minimum of 1 foot of freeboard.
- It is designed to minimize surface water flow into the working face of the landfill and to minimize discharge pollutants.
- Erosion will be reduced using Best Management Practices. Temporary and permanent erosion control measures are provided to prevent and reduce sediment generation at the site.
- Drainage structures (diversion berms (swales), chutes, perimeter channels, and collector channels) are designed as a minimum to convey peak flow rates from the 25-year, 24-hour storm event.
- Site development will not significantly alter regional drainage patterns.
- The proposed development will not restrict the flow of the 100-year flood, reduce the temporary storage capacity of the floodway or result in wash-out of solid waste.
- All areas of solid waste disposal will be adequately protected from the 24 hr duration, 25 year frequency storm event.
- All stormwater will be retained onsite with the exception of the discharge at the northwest corner of the site at detention Pond B. Discharge at this location will be less than pre-development flows as outlined in section 4.0 SITE PRE-DEVELOPMENT CONDTIONS and section 5.0 SITE POST-DEVELOPMENT CONDITIONS.

The designs, drawings, figures, data, and conclusions described herein are based upon current site conditions and existing information available. This Facility Surface Water Drainage Report (FSWDR) has been prepared for permitting purposes only.

APPENDIX 6A SITE PRE-DEVELOPMENT CONDITIONS



APPENDIX 6A.1 25 YEAR PRE-DEVELOPMENT CONDITIONS SUMMARY TABLE



25 YEAR PRE-DEVELOPMENT CONDITIONS SUMMARY TABLE

* Existing Permitted Conditions

Drainage Area	Area Sq. Mi.	Area AC.	Curve No. CN	Time of Concentration Tc-hr	Time of Concentration Tc-min	Rain Distribution Type	Frequency Year	Rainfall (24-hour) Inches	Peak Discharge CFS	
Watershed A										
PA1	0.031	19.84	46	0.4	24.0		25	8.7	27.3	Combined Total
PA2	0.05	32	40	0.69	41.4	Ш	25	8.7	22.0	49.3 cfs
PA3	0.03	19.2	40	0.64	38.4	III	25	8.7	13.7	
Watershed B										
PB1	0.041	26.24	40	0.61	36.6	Ш	25	8.7	19.0	1
PB2	0.006	3.84	42	0.32	19.2	Ш	25	8.7	4.3	7
PB3	0.01	6.4	40	0.44	26.4	111	25	8.7	5.4	
Watershed C			· · · · · · · · · · · · · · · · · · ·	, , , , , , , , , , , , , , , , , , ,	7		25	72		
PC1	0.071	45.44	42	0.6	36.0	III	25	8.7	39.6	
PC2	0.015	9.6	47	0.28	16.8	III	25	8.7	15.7	
PC3	0.005	3.2	41	0.38	22.8	III	25	8.7	3.1	

^{*} Kingsville Landfill Permit Amendment 235-B Attachment 6

Appendix 6A Pre-Development Conditions

**Existing Permitted Conditions

Drainage Area	Area Sq. Mi.	Area AC.	Curve No.	Time of Concentration Tc-hr	Time of Concentration Tc-min	Rain Distribution Type	Frequency Year	Rainfall (24-hour) Inches	Peak Discharge CFS	
Watershed A				24	71					
PA1	0.031	19.84	46	0.4	24.0	III	25	8.7	28.7	Combined Total
PA2	0.05	32	40	0.69	41.4	HI	25	8.7	22.3	51.1 cfs
PA3	0.03	19.2	40	0.64	38.4	III	25	8.7	13.9	
Watershed B	X				200					
PB1	0.041	26.24	40	0.61	36.6	Ш	25	8.7	19.5	
PB2	0.006	3.84	42	0.32	19.2	III	25	8.7	4.5	
PB3	0.01	6.4	40	0.44	26.4	III	25	8.7	5.5	
Watershed C										7
PC1	0.071	45.44	42	0.6	36.0	111	25	8.7	40.9	
PC2	0.015	9.6	47	0.28	16.8	Ш	25	8.7	17.1	
PC3	0.005	3.2	41	0.38	22.8	III	25	8.7	3.2	

^{**} Duplicated Existing Permitted Conditions from Kingsville Landfill Permit Amendment 235-B Attachment 6 Appendix 6A Pre-Development Conditions Using HydroCAD-Results Comparable

***Updated Permitted Conditions

Drainage Area	Area Sq. Mi.	Area AC.	Curve No.	Time of Concentration Tc-hr	Time of Concentration Tc-min	Rain Distribution Type	Frequency Year	Rainfall (24-hour)	Peak Discharge CFS	
Watershed A						***				
PA1	0.031	19.84	46	0.4	24.0	III	25	8.7	28.7	Combined Tot
PA2	0.05	32	40	0.69	41.4	Ш	25	8.7	22.3	51.1 cfs
PA3	0.03	19.2	40	0.64	38.4	III	25	8.7	13.9	
Watershed B			the second				•			
PB1	0.041	26.24	40	0.61	36.6	III	25	8.7	19.5	
PB2	0.006	3.84	42	0.32	19.2	III	25	8.7	4.5	
PB3	0.01	6.4	40	0.44	26.4	III	25	8.7	5.5	
***PB4	0.021	13.38	40	0.26	15.6	III	25	8.7	13.9	T .
Watershed C							*			
PC1	0.071	45.44	42	0.6	36.0	III	25	8.7	40.9	
PC2	0.015	9.6	47	0.28	16.8	Ш	25	8.7	17.1	
PC3	0.005	3.2	41	0.38	22.8	III	25	8.7	3.2	

^{***}Updated Permitted Conditions Includes the Addition of Drainage Area PB4 Results Using HydroCAD

APPENDIX 6A.2 SITE PRE-DEVELOPMENT CONDITIONS-EXISTING PERMITTED CONDITIONS



APPENDIX 6A.2.1

KINGSVILLE LANDFILL PERMIT AMENDMENT 235-B ATTACHMENT 6 APPENDIX 6A PRE-DEVELOPMENT CONDITIONS (TABLE OF CONTENTS AND PAGES 1-32)



APPENDIX 6A

Kingsville Landfill Permit Amendment 235-B Attachment 6

Appendix 6A Pre-Development Conditions

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Pre-Development Conditions TR-55 Runoff Curve Number Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PA1

I. Runoff Curve Number (CN)

Soil Name	Cover Description		CN .		Area	Product of
and hydrologic group (Appendix A)	(cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Table2-2	Fig. 2-3	Fig. 2-4	acres _x_sq.mi. %	CN x Area
Kingsville, A/D	Unimproved Area, 0 - 2% slope	39			0.01	0.39
Kingsville, A/D	Unimproved Area, 2 - 7% slope	49		ļ	0.02	0.98
Kingsville, A/D	Unimproved Area, > 7% slope	59			0.001	0.06
			- _			
			·		-	
				<u> </u>		<u> </u>
1. Use only one CN source	perline.			Totals =	0.031	1.43

CN (weighted): total product = 1.43 = 46 Use CN = 45

2. Runoff

frequency	yr.
Rainfall, P (24-hour)	In.
Runoff, Q(use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4)	in.

Storm #1	Storm #2	Storm #3
25		
8.7		
2.2	<u></u>	

S = 1000/CN - 10: S = 11.7 $Q = \frac{(P - 0.2s)^2}{(P + 0.8s)}$ Q = 2.23

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PA1 (Trial)

Sheet Flow (applicable to Tc only)	Segment ID A-B
1. Surface description (table 3-1)	grass
2. Mannings roughness coeff., n (table 3-1)	0.13
3. Flow length, L (total < 300 ft)	ft. 200
4. Two -year 24-hr rainfall, P_2	in. 4.5
5. Land slope, s	ft/ft 0.01
6. $T_t = \frac{0.007 \text{ (nL)}^{0.8}}{P_2^{0.5} \text{ s}^{0.4}}$ Compute T_t	hr. 0.28 + = 0.28
Shallow Concentrated Flow	Segment ID B-C
7. surface description (paved or unpaved)	grass
8. Flow length, L	ft 450
9. Watercourse slope, \$	ff/ft 0.06
10. average velocity, V (figure 3-1)	ft/s 4
11. $T_t = L$ Compute T_t 3600 V	hr. 0.03 + 0.03
Channel Flow	Segment ID C-D See
12. Cross sectional flow area, a	fi ² 10 Page 29
13. Wetted perimeter, Pw	ff. 20.2
14. Hydraulic radius, r = a/Pw	ft. 0.50
15. Channel slope, s	ff./ff. 0.0125
16. Manning's roughness coefficient, n	0.03
17. $V = 1.49 r^{2/3} s^{1/2}$ Compute V	ft./s 3.5
18. Flow Length, L	ft. 1000
19. $Tt = \underline{t}$ Compute T_t 3600 V	hr 0.08 + = 0.08
20. Watershed or subarea To or Tt (add Tt in ste	eps 6, 11, and 19) hr. 0.39

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PA1 (Final)

Sheet Flow (applicable to Tc only)	Segment ID A-B	
1. Surface description (table 3-1)	grass	
2. Mannings roughness coeff., n (table 3-1)	0.13	
3. Flow length, L (total < 300 ft)	ft. 200	
4. Two -year 24-hr rainfall; P2	In. 4.5	
5. Land slope, s	ff/ff 0.01	
6. $T_t = \frac{0.007 (nl)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr. 0.28 + =	0.28
Shallow Concentrated Flow	Segment ID B-C	
7. surface description (paved or unpaved)	grass	
8. Flow length, L	ft 450	
9. Watercourse slope, \$	f1/f1 0.06	
10. average velocity, V (figure 3-1)	ft/s 4	
11. $T_t = L$ Compute T_t 3600 V	hr. 0.03 + = =	0.03
Channel Row	Segment ID C-D	See
12. Cross sectional flow area, a	ft ² 8.36	Page 30
13. Wetted perimeter, Pw	ft. 18.46	
14. Hydraulic radius, r = a/Pw	ft. 0.45	
15. Channel slope, s	ff./ff. 0.0125	
16. Manning's roughness coefficient, n	0.03	
17. $V = 1.49 r^{2/3} s^{1/2}$ Compute V	ft./s 3.3	
18. Flow Length, L	ft. 1000	
19. Tt = Compute T _t 3600 V	hr 0.08 + =	80.0
20. Watershed or subarea To or Tt (add It in ste	ps 6, 11, and 19)	hr. 0.40

(where $q_p = q_u A_m Q F_p$)

Kingsville Landfill Permit Application 235-8 Attachment 6

Drainage Area PA1 (Trial and Final)

1. Daia:		
Drainage Area	A _m =	sq.mi.
Runoff Curve number	CN=	46 (from worksheet 2)
Time of concentration	T _e =	0.40 hr (from worksheet 3)
Rainfall distribution type	=	<u>III (I, IA, II, III)</u>
Pond and swamp areas spread throughtout watershed		0 % of A _m (acres/mi. ² covered)
		Storm #1 Storm #2 Storm #3
2. Frequency		year 25
3. Rainfall, P (24-hour)		inches 8.7
4. Initial abstraction, la		inches 2.35
(use CN with table 4-1)		
5. Compute I _a /P		0.27
6. Unit peak discharge, qu		csm/in 400
(use T_c and I_d/p with exhibit 4 - III)		
7. Runoff, Q		inches 2.2
(from worksheet 2)		
 Pond & swamp adjustment factor, Fp (use percent pond and swamp area with table 4-2. Factor is 1.0 for zeropercent pond and swamp area.) 		1.0
9. Peak discharge, q _p		cfs 27.3

Pre-Development Conditions TR-55 Runoff Curve Number Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PA2

1. Runoff Curve Number (CN)

Soil Name	Cover Description	ļ	ÇN		Areci	Product of
and hydrologic group (Appendix A)	(cover type, treatment, and hydrologic condition;percent impervious; unconnected/connected imperviousarea ratio)	Table2-2	Fig. 2-3	Fig. 2-4	acres _x_sq.mi. %	CN x Area
Kingsville, A/D	Unimproved Area, 0 - 2% slope	39			0.05	1.95
		<u> </u>				
<u> </u>				·		
L. Lise only one CN source	a por line	1,	.1	Totals =	0.05	1.95

I. Use only one CN source per li	Ŋ₽.
----------------------------------	-----

((weighted): total product =	1.95 =	39	Use CN =
tolol orea	0.05		

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr.	25		
Rainfall, P (24-hour)	ìn.	8.7		
Runoff, Q (use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4)	in.	1.6		-

40

$$S = 1000/CN - 10$$
: $S = 15$
 $Q = {P - 0.2s}2$ $Q = 1.6$
 ${P + 0.8s}$

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PA2

Sheet Flow (applicable to Tc only)	Segment ID F-G
1. Surface description (table 3-1)	grass
2. Mannings roughness coeff., n (table 3-1)	0.13
3. Flow length, L (total < 300 ft)	ft. 300
4. Two -year 24-hr rainfall, P_2	in. 4.5
5. Land slope, s	ff/ff 0.01
6. $T_t = 0.007 (nL)^{0.8}$ Compute T_t $P_2^{0.5} s^{0.4}$	hr. 0,39 + = 0.39
Shallow Concentrated Flow	Segment ID G-E
7. surface description (paved or unpaved)	grass
8. How length, L	ft 1700
9. Watercourse slope, S	ft/ft 0.01
10. average velocity, V (figure 3-1)	ft/s 1.6
11. T _t = <u>L</u> Compute T _t 3600 V	hr. 0.30 + = 0.30
Channel Flow	Segment ID
12. Cross sectional flow area, a	ft ²
13. Wetted perimeter, Pw	ft.
14. Hydraulic radius, r = c/Pw	ft-
15. Channel slope, s	ft./ft.
16. Manning's roughness coefficient, n	
17. $V = 1.49 r^{2/3} s^{1/2}$ Compute V	ft./s
18. Flow Length, L	ft.
19. Tt = $\frac{L}{3600 \text{ V}}$ Compute T_t	hr = 0.00
20. Watershed or subarea Tc or Tt (add Tt in s	teps 6, 11, and 19) hr. 0.69

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Drainage Area PA2

l, Data:		
Drainage Area	A _m ≔	0.05 sq.mi.
Runoff Curve number	CN=	40 (from worksheet 2)
Time of concentration	T _c =	0.69 hr (from worksheet 3)
Rainfall distribution type	=	<u>III</u> (I, 1A, II, III)
Pond and swamp areas spread throughtout watershed	=	0 % of A _m (acres/mi.² covered)
		Storm #1 Storm #2 Storm #3
2. Frequency		year 25
3. Rainfall, P (24-hour)		inches 8.7
4. Initial abstraction, la		inches 3.00
(use CN with table 4-1)		
5. Compute l _a /P		0.34
6. Unit peak discharge, qu		csm/in 275
(use T _a and I _a /p with exhibit 4 - III)		
7. Runoff, Q		inches 1.6
(from worksheet 2)		
8. Pond & swamp adjustment factor, Fp (use percent pond and swamp area with table 4-2. Factor is 1.0 for zeropercent pond and swamp area.)		1.0
9. Peak discharge, q_p (where $q_p = q_p A_m Q F_p$)		cfs 22.0

Pre-Development Conditions TR-55 Runoff Curve Number

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PA3

1. Runoff Curve Number (CN)

Soll Name	Cover Description	1	ČN		Area	Product of
and hydrologic group (Appendix A)	(cover type, treatment, and hydrologic condition;percent impervious;	Toble2-2	Fig. 2-3	Fig. 2-4	_x_ sq.mi. acres	CN x Area
1. Ipp 5, 14, 11, 17	unconnected/connected imperviouscrea ratio)				%	
Kingsville, A/D	Unimproved Area, 0 - 2% slope	39			0.03	1.17
				<u> </u>		
		<u> </u>				
		-		-		
1. Use only one CN source	a not line			Totals =	0.03	1.17

N (weighted): total product =	1.17 ₩	39	Use CN =	40
total area	0.03			

2. Runoff

Frequency	yr
Rainfall, P (24-hour)	in
Runoff, Q(use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4)	in

Storm #1	Storm #2	Storm #3
25		
8.7		
1.6		

S = 1000/CN - 10:	S = 15
$Q = \frac{(P - 0.2s)2}{(P + 0.8s)}$	Q = 1.6

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PA3

Sheet Flow (applicable to Tc only)	Segment ID H-I
1. Surface description (table 3-1)	grass
2. Mannings roughness coeff., n (table 3-1)	0.13
3. Flow length, L (total < 300 ft)	ft. 300
4. Two -year 24-hr rainfall, P ₂	in. 4.5
5. Land slope, s	ft/ft 0.01
6. $T_1 = \frac{0.007 \text{ (nL)}^{0.8}}{P_2^{0.5} \text{ s}^{0.4}}$ Compute T_1	hr. 0.39 + 0.39
Shallow Concentrated Flow	Segment ID I - E
7. surface description (paved or unpaved)	grass
8. Flow length, L	ft 1450
9. Watercaurse slope, \$	ft/ft 0.01
10. average velocity, V (figure 3-1)	ft/s 1.6
11. T _t = <u>L</u> Compute T _t	hr. 0.25 + = 0.25
Channel How	Segment ID
12. Cross sectional flow area, a	ff ²
13. Wetted perimeter, Pw	ff.
14. Hydraulic radius, r = a/Pw	ft.
15. Channel slope, s	ff./ff.
16. Manning's roughness coefficient, n	
17. $V = 1.49 r^{2/3} s^{1/2}$ Compute V	ft./s
n 18. Flow Length, L	ft.
19. Tt = $\frac{1}{3600 \text{ V}}$ Compute T _t	hr = 0.00
20. Watershed or subarea Tc or Tt (add Tt in s	teps 6, 11, and 19) hr. 0.64

(where $q_p = q_\nu A_m Q F_p$)

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PA3

1. Data:		
Drainage Area	A _m =	0.03 sq.mi.
Runoff Curve number	CN=	40_(from worksheet 2)
Time of concentration	1 _e =	0.64 hr (from worksheet 3)
Rainfall distribution type	=	(i, IA, II, III)
Pond and swamp areas spread throughtout watershed	=	0 % of A _m (acres/mi. ² covered)
2. Frequency	•	Storm #1 Storm #2 Storm #3
3. Rainfall, P (24-hour)		inches 8.7
4. Initial abstraction, l_a (use CN with table 4-1)		inches 3.00
5. Compute I _a /P		0.34
6. Unit peak discharge, q ₀ (use T _c and I _o /p with exhibit 4 - III)		csm/in 285
7. Runoff, Q (from worksheet 2)		inches 1.6
8. Pond & swamp adjustment factor, Fp (use percent pond and swamp crea with table 4-2. Factor is 1.0 for zeropercent pond and swamp area.)		1.0
9. Peak discharge, q₀		cfs 13.7

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Pre-Development Conditions TR-55 Runoff Curve Number

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Drainage Area PB1

1. Runoff Curve Number (CN)

Soil Name	Cover Description	1	CN		Area	Product of
and hydrologic group (Appendix A)	(cover type, treatment, and hydrologic condition:percent impervious; unconnected/connected imperviousarea ratio)	Table2-2	Fig. 2-3	Fig. 2-4	_x_sq.mi. _x_sq.mi. %	CN x Area
Kingsville, A/D	Unimproved Area, 0 - 2% slope	39			0.04	1.56
Kingsville, A/D	Unimproved Area, 3 - 7% slope	49			0.001	0.05
					1	
				ļ		
						<u> </u>
					1	<u> </u>
			<u> </u>	<u></u>		
1 Hea only one CN source	a nor lina			Totals =	0.041	1.61

1.	Use only	one	CN	source	per	ine
١.	use only	OFIC	C14	200100	PG	H+ 14

I (weighted): total product =-	1.61	==	39	Use CN =	40
total area	0.041				

2. Runoff

		2tom1 # I	510mm #2	2101111 #2
Frequency	γr.	25		
Rainfall, P (24-hour)	in.	8.7		
Runoff, Q	in.	1.6	·	

$$S = 1000/CN - 10$$
: $S = 15$

$$Q = {P - 0.2s}2 \qquad Q = 1.6$$

$${P + 0.8s}$$

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PB1

Sheet Flow (applicable to Tc only)	Segment ID j-k
1. Surface description (table 3-1)	grass
2. Mannings roughness coeff., n (table 3-1)	0.13
3. Flow length, L (total < 300 ft)	ft. 300
4. Two -year 24-hr rainfall, P ₂	in. 4.5
5. Land slope, s	ft/ft 0.01
6. $T_1 = \frac{0.007 (nt)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_1	hr. 0.39 + 0.39
Shallow Concentrated Flow	Segment ID k-l
7. surface description (paved or unpaved)	grass grass
8. Flow length, L	ft 1250
9. Watercourse slope, S	ft/ft 0.01
10. average velocity, V (figure 3-1)	ft/s 1.6
11. $T_t = \underline{t}$ Compute T_t	hr. 0.22 + = 0.22
Channel Flow	Segment ID
12. Cross sectional flow area, a	ft ²
13. Wetted perimeter, Pw	ft.
14. Hydraulic radius, r= a/Pw	ft.
15. Channel slope, s	ft./ft
16. Manning's roughness coefficient, n	
17. $V = 1.49 r^{2/3} s^{1/2}$ Compute V	ft./s
18. Flow Length, L	ft.
19. Tt = \underline{L} Compute T _t 3600 V	ht = 0.00
20. Watershed or subgrea To or Tt (add Tt in ste	ps 6, 11, and 19) hr. 0.61

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PB1

1. Data:		
Drainage Area	A _m =	<u>0.041</u> sq.mi.
Runoff Curve number	CN=	40_(from worksheet 2)
Time of concentration	T _c ≔	0.61 hr (from worksheet 3)
Rainfall distribution type	=	<u>HI</u> (I, IA, II, III)
Pond and swamp areas spread throughtout watershed	=	0 % of A _m (acres/mi. ² covered)
		Storm #1 Storm #2 Storm #3
2. Frequency		year <u>25</u>
3. Rainfall, P (24-hour)		inches 8.7
4. Initial abstraction, I _a		inches 3.00
(use CN with table 4-1)		
5. Compute I _a /P		0.34
6. Unit peak discharge, qu		csm/in 290
(use T_c and I_o/p with exhibit 4 - III)		
7. Runoff, Q		inches 1.6
(from worksheet 2)		
8. Pond & swamp adjustment		1.0
factor, Fp (use percent pond and swamp area with table 4-2. Factor is 1.0 for zeropercent pond and swamp area.)		
9. Peak discharge, q _p		cfs 19.0
(where $q_p = q_u A_m Q F_p$)		

Pre-Development Conditions TR-55 Runoff Curve Number

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PB2

1. Runoff Curve Number [CN]

Soil Name	Cover Description .	<u> </u>	ÇN		Area	Product of
and hydrologic group (Appendix A)	cover type, treatment, and hydrologic condition;percent impervious;	Table2-2	Fig. 2-3	Fig. 2-4	acres _x_sq.mi.	CN x Area
(Mpperion M	unconnected/connected imperviousarea ratio)	<u> </u>		ļ	%	<u> </u>
Kingsville, A/D	Unimproved Area, 0 - 2% slope	39	<u>-</u>	<u> </u>	0.004	0.16
Kingsville, A/D	Unimproved Area, 3 - 7% slope	49			0.002	0.10
				:	}	
			<u> </u>		-	
						
			<u> </u>		1	<u> </u>
		<u> </u>		<u></u>	<u></u>	
1. Use only one CN source	e per line.			Totals =	0.006	0.25

"N [weighted]: total product =	0.25 =	42	Use CN =	42
total area	0.006			

2. Runoff

requency	yr.
Rainfall, P (24-hour)	in.
Runoff, Q(use P and CN with table 2-1,	in.

fig. 2-1, or eqs. 2-3 and 2-4)

Storm #1	Storm #2	Storm #3
25		
8.7		
1.8		

$$S = 1000/CN - 10$$
: $S = 14$

$$Q = \frac{(P - 0.2s)2}{(P + 0.8s)}$$
 $Q = 1.8$

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PB2

Sheet flow (applicable to Tc only)	Segment ID m-I
1. Surface description (table 3-1)	grass
2. Mannings roughness coeff., n (table 3-1)	0.13
3. Flow length, L (total < 300 ft)	ft. 300
4. Two -year 24-hr rainfall, P₂	in. 4.5
5. Land slope, s	ft/ft 0.016
6. $T_t = 0.007 \text{ (nL)}^{0.8}$ Compute T_t	hr. 0.32 + = 0.32
Shallow Concentrated Flow	Segment ID
7. surface description (paved or unpaved)	
8. Flow length, L	ft
9. Watercourse slope, S	ft/ft
10. average velocity, V (figure 3-1)	ft/s
11. $T_t = \underbrace{L}$ Compute T_t	hr. 0.00 + = 0.00
Channel Flow	Segment ID
12. Cross sectional flow area, a	ft ²
13. Wetted perimeter, Pw	ft.
14. Hydraulic radius, r = a/Pw	ft.
15. Channel slope, s	rt./rt.
16. Manning's roughness coefficient, n	
17. $V = 1.49 r^{2/3} s^{1/2}$ Compute V	ft./s
18. Flow Length, L	ft.
19. Tt =	fnr = 0.00
20. Watershed or subarea Tc or Tt (add Tt in s	teps 6, 11, and 19) hr. 0.32

(where $q_p = q_0 A_m Q F_p$)

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PB2

1. Dafa:		
Drainage Area	A _m =	0.006 sq.ml.
Runoff Curve number	CN=	42 [from worksheet 2]
Time of concentration	T _e =	0.32 hr (from worksheet 3)
Rainfall distribution type	=	<u> (</u> [,]A, ,)
Pond and swamp areas spread throughtout watershed	=	0 % of A _m (acres/mi. ² covered)
2. frequency		Storm #1 Storm #2 Storm #3 year 25
3. Rainfail, P (24-hour)		inches 8.7
 Initial abstraction, l_a (use CN with table 4-1) 		inches 2.76
5. Compute I _a /P		0.32
 Unit peak discharge, q_u (use T_e and I_a/p with exhibit 4 - III) 		csm/in 400
7. Runoff, Q (from worksheet 2)		inches 1.8
8. Pond & swamp adjustment factor, Fp (use percent pond and swamp area with table 4-2. Factor is 1.0 for zeropercent pond and swamp area.)		1.0
9. Peak discharge, q _o		cfs 4.3

Pre-Development Conditions TR-55 Runoff Curve Number

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PB3

1. Runoff Curve Number (CN)

· Soil Name	Cover Description	1	CN		Area	Product of
and hydrologic group (Appendix A)	(cover type, treatment, and hydrologic condition;percent impervious; unconnected/connected imperviousarea ratio)	Table2-2	Fig. 2-3	Fig. 2-4	acres _x_ sq.mi, %	CN x Area
(ingsville, A/D	Unimproved Area, 0 - 2% slope	39			0.01	0.39
			·······	<u> </u>	<u> </u>	
	and the state of t					
	A A A A A A A A A A A A A A A A A A A					
						<u> </u>
Lise only one CN source	e per line.			Totals =	0.01	0.39

	0.00	-00	Use CN a	40
N (weighted): total p <u>roduct</u> =	0.39 =	39	Use CN =	40
total area	0.01			

2. Runoff

Frequency	yr.
Rainfall, P (24-hour)	in.
Runoff, Q(use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4)	in.

Storm #1	Storm #2	Storm #3
25	-	
8.7		
1.6		

$$S = 1000/CN - 10$$
: $S = 15$

$$Q = \frac{[P - 0.2s]2}{[P + 0.8s]}$$
 $Q = 1.6$

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PB3

Sheet Flow (applicable to Tc only)	Segment ID n-o
1. Surface description (table 3-1)	grass
2. Mannings roughness coeff., n (table 3-1)	0.13
3. Flow length, L (total < 300 ft)	ff. 300
4. Two -year 24-hr rainfall, P ₂	in. 4.5
5. Land slope, s	ft/ft 0.01
6. $T_1 = \frac{0.007 \text{ (nL)}^{0.8}}{P_2^{0.5} \text{ s}^{0.4}}$ Compute T_1	hr. 0.39 + = 0.39
Shallow Concentrated Flow	Segment ID o-m
7. surface description (paved or unpaved)	grass
8. Flow length, I.	ft 300
9. Watercourse slope, \$	ff/ff 0.01
10. average velocity, V (figure 3-1)	ft/s 1.6
11. $T_t = L$ Compute T_t 3600 V	hr. 0.05 + = 0.05
Channel Flow	Segment ID
12. Cross sectional flow area, a	ft ²
13. Wetted perimeter, Pw	ft.
14. Hydraulic radius, r = a/Pw	fi.
15. Channel slope, s	ft./ft.
16. Manning's roughness coefficient, n	
17. $V = 1.49 r^{2/3} s^{1/2}$ Compute V	ft./s
18. Flow Length, L	ft.
19. Tt = <u>L</u> Compute T _t 3600 V	hr + = 0.00
On Watershad or withgroad To or It ladd It in stell	os 6, 11, and 19) br. 0.44

(where $q_p = q_u A_m Q F_p$)

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PB3

1. Data:		
Drainage Area	A _m =	0.01 sq.mi.
Runoff Curve number	CN=	40 [from worksheet 2]
Time of concentration	7 _c =	0.44 hr (from worksheet 3)
Rainfall distribution type	=	<u> </u>
Pond and swamp areas spread throughtout watershed	=	0 % of A _m (acres/mi. ² covered)
2. Frequency		Storm #1 Storm #2 Storm #3
3. Rainfall, P (24-hour)		inches 8.7
4. Initial abstraction, I _a [use CN with table 4-1)		inches 3.00
5. Compute I _a /P		0.34
6. Unit peak discharge, q_{ν} (use T_{c} and I_{d}/p with exhibit 4 - III)		csm/in 340
7. Runoff, Q (from worksheet 2)		înches 1.6
8. Pond & swamp adjustment factor, Fp (use percent pond and swamp area with table 4-2. Factor is 1.0 for zeropercent pond and swamp area.)		1.0
9. Peak discharge, q _p		cfs 5.4

Appendix 6A May 1998 Revision 1

Part III, Attachment 6, Appendix 6A.2.1, p.g.-21

Pre-Development Conditions TR-55 Runoff Curve Number

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PC1

1. Runoff Curve Number (CN)

Soil Name	Cover Description		CN		Areci	Product of
and hydrologic group (Appendix A)	(cover type, treatment, and hydrologic condition;percent impervious; unconnected/connected imperviousarea ratio)	Table2-2	Fig. 2-3	Fig. 2-4	acres _x_sq.mi. %	CN x Area
Kingsville. A/D	Unimproved Area, 0 - 2% siope	39			0.05	1.95
Kingsville, A/D	Unimproved Area, 3 - 7% slope	49			0.02	0.98
Kingsville, A/D	Unimproved Area, > 7% slope	59			0.001	0.06
					<u> </u>	
				<u></u>	<u> </u>	<u> </u>
			<u> </u>			<u> </u>
		<u> </u>	! ! 			
Use only one CN source	per line.			Totals =	0.071	2.99

			_	
:N (weighted): total product =	2.99	=	42	Use CN =
total area	0.071			
ioidi disa	0.07			

2. Runoff

		Slorm #1	Storm #2	Storm #3
Frequency	yr.	25		
Rainfall, P (24-hour)	in.	8.7		·
Runoff, Q	in.	1.8	,	

42

$$S = 1000/CN - 10$$
: $S = 13.8$ }
$$Q = (P - 0.2s)2 \qquad Q = 1.8$$
$$\{P + 0.8s\}$$

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PC1

Sheet Flow (applicable to Tc only)	Segment ID j-p
1. Surface description (table 3-1)	grass
2. Mannings roughness coeff., n (lable 3-1)	0.13
3. Flow length, L (total < 300 ft)	ft. 300
4. Two -year 24-hr rainfall, P ₂	in. 4.5
5. Land slope, s	ff/ff 0.01
6. $T_1 = 0.007 \text{ [nL]}^{0.8}$ Compute T_1 $P_2^{0.5} s^{0.4}$	hr. 0.39 + = 0.39
Shallow Concentrated Flow	Segment ID p-q
7. surface description (paved or unpaved)	grass
8. Flow length, L	ff 650
9. Watercourse slope, \$	ft/ft 0.025
10. average velocity, V (figure 3-1)	ft/s 1.6
11. $T_t = \underline{L}$ Compute T_t	hr. 0.11 + = 0.11
Channel Flow	Segment ID q-r See
12. Cross sectional flow area, a	ft ² 17.5 Page 31
13. Wetted perimeter. Pw	fl. 70.01
14. Hydraulic radius, r = a/Pw	ft. 0.25
15. Channel slope, s	ff./ff. 0.018
16. Manning's roughness coefficient, n	0.03
17. $V = 1.49 r^{2/3} s^{1/2}$ Compute V	ft./s 2.6
n 18. Flow Length, L	ft. 950
19. Tt =L	hr 0.10 + = 0.10
20. Watershed or subarea Tc or Tt (add Tt in ste	ps 6, 11, and 19) hr. 0.60

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PC1

1. Data:		
Drainage Area	۸ _m =	0.071 sq.ml.
Runoff Curve number	CN=	42 (from worksheet 2)
Time of concentration	T _c ≔	0.60 hr (from worksheet 3)
Rainfall distribution type	=	<u>III</u> (I, IA, II, III)
Pond and swamp areas spread throughtout watershed	=	0 % of A _m (acres/mi. ² covered)
		Storm #1 Storm #2 Storm #3
2. Frequency		year 25
3. Rainfall, P (24-hour)		inches 8.7
4. Initial abstraction, la		inches 2.76
(use CN with table 4-1)		
5. Compute I _a /P		0.32
 Unit peak discharge, q_v (use I_c and I_a/p with exhibit 4 - III) 		csm/in 310
7. D. m. o. 6. 🔿		inches I.8
7. Runoff, Q (from worksheet 2)		1101100
8. Pond & swamp adjustment factor, Fp (use percent pond and swamp area with table 4-2. Factor is 1.0 for zeropercent pond and swamp area.)		0.1
9. Peak discharge, q_p (where $q_p = q_u A_m Q F_p$)		cfs 39.6

Pre-Development Conditions TR-55 Runoff Curve Number Kingsvilte Landfill Permit Application 235-B Attachment 6

Drainage Area PC2

1. Runoff Curve Number (CN)

Soil Name	Cover Description	1	CN		Area	Product of
and hydrologic group (Appendix A)	(cover type, treatment, and hydrologic condition;percent impervious; unconnected/connected imperviousarea ratio)	Table2-2	Fig. 2-3	Fig. 2-4	acres _x_sq.mi. %	CN x Area
Kingsville, A/D	Unimproved Area, 0 - 2% slope	39			0.004	0.16
Kingsville, A/D	Unimproved Area, 3 - 7% slope	49			0.01	0.49
Kingsville, A/D	Unimproved Area, > 7% slope	59		<u> </u>	0.001	0.06
					<u> </u>	
<u>, </u>		:	<u> </u>			
			<u> </u>			
I. Use only one CN source	ner line	<u> </u>		Totals =	0.015	0.71

,v (weighted):total product =	0.71 =	47	Use CN :	47
total area	0.015			

2. Runoff

Frequency	yr.
Rainfall, P (24-hour)	in.
Runoff, Q(use P and CN with fable 2-1,	în.

Storm #1	Storm #2	Storm #3
25		-
8.7		
2.3		

S = 1000/CN - 10:

S = 11

fig. 2-1, or eqs. 2-3 and 2-4)

 $Q = \frac{[P - 0.2s]2}{[P + 0.8s]}$

Q = 2.3

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PC2

Sheet Flow (applicable to Tc only)	Segment ID a-I
1. Surface description (table 3-1)	grass
2. Mannings roughness coeff., n (table 3-1)	0.13
3. Flow length, L (total < 300 ft)	ft. 150
4. Two -year 24-hr rainfall, P_2	in. 4.5
5. Land slope, s	ft/ft 0.01
6. $T_t = 0.007 (nL)^{0.8}$ Compute T_t	hr. 0.22 + = 0.22
Shallow Concentrated Flow	Segment ID U-w
7. surface description (paved or unpaved)	grass
8. Flow length, L	ft 180
9. Watercourse slope, \$	ft/ft 0.06
10. average velocity, V (figure 3-1)	ft/s 4
11. $T_t = L$ Compute T_t 3600 V	hr. 0.01 + = 0.01
Channel Flow	Segment ID W-X
12. Cross sectional flow area, a	fl ² 3.54 See
13. Wetted perimeter, Pw	ff. 11.72 Page 32
14. Hydraulic radius, r = a/Pw	ff. 0.30
15. Channel slope, s	ft./ft. 0.036
16. Manning's roughness coefficient, n	0.03
17. $V = 1.49 r^{2/3} s^{1/2}$ Compute V	ft./s 4.2
n 18. Flow Length, L	ft. 650
19. Th = \underline{L} Compute T_t 3600 V	$hr = 0.04 \pm = 0.04$
an watershad or subgreate or It ladd It in	steps 6, 11, and 19) hr. 0.28

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PC2

I. Daid:		
Drainage Area	A _m =	0.015 sq.mi.
Runoff Curve number	CN=	(from worksheet 2)
Time of concentration	$T_e =$	0.28 hr (from worksheet 3)
Rainfall distribution type	=	<u>III</u> (I, IA, II, III)
Pond and swamp areas spread throughtout watershed	=	0 % of A _m (acres/mi. ² covered)
• •		Storm #1 Storm #2 Storm #3_
2. Frequency		year 25
·		
3. Rainfall, P (24-hour)		inches 8.7
4. Initial abstraction, I _a		inches 2.26
(use CN with table 4-1)		
5. Compute I _a /P		0.26
6. Unit peak discharge, qu		csm/in 455
(use T_c and I_a/p with exhibit 4 - III)		
7. 0		inches 2.3
7. Runoff, Q		niches 25
(from worksheet 2)		
8. Pond & swamp adjustment factor, Fp (use percent pond and swamp area with table 4-2. Factor is 1.0 for zeropercent pond and swamp area.)		1.0
9. Peak discharge, q _p		cfs 15.7
(where $q_p = q_u A_m Q f_p$)		

Pre-Development Conditions TR-55 Runoff Curve Number

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PC3

). Runoff Curve Number (CN)

Soil Name	Cover Description		ĊИ		Area	Product of
and hydrologic group (Appendix A)	(cover type, treatment, and hydrologic condition;percent impervious; unconnected/connected imperviousarea ratio)	Table2-2	Fig. 2-3	Fig. 2-4	acres _x_sq.mi. %	CN x Area
Kingsville, A/D	Unimproved Area, 0 - 2% slope	39			0.004	0.16
Kingsville, A/D	Unimproved Area, 3 - 7% slope	49	:	ļ	0.001	0.05
	·					
	·					
Use only one CN source	e per line.	·····	<u> </u>	Totals =	0.005	0.21

N (weighted): total product =	0.21 =	41	Use CN :	41
total area	0.005			

2. Runoff

Frequency	yr.
Rainfall, P (24-hour)	in.
Runoff, Q	in.

Storm #1	Storm #2	Storm #3
25		
8.7		
1.7		

$$S = 1000/CN - 10$$
: $S = 14$
 $Q = (P - 0.2s)2$ $Q = 1.7$
 $(P + 0.8s)$

Appendix 6A May 1998 Revision 1 Pre-Development Conditions TR-55 Time of Concentration

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PC3

Sheet Flow (applicable to Tc only)	Segment ID y-s
	1
Surface description (table 3-1)	grass
2. Mannings roughness coeff., n (table 3-1)	0.13
3. Flow length, L (total < 300 ft)	ff. 300
4. Two -year 24-hr rainfall. P ₂	in. 4.5
5. Land slope, s	ft/ft 0.015
6. $T_1 = 0.007 \text{ (nL)}^{0.8}$ Compute T_1 $P_2^{0.8}$ s $^{0.4}$	hr. 0.33 + = 0.33
Shallow Concentrated Flow	Segment ID s-t
7. surface description (paved or unpaved)	grass
8. Flow length, L	ft 300
9. Watercourse slope, S	ft/ft 0.015
10. average velocity, V (figure 3-1)	ft/s 1.6
11. T _t =L Compute T _t 3600 V	hr. 0.05 + = 0.05
Channel Flow	Segment ID
12. Cross sectional flow area, a	ff ²
13. Wetted perimeter, Pw	ft.
14. Hydraulic radius, r = a/Pw	ft.
15. Channel slope, s	ft./ft.
16. Manning's roughness coefficient, n	
17. $V = 1.49 r^{2/3} s^{1/2}$ Compute V	ft./s
18. Flow Length, L	ft.
19. Tt = $\frac{L}{3600 \text{ V}}$ Compute T_t	hr = 0.00
20. Watershed or subarea To or Tt (add Tt in step	os 6, 11, and 19) hr. 0.38

Appendix 6A May 1998 Revision 1

Pre-Development Conditions TR-55 Graphical Peak Discharge Method

Kingsville Landfill Permit Application 235-B Attachment 6

Drainage Area PC3

I. Data:		•
Drainage Area	A _m =	0.005 sq.mi.
Runoff Curve number	CN=	(from worksheet 2)
Time of concentration	T _e =	0.38 hr (from worksheet 3)
Rainfall distribution type	=	(I, 1A, II, III)
Pond and swamp areas spread throughtout watershed	=	0 % of A _m (acres/mi. ² covered)
		Storm #1 Storm #2 Storm #3
2. Frequency		year 25
3. Rainfall, P (24-hour)		inches 8.7
4. Initial abstraction, I _a		inches 2.88
(use CN with table 4-1)		<u> </u>
5. Compute l _a /P		0.33
6. Unit peak discharge, qu		csm/in 360
(use T_c and I_a/p with exhibit 4 - III)		<u> </u>
7. Runoff, Q		inches 1.7
(from worksheet 2)		menos as
		-
 Pond & swamp adjustment factor. Fp (use percent pond and swamp area with table 4-2. Factor is 1.0 for zeropercent pond and swamp area.) 		1.0
9. Peak discharge, q _p		cfs 3.1
(where $q_p = q_0 A_m Q F_p$)		

Appendix 6A May 1998 Revision 1

Kingsville Landfill Permit Amendment 235-B Attachment 6 PreDevelop Channel C-D Trial 1 Worksheet for Triangular Channel

Project Description	
Project File	d:\98 files\kingsville landfill permit 235b\predevel.fm2
Worksheet	Seg CD
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data	
Mannings Coefficient	0.030
Channel Slope	0.012500 ft/ft
Depth	1.00 ft
Left Side Slope	17.000000 H : V
Right Side Slope	3,000000 H:V

Results		
Discharge	34.66	cfs
Flow Area	10.00	ff²
Wetted Perimeter	20.19	ft
Top Width	20.00	ft
Critical Depth	0.94	ft
Critical Slope	0.01706	33 ft/ft
Velocity	3.47	ft/s
Velocity Head	0.19	ft
Specific Energy	1.19	ft
Froude Number	0.86	
Flow is subcritical.		

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Revision: 0

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Kingsville Landfill Permit Amendment 235-B Pre-Development Channel C-D Final Appendix 6A Worksheet for Triangular Channel

Project Description	
Project File	d:\98 files\kingsville landfiil permit 235b\final.fm2
Worksheet	6A C-D final
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.030
Channel Slope	0.012500 ft/ft
Left Side Slope	17.000000 H:V
Right Side Slope	3.000000 H:V
Discharge	27.30 cfs

Results		_
Depth	0.91	ft
Flow Area	8.36	ft²
Wetted Perimeter	18.46	ft
Top Width	18.29	ft
Critical Depth	0.86	ft
Critical Slope	0,0176	16 ft/ft
Velocity	3.27	ft/s
Velocity Head	0.17	ft
Specific Energy	1.08	· ft
Froude Number	0.85	
Flow is subcritical.		

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Kingsville Landfill Permit Amendment 235-8 PreDevelopment Segment Q - R Attachment 6 Worksheet for Triangular Channel

Project Description	חס
Project File	d:\98 files\kingsville landfill permit 235b\predevel.fm2
Worksheet	PreDev Q-R
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data	
Mannings Coefficient	0.030
Channel Slope	0.018000 ft/ft
Depth	0.50 ft
Left Side Slope	82,000000 H:V
Right Side Slope	58,000000 H : V

Results		
Discharge	46.15	cfs
Flow Area	17,50	ff²
Wetted Perimeter	70.01	ft
Top Width	70.00	ft
Critical Depth	0.49	ft
Critical Slope	0.021023	ft/ft
Velocity	2.64	ft/s
Velocity Head	0.11	ft
Specific Energy	D.61	ft
Froude Number	0.93	
Flow is subcritical.		

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Kingsville Landfill Permit Amendment 235-B PreDevelopment Segment W-X Attachment 6 Worksheet for Triangular Channel

Project Description	n
Project File	d:\98 files\kingsville landfill permit 235b\predevel.fm2
Worksheet	PreD WX Final
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.030
Channel Slope	0.036000 ft/ft
Left Side Slope	16.000000 H : V
Right Side Slope	3,000000 H : V
Discharge	15.00 cfs

Results		
Depth	0.61	ft
Flow Area	3,54	ft²
Wetted Perimeter	11.72	ft
Top Width	11.60	ft
Critical Depth	0.69	ft
Critical Slope	0.0189	64 ft/ft
Velocity .	4.23	ft/s
Velocity Head	0.28	ft
Specific Energy	0.89	ft
Froude Number	1.35	
Flow is supercritical.		

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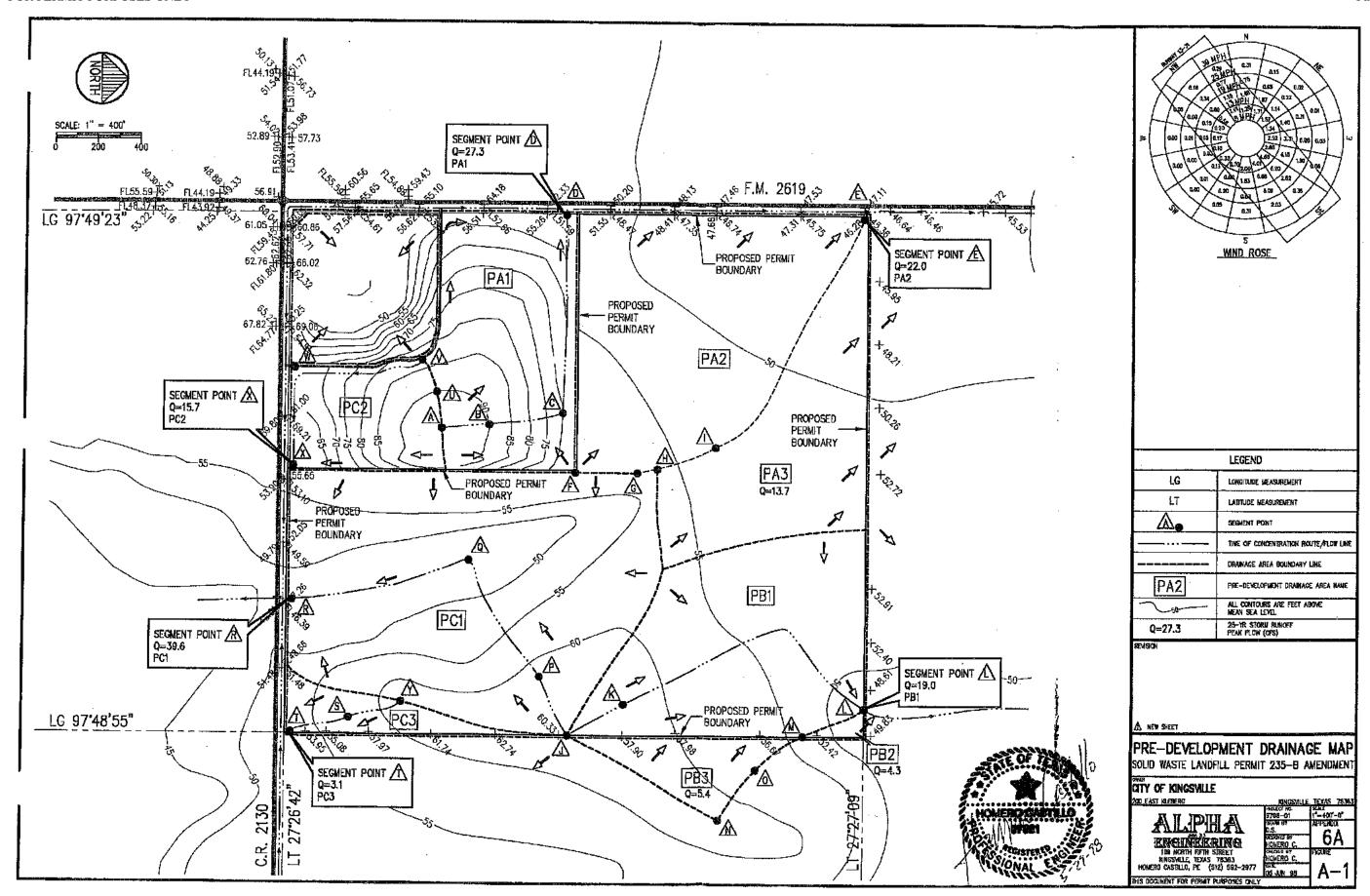
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APPENDIX 6A.2.2

PRE-DEVELOPMENT DRAINAGE MAP SOLID WASTE LANDFILL PERMIT 235-B AMENDMENT FIGURE A-1



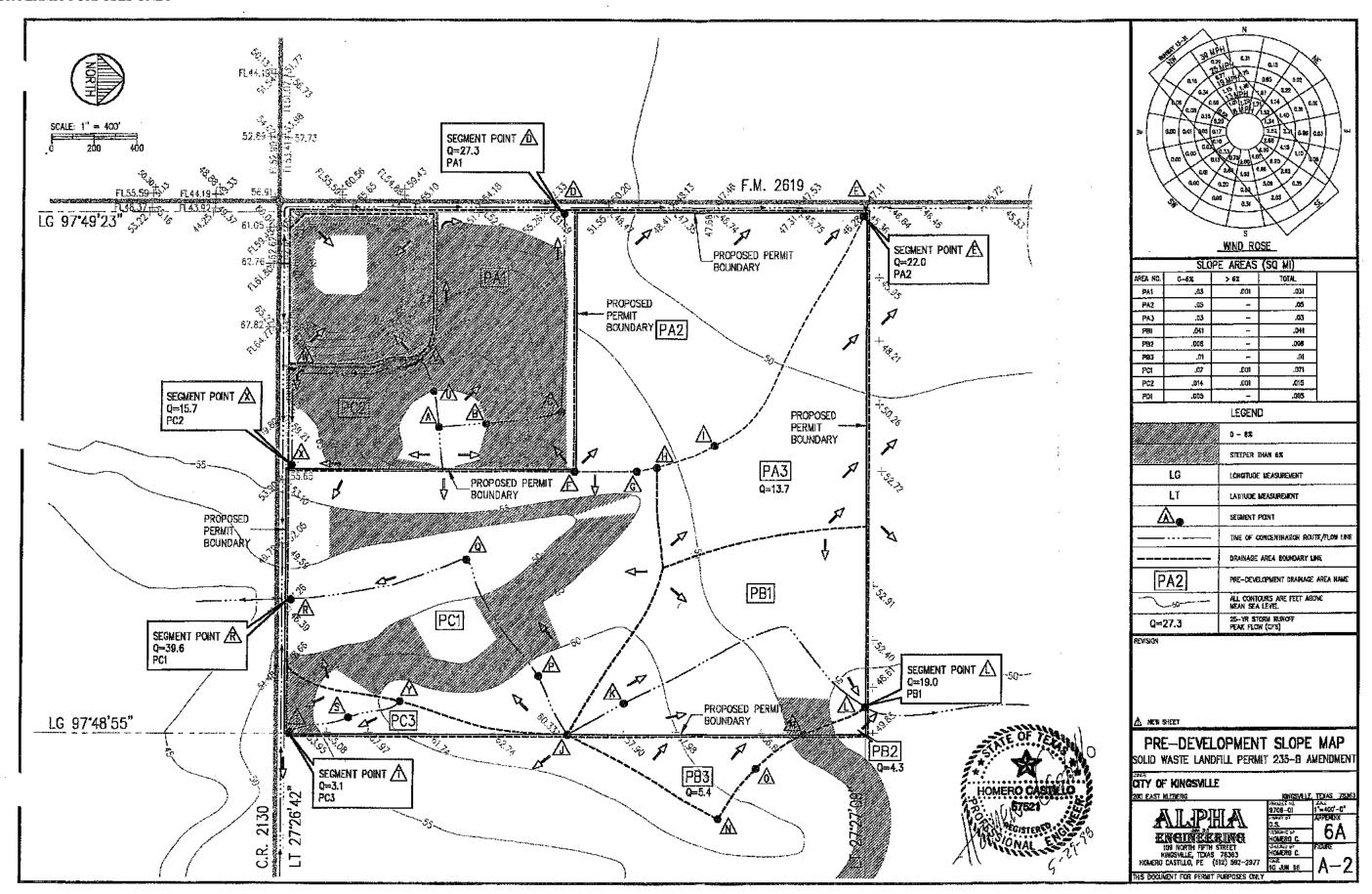


Part III, Attachment 6, Appendix 6A.2.2, p.g.-1

APPENDIX 6A.2.3

PRE-DEVELOPMENT SLOPE MAP SOLID WASTE LANDFILL PERMIT 235-B AMENDMENT FIGURE A-2





APPENDIX 6A.2.4

HYDROCAD MODEL PRE-DEVELOPMENT CONDITIONS 25 YEAR EXISTING PERMITTED CONDITIONS



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Page 2

Area Listing (all nodes)

Area	CN	Description
(acres)		(subcatchment-numbers)
19.840	46	(PA1)
83.840	40	(PA2, PA3, PB1, PB3)
49.280	42	(PB2, PC1)
9.600	47	(PC2)
3.200	41	(PC3)
165.760	42	TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
165.760	Other	PA1, PA2, PA3, PB1, PB2, PB3, PC1, PC2, PC3
465 760		TOTAL ARFA

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
 0.000	0.000	0.000	0.000	165.760	165.760		PA1, PA2, PA3,
							PB1, PB2, PB3,
				•			PC1, PC2, PC3
0.000	0.000	0.000	0.000	165,760	165.760	TOTAL AREA	

Subcatchment PC3: PC3

PreDevelopment Existing 25 Yr

Type III 24-hr 25-Year Rainfall=8.70"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PA1: PA1	Runoff Area=19.840 ac 0.00% Impervious Runoff Depth=2.23" Tc=24.0 min CN=46 Runoff=28.74 cfs 3.688 af
Subcatchment PA2: PA2	Runoff Area=32,000 ac 0.00% Impervious Runoff Depth=1.57" Tc=41.4 min CN=40 Runoff=22.31 cfs 4,186 af
Subcatchment PA3: PA3	Runoff Area=19.200 ac 0.00% Impervious Runoff Depth=1.57" Tc=38.4 min CN=40 Runoff=13.91 cfs 2,511 af
Subcatchment PB1: PB1	Runoff Area=26.240 ac 0.00% Impervious Runoff Depth=1.57" Tc=36.6 min CN=40 Runoff=19.49 cfs 3.432 af
Subcatchment PB2: PB2	Runoff Area=3,840 ac 0.00% Impervious Runoff Depth=1,79" Tc=19.2 min CN=42 Runoff=4,48 cfs 0.571 af
Subcatchment PB3: PB3	Runoff Area=6.400 ac 0.00% Impervious Runoff Depth=1.57" Tc=26.4 min CN=40 Runoff=5.49 cfs 0.837 af
Subcatchment PC1: PC1	Runoff Area=45.440 ac 0.00% Impervious Runoff Depth=1.79" Tc=36.0 min CN=42 Runoff=40.94 cfs 6.761 af
Subcatchment PC2: PC2	Runoff Area=9.600 ac 0.00% Impervious Runoff Depth=2.34" Tc=16.8 min CN=47 Runoff=17.12 cfs 1.875 af
•	

Total Runoff Area = 165.760 ac Runoff Volume = 24.309 af Average Runoff Depth = 1.76" 100.00% Pervious = 165.760 ac 0.00% Impervious = 0.000 ac

Runoff Area=3.200 ac 0.00% Impervious Runoff Depth=1.68"

Tc=22.8 min CN=41 Runoff=3.20 cfs 0.447 af

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PA1: PA1

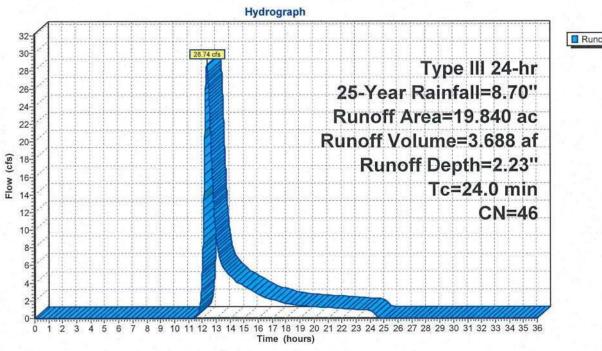
28.74 cfs @ 12.38 hrs, Volume= Runoff

3.688 af, Depth= 2.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

-	Area	(ac)	CN	Desc	cription			
*	19	.840	46			Jan 15		
	19	.840		100.	00% Pervi	ous Area		
	Tc (min)	Lengt (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
	24.0						Direct Entry,	

Subcatchment PA1: PA1



Runoff

Type III 24-hr 25-Year Rainfall=8.70"

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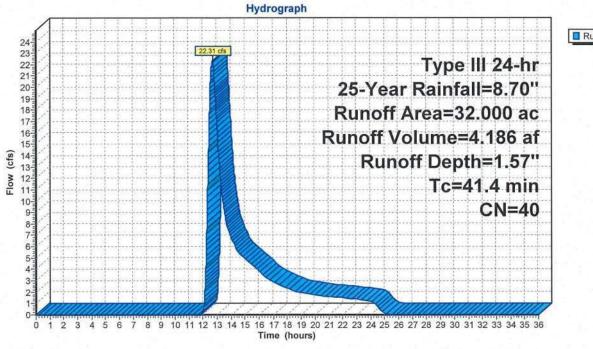
Summary for Subcatchment PA2: PA2

Runoff 22.31 cfs @ 12.69 hrs, Volume= 4.186 af, Depth= 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

	Area	(ac)	CN I	Desc	cription			
	32	.000	40					
-	32	.000	3	100.	00% Pervi	ous Area		
	Тс	Length		оре		Capacity	Description	
	(min)	(feet) (fl	t/ft)	(ft/sec)	(cfs)	Hardala and the Company of the Compa	
	41.4						Direct Entry,	

Subcatchment PA2: PA2



Runoff

Part III

PreDevelopment Existing 25 Yr

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PA3: PA3

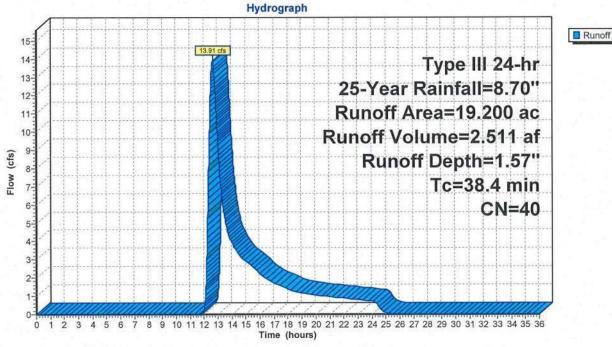
13.91 cfs @ 12.64 hrs, Volume= Runoff

2.511 af, Depth= 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

_	Area	(ac)	CN	Desc	cription		<u> Karata da Afrika ana kaominina da </u>
*	19	.200	40				
	19	.200		100.	00% Pervi	ous Area	
	Tc (min)	Lengtl (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
	38.4						Direct Entry, Direct Entry

Subcatchment PA3: PA3



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PB1: PB1

Runoff =

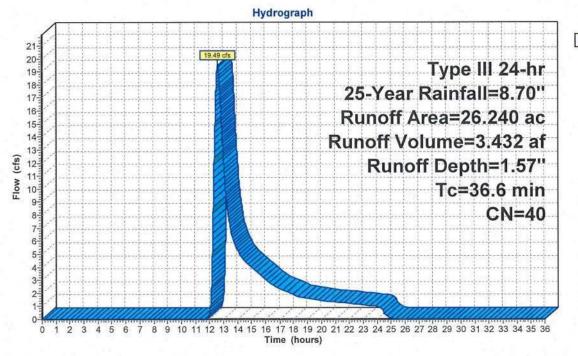
19.49 cfs @ 12.61 hrs, Volume=

3.432 af, Depth= 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

-	Area	(ac)	CN	Desc	cription			
*	26.240		40					
	26.	240		100.	00% Pervi	ous Area		
L.	Tc (min)	Lengtl (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
	36.6						Direct Entry.	

Subcatchment PB1: PB1



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PB2: PB2

Runoff =

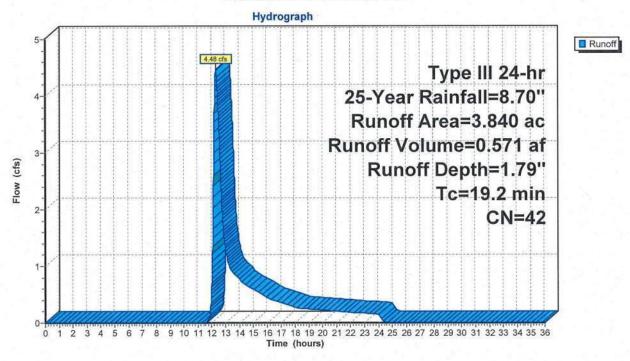
4.48 cfs @ 12.31 hrs, Volume=

0.571 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

	Area	(ac)	CN	Desc	cription			
*	3	.840	42					
	3	.840	- 4	100.	00% Pervi	ous Area		
	Tc (min)	Leng (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
	19.2	(166)	(II/II)	(lusec)	(CIS)	Direct Entry,	

Subcatchment PB2: PB2



Submittal Date: September 2018

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PB3: PB3

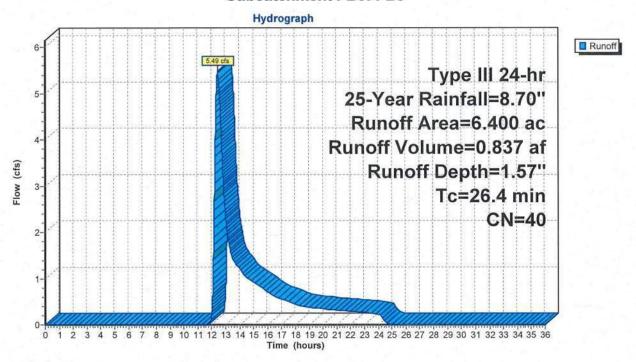
Runoff = 5.49 cfs @ 12.46 hrs, Volume=

0.837 af, Depth= 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

-	Area	(ac)	CN	Desc	cription			
*	6.	400	40					1
	6.	400		100.	00% Pervi	ous Area		
	Tc (min)	Lengt		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
	26.4	(166	ι)	(IUIL)	(IUSEC)	(CIS)	Direct Entry,	

Subcatchment PB3: PB3



Part III

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Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PC1: PC1

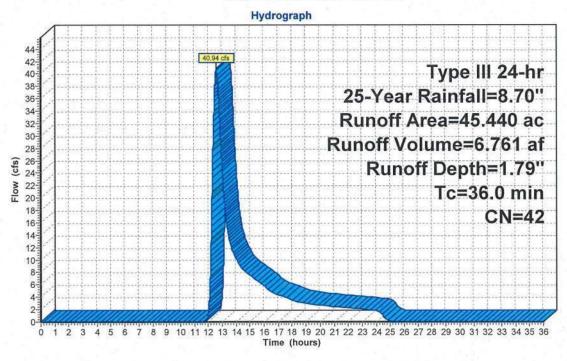
Runoff = 40.94 cfs @ 12.60 hrs, Volume=

6.761 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

-	Area (ac)		CN	Des	cription			11
*	45.440		42					
	45	.440		100.	00% Pervi	ous Area		
100	Tc (min)	Lengt (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
	36.0						Direct Entry.	

Subcatchment PC1: PC1



Runoff

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PC2: PC2

Runoff

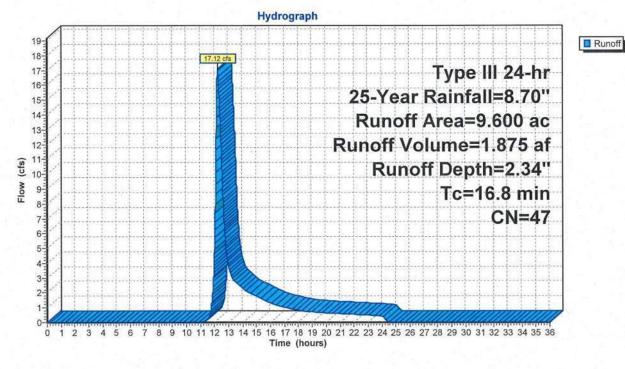
17.12 cfs @ 12.26 hrs, Volume=

1.875 af, Depth= 2.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

١.	Area	(ac)	CN	Des	cription			
*	9.600		47					
	9	.600		100.	00% Pervi	ous Area		
	Tc (min)	Leng (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
	16.8	(100		(1010)	(12000)	(0.0)	Direct Entry,	The second second

Subcatchment PC2: PC2



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PC3: PC3

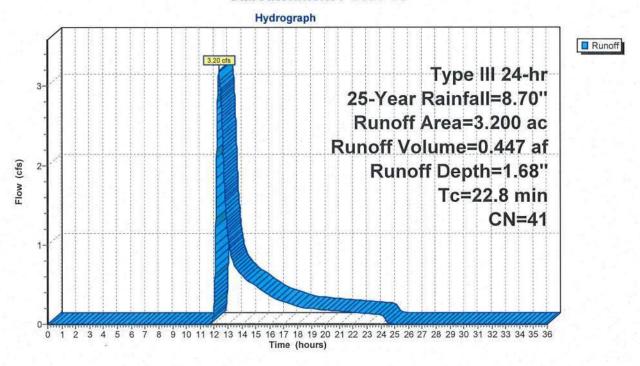
Runoff = 3.20 cfs @ 12.39 hrs, Volume= 0.

0.447 af, Depth= 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

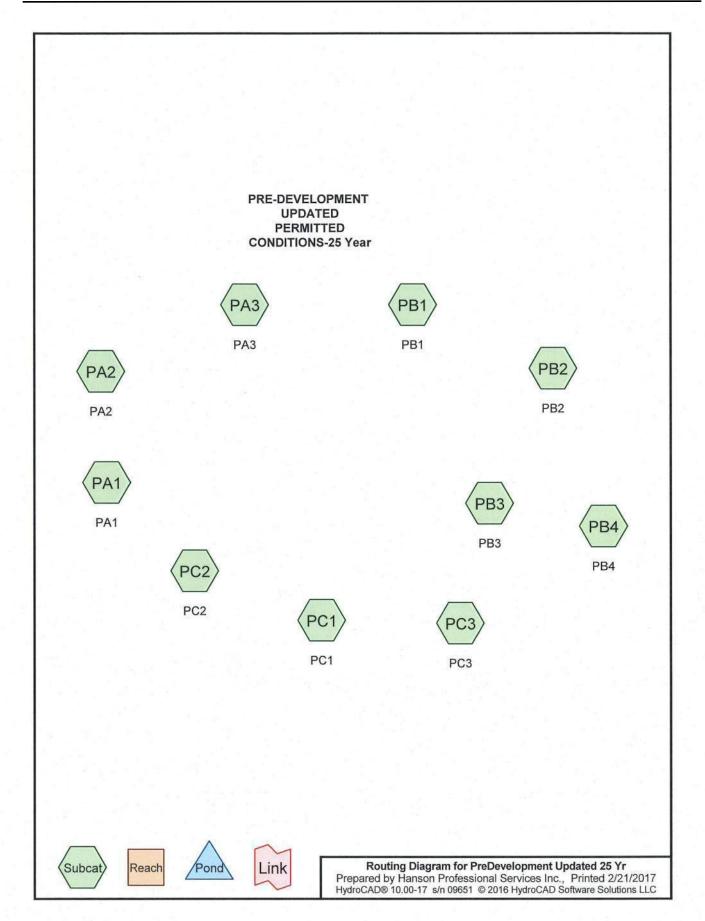
8	Area	(ac)	CN	Desc	cription			
*	3.	200	41					
	3	200		100.	00% Pervi	ous Area		
	Tc (min)	Lengt (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
	22.8	(100	.,	(1010)	(10000)	(0.0)	Direct Entry.	

Subcatchment PC3: PC3



APPENDIX 6A.2.5 HYDROCAD MODEL PRE-DEVELOPMENT CONDITIONS 25 YEAR UPDATED PERMITTED CONDITIONS





PreDevelopment Updated 25 Yr

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Area Listing (all nodes)

Area	CN	Description
(acres)		(subcatchment-numbers)
 19.840	46	(PA1)
97.220	40	(PA2, PA3, PB1, PB3, PB4)
49.280	42	(PB2, PC1)
9.600	47	(PC2)
3.200	41	(PC3)
179,140	42	TOTAL AREA

PreDevelopment Updated 25 Yr

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Soil Listing (all nodes)

Area	Soil	Subcatchment
 (acres)	Group	Numbers
 0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
179.140	Other	PA1, PA2, PA3, PB1, PB2, PB3, PB4, PC1, PC2, PC3
179 140		TOTAL AREA

Part III

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	179.140	179.140		PA1, PA2, PA3,
							PB1, PB2, PB3,
							PB4, PC1, PC2,
							PC3
0.000	0,000	0.000	0.000	179,140	179,140	TOTAL AREA	

Subcatchment PC3: PC3

PreDevelopment Updated 25 Yr

Type III 24-hr 25-Year Rainfall=8.70"

Tc=16.8 min CN=47 Runoff=17.12 cfs 1.875 af

Tc=22.8 min CN=41 Runoff=3.20 cfs 0.447 af

Runoff Area=3.200 ac 0.00% Impervious Runoff Depth=1.68"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PA1: PA1	Runoff Area=19.840 ac 0.00% Impervious Runoff Depth=2.23" Tc=24.0 min CN=46 Runoff=28.74 cfs 3.688 af
Subcatchment PA2: PA2	Runoff Area=32.000 ac 0.00% Impervious Runoff Depth=1.57" Tc=41.4 min CN=40 Runoff=22.31 cfs 4.186 af
Subcatchment PA3: PA3	Runoff Area=19.200 ac 0.00% Impervious Runoff Depth=1.57" Tc=38.4 min CN=40 Runoff=13.91 cfs 2.511 af
Subcatchment PB1: PB1	Runoff Area=26.240 ac 0.00% Impervious Runoff Depth=1.57" Tc=36.6 min CN=40 Runoff=19.49 cfs 3.432 af
Subcatchment PB2: PB2	Runoff Area=3.840 ac 0.00% Impervious Runoff Depth=1.79" Tc=19.2 min CN=42 Runoff=4.48 cfs 0.571 af
Subcatchment PB3: PB3	Runoff Area=6.400 ac 0.00% Impervious Runoff Depth=1.57" Tc=26.4 min CN=40 Runoff=5.49 cfs 0.837 af
Subcatchment PB4: PB4	Runoff Area=13.380 ac
Subcatchment PC1: PC1	Runoff Area=45.440 ac 0.00% Impervious Runoff Depth=1.79" Tc=36.0 min CN=42 Runoff=40.94 cfs 6.761 af
Subcatchment PC2: PC2	Runoff Area=9.600 ac 0.00% Impervious Runoff Depth=2.34"

Total Runoff Area = 179.140 ac Runoff Volume = 26.059 af Average Runoff Depth = 1.75" 100.00% Pervious = 179.140 ac 0.00% Impervious = 0.000 ac

PreDevelopment Updated 25 Yr

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PA1: PA1

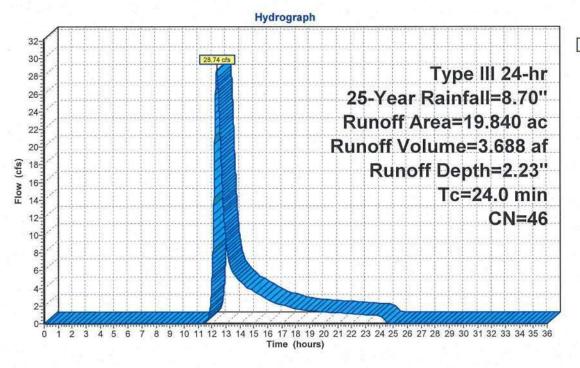
Runoff = 28.74 cfs @ 12.38 hrs, Volume=

3.688 af, Depth= 2.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

200	Area	(ac)	CN	Desc	cription			The second second
*	19	840	46					
(4)	19.	.840		100.	00% Pervi	ous Area		
	Tc (min)	Leng (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
	24.0					1111	Direct Entry,	

Subcatchment PA1: PA1



Runoff

PreDevelopment Updated 25 Yr

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PA2: PA2

Runoff =

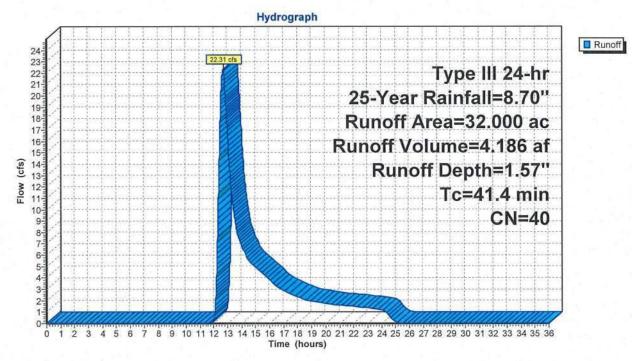
= 22.31 cfs @ 12.69 hrs, Volume=

4.186 af, Depth= 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

_	Area	(ac)	CN	Des	cription			
*	32.	.000	40					
	32.000			100.	00% Pervi	ous Area		
	Tc (min)	Leng (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
	41.4	~			38	44	Direct Entry,	

Subcatchment PA2: PA2



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PreDevelopment Updated 25 Yr

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PA3: PA3

Runoff

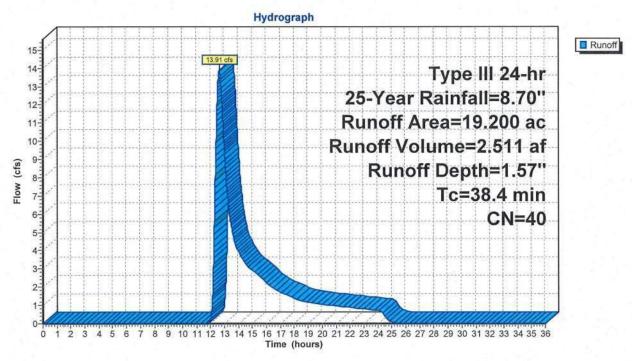
13.91 cfs @ 12.64 hrs, Volume=

2.511 af, Depth= 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

	Area	(ac)	CN	Desc	cription		
*	19	.200	40				
1	19.200		100.00% Pervious Area			ous Area	
	Tc (min)	Lengt (feet		ope ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
	38.4						Direct Entry, Direct Entry

Subcatchment PA3: PA3



PreDevelopment Updated 25 Yr

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PB1: PB1

Runoff

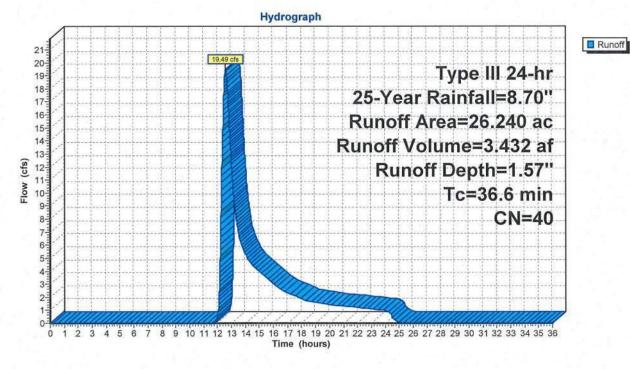
19.49 cfs @ 12.61 hrs, Volume=

3.432 af, Depth= 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

	Area	(ac)	CN	Desc	cription			
*	26	240	40					
	26	.240		100.00% Pervious Area				
	Tc (min)	Lengt (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
-	36.6	(100	.,	(ioit)	(10000)	(013)	Direct Entry,	1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1

Subcatchment PB1: PB1



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PB2: PB2

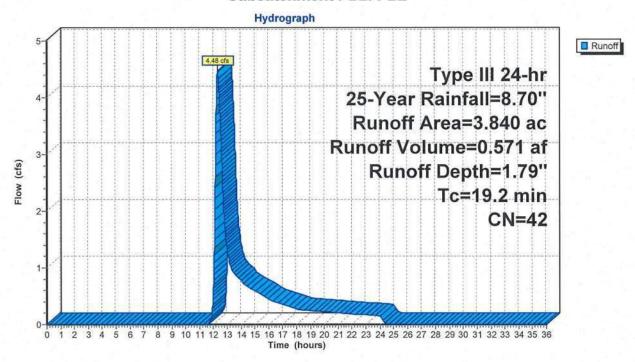
Runoff = 4.48 cfs @ 12.31 hrs, Volume=

0.571 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

-	Area	(ac)	CN	Desc	cription			
*	3	.840	42					
477	3	.840		100.	00% Pervi	ous Area		
	Tc (min)	Lengt (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
-	19.2		-				Direct Entry,	

Subcatchment PB2: PB2



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PB3: PB3

Runoff

=

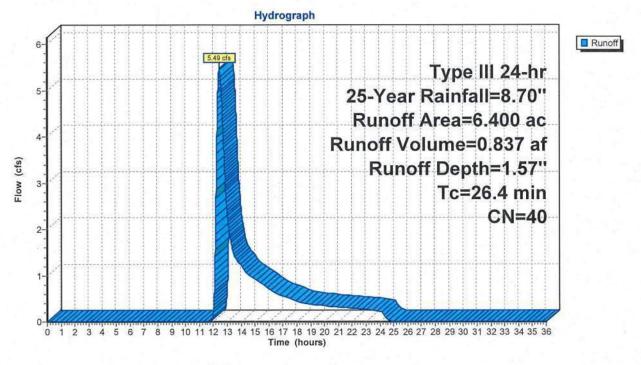
5.49 cfs @ 12.46 hrs, Volume=

0.837 af, Depth= 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

	Area	(ac)	CN	Desc	cription			
4	6	.400	40					
-	6	.400		100.	00% Pervi	ous Area		
	Tc (min)	Leng (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
. 1	26.4			-1			Direct Entry,	

Subcatchment PB3: PB3



Submittal Date: September 2018

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PB4: PB4

Runoff

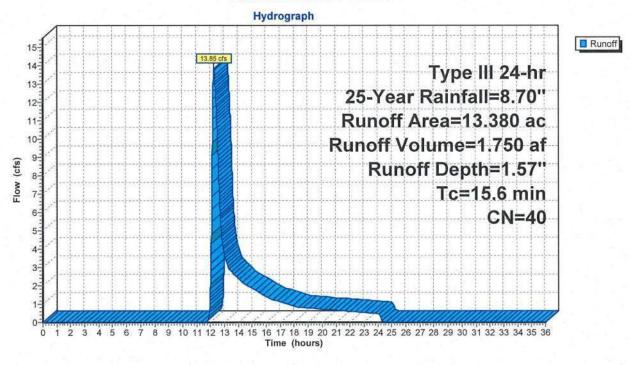
13.85 cfs @ 12.26 hrs, Volume=

1.750 af, Depth= 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

2	Area	(ac)	CN	Desc	cription	1		
,	13	.380	40					
-	13	.380		100.	00% Pervi	ous Area		
	Tc (min)	Lengt (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
	15.6	-					Direct Entry,	1000

Subcatchment PB4: PB4



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PC1: PC1

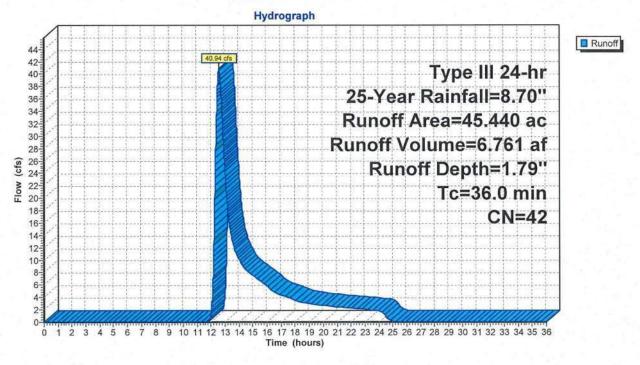
Runoff = 40.94 cfs @ 12.60 hrs, Volume=

6.761 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

	Area	(ac)	CN	Desc	cription			
*	45.	440	42					
Ī	45.	440		100.	00% Pervi	ous Area		
	Tc (min)	-		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
-	36.0	(fee	L)	(IVIL)	(IUSEC)	(CIS)	Direct Entry,	

Subcatchment PC1: PC1



Part III

PreDevelopment Updated 25 Yr

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PC2: PC2

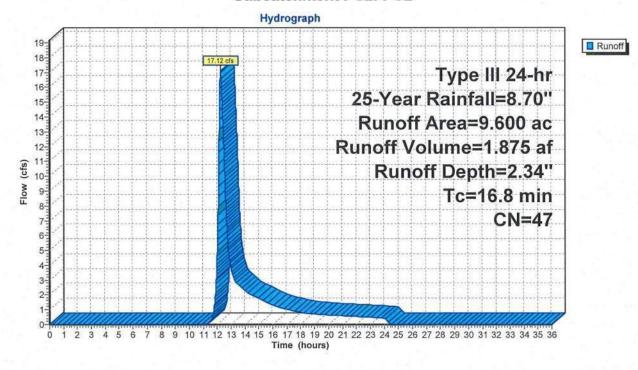
Runoff = 17.12 cfs @ 12.26 hrs, Volume=

1.875 af, Depth= 2.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

-	Area	(ac)	CN	Desc	cription			
*	9.	600	47					
3	9.	600		100.	00% Pervi	ous Area		
(Tc (min)	Leng (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
	16.8		2.7				Direct Entry,	

Subcatchment PC2: PC2



Revision: 0

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PreDevelopment Updated 25 Yr

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment PC3: PC3

Runoff =

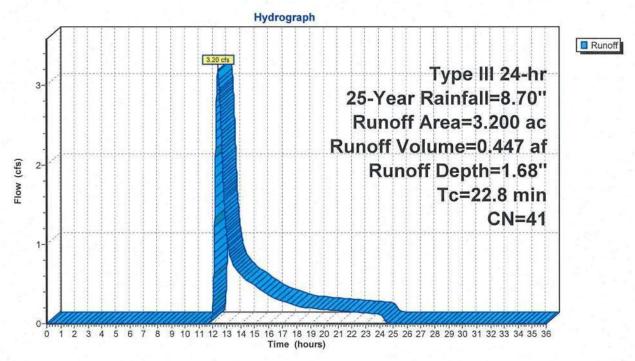
3.20 cfs @ 12.39 hrs, Volume=

0.447 af, Depth= 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

100	Area	(ac)	CN	Des	cription			
*	3	.200	41					
	3	.200		100.	00% Pervi	ous Area		
	Tc (min)	Leng (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
100	22.8	70		1			Direct Entry,	

Subcatchment PC3: PC3



Submittal Date: September 2018 Revision: 0

APPENDIX 6A.2.6

NATIONAL ENGINEERING HANDBOOK (NEH), CHAPTER 15, FIGURE 15-4 VELOCITY VERSUS SLOPE FOR SHALLOW CONCENTRATED FLOW [ANNOTATED]



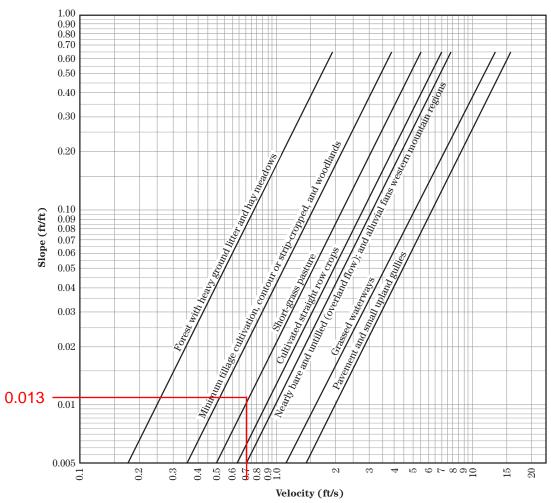
Part III

Chapter 15

Time of Concentration

Part 630 National Engineering Handbook

Figure 15-4 Velocity versus slope for shallow concentrated flow



PB4

Elev 60 ft → Elev 50 ft

 $s = 10 \text{ ft}/750 \text{ ft} = 0.01\overline{3}$

0.80

tc = 750 ft/0.80 ft/sec = 937.5 sec

tc = 937.5 sec/60 sec/min = 15.6 min

 Table 15–3
 Equations and assumptions developed from figure 15–4

Flow type	Depth (ft)	Manning's n	Velocity equation (ft/s)
Pavement and small upland gullies	0.2	0.025	V =20.328(s) ^{0.5}
Grassed waterways	0.4	0.050	$V=16.135(s)^{0.5}$
Nearly bare and untilled (overland flow); and alluvial fans in western mountain regions $% \left(1\right) =\left(1\right) \left(1\right) $	0.2	0.051	$V=9.965(s)^{0.5}$
Cultivated straight row crops	0.2	0.058	$V=8.762(s)^{0.5}$
Short-grass pasture	0.2	0.073	$V=6.962(s)^{0.5}$
Minimum tillage cultivation, contour or strip-cropped, and woodlands	0.2	0.101	$V=5.032(s)^{0.5}$
Forest with heavy ground litter and hay meadows	0.2	0.202	$V=2.516(s)^{0.5}$

15<u>–8</u>

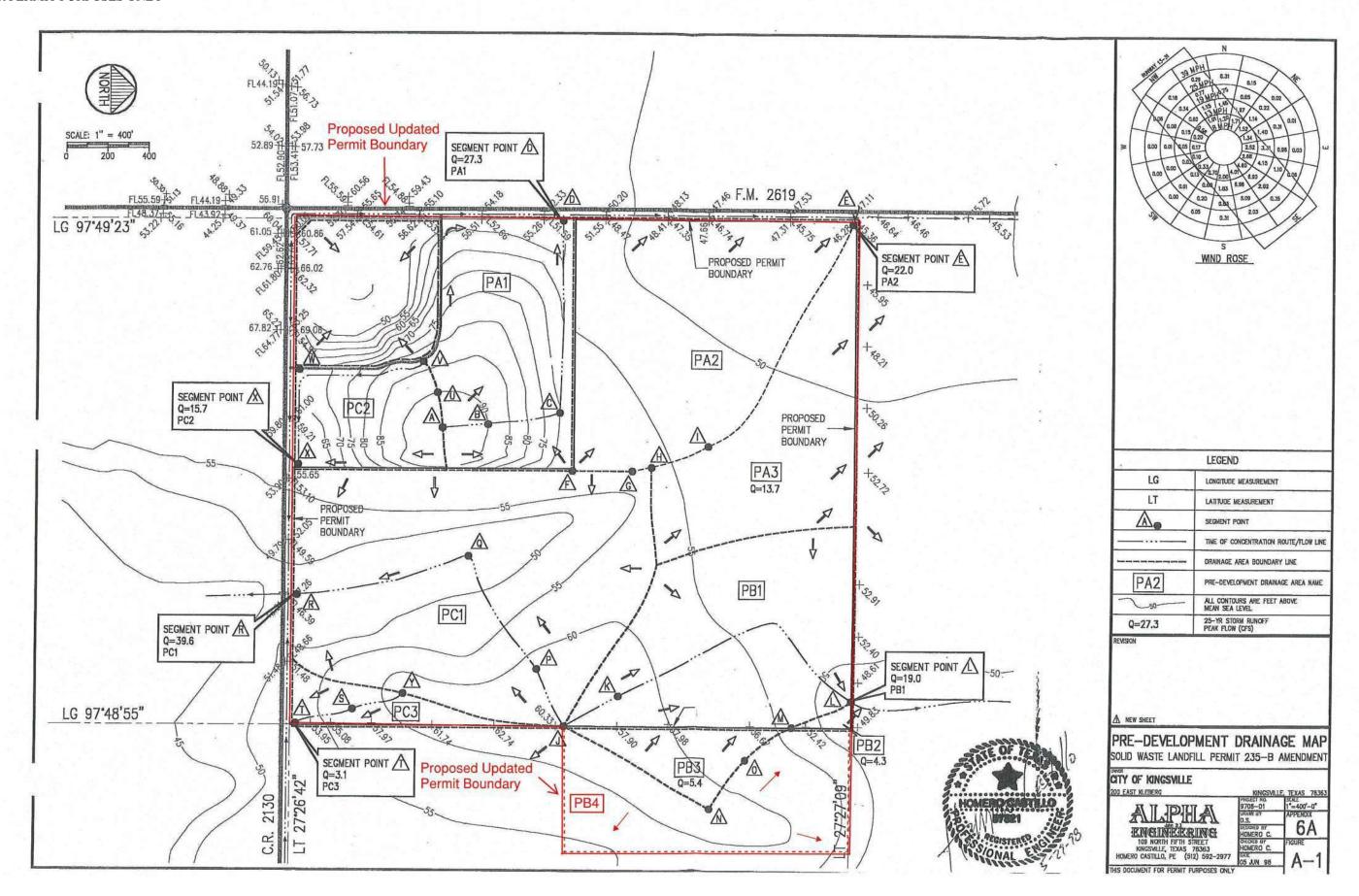
(210-VI-NEH, May 2010)

Revision: 0

APPENDIX 6A.2.7

PRE-DEVELOPMENT DRAINAGE MAP SOLID WASTE LANDFILL PERMIT 235-B AMENDMENT FIGURE A-1 (UPDATED PERMITTED CONDITIONS)





Part III, Attachment 6, Appendix 6A.2.7, p.g.-1

APPENDIX 6B SITE POST-DEVELOPMENT CONDITIONS



APPENDIX 6B.1

USGS ATLAS OF DEPTH-DURATION FREQUENCY OF PRECIPITATION ANNUAL MAXIMA FOR TEXAS-DEPTH OF PRECIPITATION FOR 25 YR-24 HR & 100 YR-24 HR [ANNOTATED]





In cooperation with the Texas Department of Transportation

Atlas of Depth-Duration Frequency of Precipitation Annual Maxima for Texas



Scientific Investigations Report 2004–5041 (TxDOT Implementation Report 5–1301–01–1)

U.S. Department of the Interior U.S. Geological Survey

Part III

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.		
FHWA/FX-04/5-1301-01-1				
4. Title and Subtitle		5. Report Date		
ATLAS OF DEPTH-DURATION FI	REQUENCY OF	June 2004		
PRECIPITATION ANNUAL MAXI	6. Performing Organization Code			
7. Author(s)	8, Performing Organization Report No.			
William H. Asquith and Meghan C. Rousse	SIR 2004–5041			
9. Performing Organization Name and Add	10. Work Unit No. (TRAIS)			
U.S. Geological Survey				
Water Resources Division		11. Contract or Grant No. Project 5-1301		
8027 Exchange Drive				
Austin, Texas 78754				
12. Sponsoring Agency Name and Address		13. Type of Report and Period Covered		
Texas Department of Transportation	U.S. Geological Survey	Research from 2003 to 2004		
Research and Technology Implementation Office		14, Sponsoring Agency Code		
4000 Jackson Ave., Bldg. 1 P.O. Box 5080	8027 Exchange Drive Austin, Texas 78754			
Austin, TX 78731				
15. Supplementary Notes				
Project conducted in cooperation with the I	lexas Department of Transportation	and the Federal Highway Administration.		
16, Abstract				

Ninety-six maps depicting the spatial variation of the depth-duration frequency of precipitation annual maxima for Texas are presented. The recurrence intervals represented are 2, 5, 10, 25, 50, 100, 250, and 500 years. The storm durations represented are 15 and 30 minutes; 1, 2, 3, 6, and 12 hours; and 1, 2, 3, 5, and 7 days. The maps were derived using geographically referenced parameter maps of probability distributions used in previously published research by the U.S. Geological Survey to model the magnitude and frequency of precipitation annual maxima for Texas. The maps in this report apply that research and update depth-duration frequency of precipitation maps available in earlier studies performed by the National Weather Service.

17, Key Words	18. Distribution Statement								
Precipitation, Depth duration frequen L-moments, Texas	No restrictions.								
19. Security Classif. (of report)	20. Security Classif. (of this page)		2). No. of pages	22. Price					
Unclassified	Unclassified		106	\$4.00					

Form DOT F 1700.7 (8-72)

Reproduction of completed page authorized

Cover:

West Sister Creek near Sisterdale, Texas, on FM 473, Kendali County, May 10, 2004.

Hanson Professional Services Inc. Submittal Date: September 2018

Revision: 0

Atlas of Depth-Duration Frequency of Precipitation Annual Maxima for Texas

Rv W/illi	am H. As	auith an	d Meah	an C. I	Antiesel

In cooperation with the Texas Department of Transportation

Scientific Investigations Report 2004–5041 (TxDOT Implementation Report 5–1301–01–1)

U.S. Department of the Interior U.S. Geological Survey

U.S. Department of the Interior

Gale A. Norton, Secretary

U.S. Geological Survey

Charles G. Groat, Director

U.S. Geological Survey, Reston, Virginia: 2004 For sale by U.S. Geological Survey, Information Services Box 25286, Denver Federal Center Denver, CO 80225

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The contents of this report do not necessarily reflect the official view or policies of the Texas Department of Transportation (TxDOT). This report does not constitute a standard, specification, or regulation.

Suggested citation:

Asquith, W.H., and Roussel, M.C., 2004, Atlas of depth-duration frequency of precipitation annual maxima for Texas: U.S. Geological Survey Scientific Investigations Report 2004–5041, 106 p.

54 Atlas of Depth-Duration Frequency of Precipitation Annual Maxima for Texas

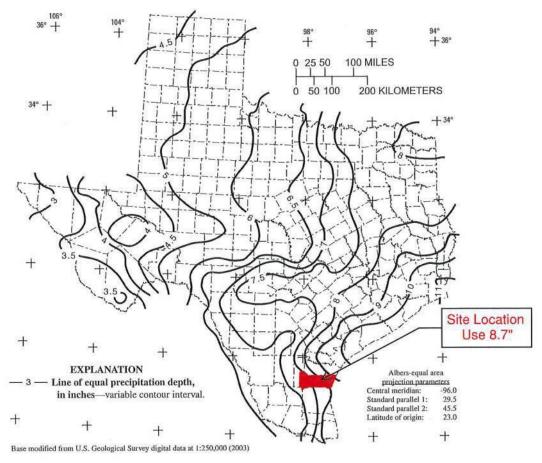


Figure 47. Depth of precipitation for 25-year storm for 1-day duration in Texas.

78 Atlas of Depth-Duration Frequency of Precipitation Annual Maxima for Texas

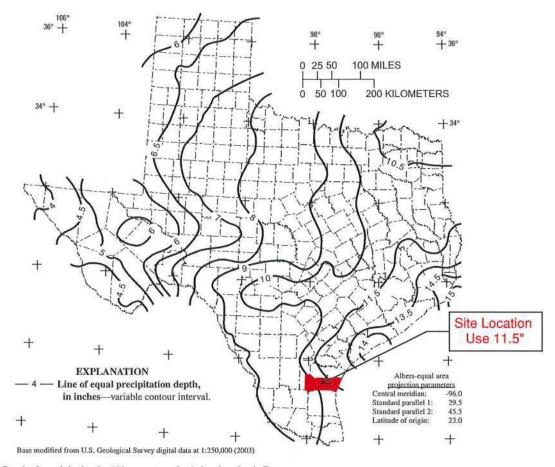


Figure 71. Depth of precipitation for 100-year storm for 1-day duration in Texas.

APPENDIX 6B.2

TABLE 6B-1 HYDROLOGIC SOIL GROUPS FOR ON-SITE SOILS (FROM NRCS, 2015) AND CITY OF KINGSVILLE MUNICIPAL SOLID WASTE LANDFILL FINAL DRAINAGE AREAS



Table 6B-1. Hydrotogic Soil Groups for On-Site Soils (from NRCS, 2015)

					_	
		Representative V	% Sand % Sift	36.5	19.9	
	Repr	% Sand	33.5	66.1	,	
g Counties, Texas			1 PRC10F	5	\$,
RUSLE2 Relatef Attributes - Kenedy and Reberg Counties, Texas	ğ		0,24	0,2		
	Hydrologic Soil Group		٥	æ		
	a€o₁g	###	86	86		
	Peter	Map Unit	8	96		
	RUSLE2 R	-	Fercent of AUI	10.7	9.3	600
			Map Symbol and Soil Name	CkA - Clareville Clay Loum 0 to 1 percent stopes	CmA - Colmens Fine Sandy Loun 0 to 1 percent slopes	PtT - Pite Duscov

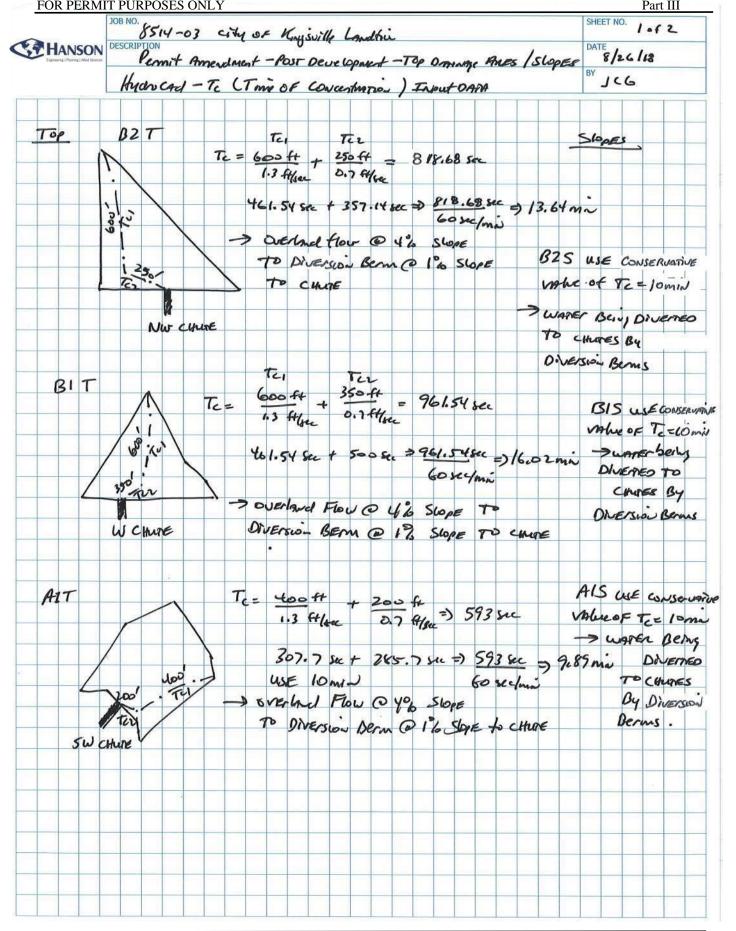
Area	
Drainage	
III pue	
Variet	
Volida	
ed cir	
Ž.	
y of Kă	

Designage Area	Area
A1T	7.425
A1S	8.009
A2T	5,120
A2S	12.241
ABT	7.489
A35	10.760
B1T	7.499
815	14.884
82T	4.309
625	8.806
C1T	6.292
C1S	11.506
727	5.249
C2S	10.038
3	3.500
C4	9.500
CS	2,690
	3.982
3.0	1,000
30	1.480
3C	1.640
40	0.910
sc	1.000
90	1.000
75	1.00
PAR	7,440
PBR	4.290
PCR	4.540
CISNI	0.250
C1SN2	0.250
CISS1	0.250
C1SS2	0.250
Total	164.60

APPENDIX 6B.3

PERMIT AMENDMENT-POST DEVELOPMENT-TOP DRAINAGE AREAS/SLOPES HYDROCAD (Tc-TIME OF CONCENTRATION) INPUT DATA





FOR PERMIT PURPOSES ONLY

FOR PERMIT PURPOSES UINL I

JOB NO. 85/4-03 City of Kingswille Landkin

DESCRIPTION

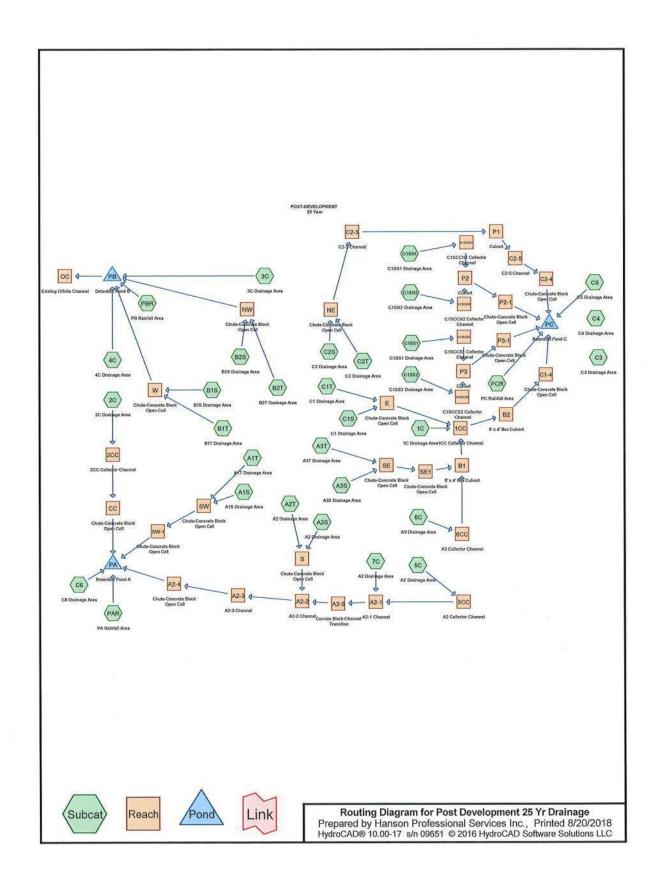
Permit Amendment - Post Development - Top Dominge Amens | BY

Slopes BY

JCG 8/26/18 Hydrocap - To (Time of Concertnation) INput DATA TOP 350 ft => 500 SEC Slopes AZT A25 USE CONSENTATIVE 500 Sec => 8,3 mi VALUE OF TC = 10 min, -> WATER BOING DIVETTED lomi TO CHUTES BY DIVERSION Benns. > Flow @ 1% Slope to CHATE S A3 T Te = 750 for + 300ft => 1005.48 SEC A35 USE CONSENUATIVE VALUE OF TEELOMIN -> WATER DELY Te = 576.92 + 428.57 => Lows.41 sec => 16.76 min ONETED TO CHUPES BY ? overland Flow @ 4 % slope DIVERSIÓN Berns To Disersion BEM @ 16 to CHARE CHUTE SE CIS USE CONSERVATIVE Tc: 600ff + 200ft => 747,25 Sec value of Te= 10 min To conges by Diverse Berns CIT -> Overhand Flour @ 40% Slope 60 Sec/min 12:45 min TO Olversion Benn @ 106 to chure CZS USE CONSCRUÇTIVE TC = 600 ft + 200 ft => 14-7.2 FER TO CHURES BY DIVERSION CHURE E Tei CZT 461.54 Sec + 285.71 Sec =>747.25 Sec => 12.45 Min - Overland FWWW Y'W Slope TO DIVERSION BERM @ 1 % Slope to CHUPE CHUTE NE

APPENDIX 6B.4 HYDROCAD MODEL POST DEVELOPMENT-25 YEAR





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Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
 128.657	79	50-75% Grass cover, Fair, HSG C (1C, 2C, 3C, 4C, 5C, 6C, 7C, A1S, A1T, A2S, A2T, A3S, A3T, B1S, B1T, B2S, B2T, C1S, C1SN1, C1SN2, C1SS1, C1SS2, C1T, C2S, C2T)
19.672	86	<50% Grass cover, Poor, HSG C (C3, C4, C5, C6)
16.270	98	Water Surface, 0% imp, HSG C (PAR, PBR, PCR)
164.599	82	TOTAL AREA

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Page 3

Soil Listing (all nodes)

Area	Soil	Subcatchment
 (acres)	Group	Numbers
0.000	HSG A	
0.000	HSG B	
164.599	HSG C	1C, 2C, 3C, 4C, 5C, 6C, 7C, A1S, A1T, A2S, A2T, A3S, A3T, B1S, B1T, B2S, B2T, C1S, C1SN1, C1SN2, C1SS1, C1SS2, C1T, C2S, C2T, C3, C4, C5, C6, PAR, PBR, PCR
0.000	HSG D	
0.000	Other	
164.599		TOTAL AREA

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Part III

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	(acres) 0.000	(acres) 128.657	(acres) 0.000	(acres) 0.000	(acres) 128.657	Cover 50-75% Grass cover, Fair	
							C1SS1, C1SS2, C1T, C2S,
0.000	0.000	19.672	0,000	0.000	19.672	<50% Grass cover, Poor	C2T C3, C4, C5, C6
0,000	0.000	16.270	0.000	0.000	16,270	Water Surface, 0% imp	PAR, PBR, PCR
0.000	0.000	164.599	0.000	0.000	164.599	TOTAL AREA	1 011

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Pipe Listing (all nodes)

	Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
_	1	B1	56.54	53.89	464.0	0.0057	0.013	60.0	48.0	0.0
	2	B2	53.45	49.80	200.0	0,0183	0.013	60.0	48.0	0.0
	3	P1	51.75	51.11	64.0	0.0100	0.011	48.0	0.0	0.0
	4	P2	54.39	53.31	72.0	0.0150	0.011	18.0	0.0	0.0
	5	P3	55.41	54.33	72.0	0.0150	0.011	18.0	0.0	0.0
	6	PB	47.00	46.75	128.0	0.0020	0.013	21.0	0.0	0.0
	7	PB	47.00	46.75	128.0	0.0020	0.013	21.0	0.0	0.0

Type III 24-hr 25-Year Rainfall=8.70"

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Page 6

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1C: 1C Drainage Area	Runoff Area=1.000 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=8.22 cfs 0.514 af
Subcatchment 2C: 2C Drainage Area	Runoff Area=1,480 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=9.20 cfs 0.760 af
Subcatchment 3C: 3C Drainage Area	Runoff Area=1,640 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=10.20 cfs 0.842 af
Subcatchment 4C: 4C Drainage Area	Runoff Area=0.910 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=5.66 cfs 0.467 af
Subcatchment 5C: A2 Drainage Area	Runoff Area=1.000 ac 0.00% Impervious Runoff Depth∺6.16" Tc=10.0 min CN=79 Runoff=6.22 cfs 0.514 af
Subcatchment 6C: A3 Drainage Area	Runoff Area=1.000 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=6.22 cfs 0.514 af
Subcatchment 7C: A2 Drainage Area	Runoff Area=1,000 ac 0.00% Impervious Runoff Depth=6.16° Tc=10.0 min CN=79 Runoff=6.22 cfs 0.514 af
Subcatchment A1S: A1S Drainage Area	Runoff Area=8.009 ac 0.00% impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=49.80 cfs 4.113 af
Subcatchment A1T: A1T Drainage Area	Runoff Area=7.425 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=46.16 cfs 3.813 af
Subcatchment A2S: A2 Drainage Area	Runoff Area=12.241 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=76.11 cfs 6.287 af
Subcatchment A2T: A2 Drainage Area	Runoff Area=5.120 ac 0.00% Impervious Runoff Depth=6.16" Tc=10,0 min CN=79 Runoff=31.83 cfs 2.629 af
Subcatchment A3S: A3S Drainage Area	Runoff Area=10.760 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=66.90 cfs 5.526 af
Subcatchment A3T: A3T Drainage Area Flow	Runoff Area=7.489 ac 0.00% Impervious Runoff Depth=6.16" Length=1,050' Tc=16.7 min CN=79 Runoff=38.81 cfs 3.846 af
Subcatchment B1S: B1S Drainage Area	Runoff Area=14.884 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=92.54 cfs 7.644 af
Subcatchment B1T: B1T Drainage Area Flow	Runoff Area=7.499 ac 0.00% Impervious Runoff Depth=6.16" w Length=950' To=16.0 min CN=79 Runoff=39.52 cfs 3.851 af
Subcatchment B2S: B2S Drainage Area	Runoff Area=8.806 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=54.75 cfs 4.522 af

Part III

Post Development 25 Yr Drainage Prepared by Hanson Professional Services HydroCAD® 10.00-17 s/n 09651 © 2016 HydroC	
Subcatchment B2T: B2T Drainage Area Flow	Runoff Area=4.309 ac 0.00% Impervious Runoff Depth=6.16" Length=850' Tc=13.7 min CN=79 Runoff=24.07 cfs 2.213 af
Subcatchment C1S: C1 Drainage Area	Runoff Area=11.506 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=71.54 cfs 5.909 af
Subcatchment C1SN1: C1SN1 Drainage Area	Runoff Area=0.250 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=1.55 cfs 0.128 af
Subcatchment C1SN2: C1SN2 Drainage Area	Runoff Area=0.250 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=1.55 cfs 0.128 af
Subcatchment C1SS1: C1SS1 Drainage Area	Runoff Area=0.250 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=1.55 cfs 0.128 af
Subcatchment C1SS2: C1SS2 Drainage Area	Runoff Area=0.250 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=1.55 cfs 0.128 af
Subcatchment C1T: C1 Drainage Area Flow	Runoff Area=6.292 ac 0.00% Impervious Runoff Depth=6.16" Length=800' Tc=12.5 min CN=79 Runoff=36.29 cfs 3.231 af
Subcatchment C2S: C2 Drainage Area	Runoff Area=10.038 ac 0.00% Impervious Runoff Depth=6.16* Tc=10.0 min CN=79 Runoff=62.41 cfs 5.155 af
Subcatchment C2T: C2 Drainage Area Flow	Runoff Area=5.249 ac 0.00% Impervious Runoff Depth=6.16" Length=800' Tc=12.5 min CN=79 Runoff=30.27 cfs 2.696 af
Subcatchment C3; C3 Drainage Area	Runoff Area=3.500 ac 0.00% Impervious Runoff Depth=7.01" Tc=10.0 min CN=86 Runoff=24.05 cfs 2.045 af
Subcatchment C4: C4 Drainage Area	Runoff Area=9.500 ac 0.00% Impervious Runoff Depth=7.01" Tc=10.0 min CN=86 Runoff=65.28 cfs 5.551 af
Subcatchment C5: C5 Drainage Area	Runoff Area=2.690 ac 0.00% Impervious Runoff Depth=7.01" Tc=10.0 min CN=86 Runoff=18.49 cfs 1.572 af
Subcatchment C6: C6 Drainage Area	Runoff Area=3.982 ac 0.00% Impervious Runoff Depth=7.01" Tc=10.0 min CN=86 Runoff=27.36 cfs 2.327 af
Subcatchment PAR: PA Rainfall Area	Runoff Area=7.440 ac 0.00% Impervious Runoff Depth=8.46" Tc=0.0 min CN=98 Runoff=77.55 cfs 5.245 af
Subcatchment PBR: PB Rainfall Area	Runoff Area=4,290 ac 0.00% Impervious Runoff Depth=8,46" Tc=0.0 min CN=98 Runoff=44,71 cfs 3,024 af
Subcatchment PCR: PC Rainfall Area	Runoff Area=4.540 ac 0.00% Impervious Runoff Depth=8.46"

Reach 1CC: 1CC Collector Channel Avg. Flow Depth=4.52' Max Vel=3.89 fps Inflow=213.11 cfs 19.540 af n=0.030 L=222.0' S=0.0020 '/' Capacity=2,157.50 cfs Outflow=211.91 cfs 19.540 af

Tc=0.0 min CN=98 Runoff=47.32 cfs 3.201 af

Type III 24-hr 25-Year Rainfall=8.70"

Post Development 25 Yr Drainage

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Reach 2CC: 2CC Collector Channel Avg. Flow Depth=1.28' Max Vel=1.58 fps Inflow=9.20 cfs 0.760 af n=0.030 L=650.0' S=0.0020 '/' Capacity=46.53 cfs Outflow=7.72 cfs 0.760 af
Reach 5CC: A2 Collector Channel Avg. Flow Depth=0.97' Max Vel=1.36 fps Inflow=6.22 cfs 0.514 af
n=0.030 L=595.0' S=0.0015 '/' Capacity=68.72 cfs Outflow=5.17 cfs 0.514 af Reach 6CC: A3 Collector Channel Avg. Flow Depth=0.77' Max Vel=1.97 fps Inflow=6.22 cfs 0.514 af
n=0,030 L=740.0' S=0.0040 '/' Capacity=50.02 cfs Outflow=5.34 cfs 0.514 af
Reach A2-1: A2-1 Channel Avg. Flow Depth=1.24' Max Vel=1.57 fps Inflow=8.74 cfs 1.027 af n=0.030 L=250.5' S=0.0015 '/' Capacity=83.47 cfs Outflow=8.70 cfs 1.027 af
Reach A2-2: A2-2 Channel Avg. Flow Depth=2.53' Max Vel=3.72 fps Inflow=114.51 cfs 9.943 af n=0.025 L=257.0' S=0.0020 '/' Capacity=338.68 cfs Outflow=113.50 cfs 9.943 af
Reach A2-3: A2-3 Channel Avg. Flow Depth=2.57' Max Vel=3.19 fps Inflow=113.50 cfs 9.943 af n=0.030 L=582.0' S=0.0020 7' Capacity=532.10 cfs Outflow=108.05 cfs 9.943 af
Reach A2-4: Chute-Concrete Block Avg. Flow Depth=0.75' Max Vel=11.15 fps Inflow=108.05 cfs 9.943 af n=0.025 L=250.0' S=0.0697'/ Capacity=692.98 cfs Outflow=107.90 cfs 9.943 af
Reach A2-5: Cocrete Block-Channel Avg. Flow Depth=0.30' Max Vel=11.21 fps Inflow=8.70 cfs 1.027 af n=0.025 L=5.6' S=0.2482 '/' Capacity=903.50 cfs Outflow=8.70 cfs 1.027 af
Reach B1: 5' x 4' Box Culvert
Reach B2: 5' x 4' Box Culvert Avg. Flow Depth=2.40' Max Vel=17.67 fps Inflow=211.91 cfs 19.540 af 60.0" x 48.0" Box Pipe n=0.013 L=200.0' S=0.0183 '/' Capacity=331.32 cfs Outflow=211.71 cfs 19.540 af
Reach C1-4: Chute-Concrete Block Avg. Flow Depth=1.01' Max Vet=23.03 fps Inflow=211.71 cfs 19.540 af n=0.025 L=76.0' S=0.2474 '/' Capacity=872.67 cfs Outflow=211.66 cfs 19.540 af
Reach C1SCCN1: C1SCCN1 Collector Avg. Flow Depth=0.33' Max Vel=1.19 fps Inflow=1.55 cfs 0.128 af n=0.030
Reach C1SCCN2; C1SCCN2 Collector Avg. Flow Depth=0.33¹ Max Vel=1.19 fps Inflow=1.55 cfs 0.128 af n=0.030 L=287.5¹ S=0.0033 ¹¹ Capacity=24.36 cfs Outflow=1.44 cfs 0.128 af
Reach C1SCCS1: C1SCCS1 Collector Avg. Flow Depth=0.33' Max Vel=1.19 fps Inflow=1.55 cfs 0.128 af n=0.030 L=280.0' S=0.0033 '/' Capacity=24.30 cfs Outflow=1.44 cfs 0.128 af
Reach C1SCCS2: C1SCCS2 Collector Avg. Flow Depth=0.33' Max Vel=1.19 fps Inflow=1.55 cfs 0.128 af n=0.030 L=280.0' S=0.0033'/ Capacity=24.30 cfs Outflow=1.44 cfs 0.128 af
Reach C2-3: C2-3 Channel Avg. Flow Depth=2.82' Max Vel=3.06 fps Inflow=91.74 cfs 7.851 af n=0.030 L=882.0' S=0.0020 '/' Capacity=178.76 cfs Outflow=82.99 cfs 7.851 af

Type III 24-hr 25-Year Rainfall=8.70"

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- Reach C2-5; C2-5 Channel Avg. Flow Depth=1.08' Max Vel=8.22 fps Inflow=82.96 cfs 7.851 af n=0.025 L=106.0' S=0.0293'/' Capacity=492.25 cfs Outflow=82.89 cfs 7.851 af
- Reach CC: Chute-Concrete Block Open Avg. Flow Depth=0.21' Max Vel=6.18 fps Inflow=7.72 cfs 0.760 af n=0.025 L=160.0' S=0.1028 '/' Capacity=562.60 cfs Outflow=7.71 cfs 0.760 af

- Reach NW: Chute-Concrete Block n=0.025 L=464.0' S=0.2500 '/' Capacity=877.30 cfs Outflow=77.39 cfs 6.735 af
- Reach OC: Existing Offsite Channel Avg. Flow Depth=1.82' Max Vel=1.72 fps Inflow=33.70 cfs 21.821 af n=0.030 L=2,800.0' S=0.0010 V Capacity=44.23 cfs Outflow=32.78 cfs 21.722 af
- Reach P1: Culvert Avg. Flow Depth=1.97' Max Vel=13.43 fps Inflow=82.99 cfs 7.851 af 48.0" Round Pipe n=0.011 L=64.0' S=0.0100 '/' Capacity=169.76 cfs Outflow=82.96 cfs 7.851 af
- Reach P2: Culvert Avg. Flow Depth=0.44' Max Vel=6.62 fps Inflow=2.88 cfs 0.257 af 18.0" Round Pipe n=0.011 L=72.0' S=0.0150 '/ Capacity=15.20 cfs Outflow=2.88 cfs 0.257 af
- Reach P3: Culvert Avg. Flow Depth=0.44' Max Vel=6.62 fps Inflow=2.89 cfs 0.257 af 18.0" Round Pipe n=0.011 L=72.0' S=0.0150 '/' Capacity=15.20 cfs Outflow=2.89 cfs 0.257 af
- Reach S: Chute-Concrete Block | Avg. Flow Depth=0.72' | Max Vel=19.13 fps | Inflow=107.94 cfs | 8.916 af n=0.025 | L=459.0' | S=0.2500 '/' | Capacity=877.30 cfs | Outflow=107.70 cfs | 8.916 af

- Reach SW-1: Chute-Concrete Block Avg. Flow Depth=0.80' Max Vel=14.51 fps Inflow=95.76 cfs 7.926 af n=0.025 L=266.0' S=0.1269'/ Capacity=624.99 cfs Outflow=95.59 cfs 7.926 af
- Reach W: Chute-Concrete Block n=0.025 | Avg. Flow Depth=0.76' Max Vel=20.06 fps Inflow=127.46 cfs 11.495 af L=464.0' S=0.2500 '/' Capacity=877.30 cfs Outflow=127.27 cfs 11.495 af

Part III

Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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Pond PA: Retention Pond A

Peak Elev=47.33' Storage=26.200 af Inflow=225.75 cfs 26.201 af

Outflow=0.00 cfs 0.000 af

Pond PB: Detention Pond B

Peak Elev=50.87' Storage=11.562 af Inflow=235.89 cfs 22.565 af

Outflow=33.70 cfs 21.821 af

Pond PC: Retention Pond C

Peak Elev=42.36' Storage=32.676 af Inflow=313.19 cfs 32.676 af

Outflow=0.00 cfs 0.000 af

Total Runoff Area = 164.599 ac Runoff Volume = 89.038 af Average Runoff Depth = 6.49"

100.00% Pervious = 164.599 ac 0.00% Impervious = 0.000 ac

Runoff

Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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6.22 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment 1C: 1C Drainage Area

Use Conservative Value of Tc=10 min

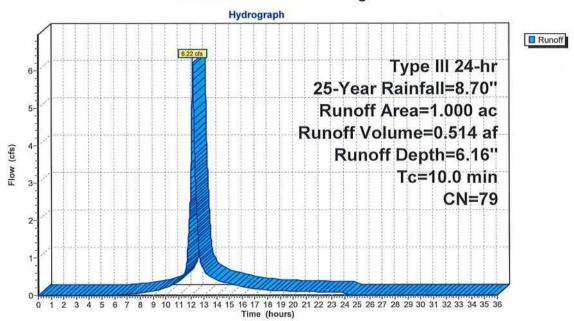
S-----

0.514 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	cription		
1.	000	79	50-7	5% Grass	cover, Fair,	HSG C
1.	000		100.	00% Pervi	ous Area	
Tc (min)	Lengi (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	(icc	,,,	(ivit)	(10300)	(010)	Direct Entry, Drainage Area at Bottom of Slope

Subcatchment 1C: 1C Drainage Area



Runoff

Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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9.20 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment 2C: 2C Drainage Area

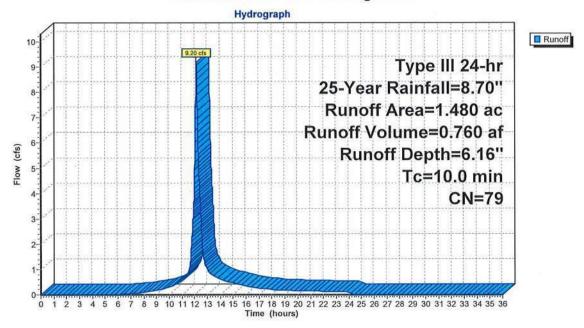
Use Conservative Value of Tc=10 min

0.760 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	cription		
1.	480	79	50-7	5% Grass	HSG C	
1	480		100.	00% Pervi	ous Area	
Tc	Leng	th	Slope	Velocity	Capacity	Description
(min)	(fee	et)	(ft/ft)	(ft/sec)	(cfs)	MIN-SADO-MANA 250 250 250 250 250 250 250 250 250 250
10.0	161		375	24	200	Direct Entry, Drainage Area at Bottom of Slope

Subcatchment 2C: 2C Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment 3C: 3C Drainage Area

Use Conservative Value of Tc=10 min

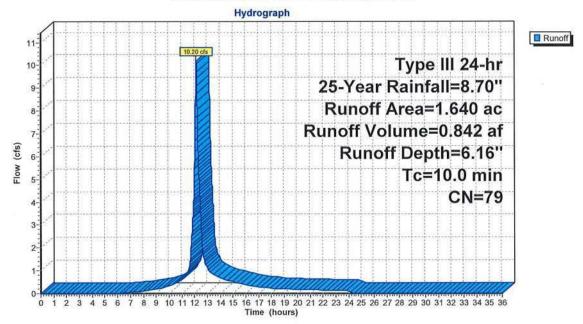
Runoff = 10.20 cfs @ 12.14 hrs, Volume=

0.842 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	Description						
1.640		79	50-7	5% Grass	cover, Fair	, HSG C				
1.	640		100.	00% Pervi	ous Area					
Tc (min)	Lengt (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description				
10.0			70			Direct Entry, Surface Drainage to Pond B				

Subcatchment 3C: 3C Drainage Area



Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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5.66 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment 4C: 4C Drainage Area

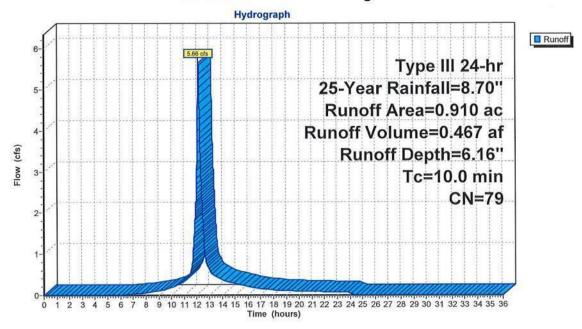
Use Conservative Value of Tc=10 min

0.467 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	cription		
0.	.910	79	50-7	5% Grass	cover, Fair,	, HSG C
0.	910		100.	00% Pervi	ous Area	
Tc (min)	Lengtl (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	70		100 0 200 -	7/2	- 12 (A)	Direct Entry, Surface Drainage to Pond B

Subcatchment 4C: 4C Drainage Area



Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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6.22 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment 5C: A2 Drainage Area

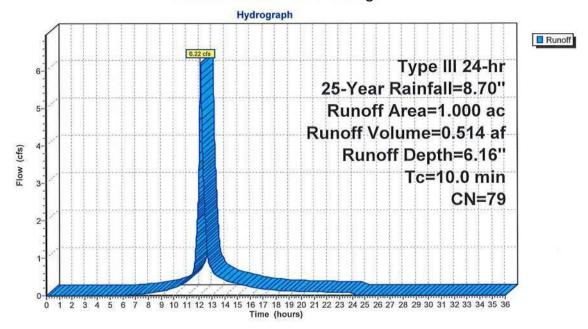
Use Conservative Value of Tc=10 min

0.514 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	cription		
1.	.000	79	50-7	5% Grass	cover, Fair	, HSG C
1.	.000		100.	00% Pervi	ous Area	
Tc (min)	Lengt (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0			X	**	30-0-30-	Direct Entry, Drainage Area at Bottom of Slope

Subcatchment 5C: A2 Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment 6C: A3 Drainage Area

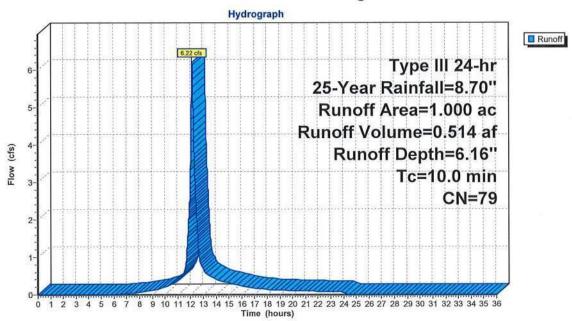
Use Conservative Value of Tc=10 min

Runoff = 6.22 cfs @ 12.14 hrs, Volume= 0.514 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	cription						
1.	1.000 79		50-75% Grass cover, Fair, HSG C							
1.	.000		100.	00% Pervi	ous Area					
Tc (min)	Length (feet		lope ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description				
10.0	2 - 2		200			Direct Entry, Drainage Area at Bottom of Slope				

Subcatchment 6C: A3 Drainage Area



Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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6.22 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment 7C: A2 Drainage Area

Use Conservative Value of Tc=10 min

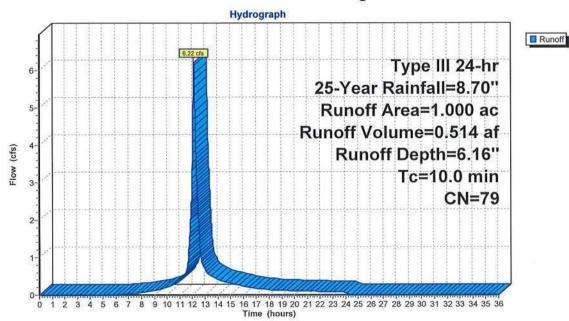
.

0.514 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Des	cription								
1.	1.000 7		50-7	50-75% Grass cover, Fair, HSG C								
1.	.000		100.	00% Pervi	ous Area							
Tc (min)	Leng (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description						
10.0	72	30	-0.	10 10 E		Direct Entry, Drainage Area at Bottom of Slope						

Subcatchment 7C: A2 Drainage Area



Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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49.80 cfs @ 12.14 hrs, Volume=

Summary for Subcatchment A1S: A1S Drainage Area

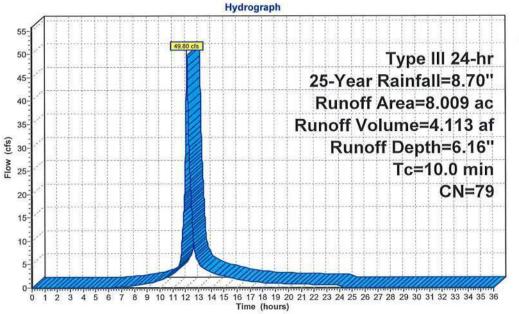
Use Conservative Value of Tc=10 min.

4.113 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac) (CN De	scription						
8	.009	79 50-	50-75% Grass cover, Fair, HSG C						
8	.009	100).00% Perv	ious Area					
Tc (min)	Length (feet)	1020000	Velocity (ft/sec)	Capacity (cfs)	Description				
10.0	- A - 10		- 0	7	Direct Entry, A1S-Chute Flow Evaluation				

Subcatchment A1S: A1S Drainage Area



Runoff

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment A1T: A1T Drainage Area

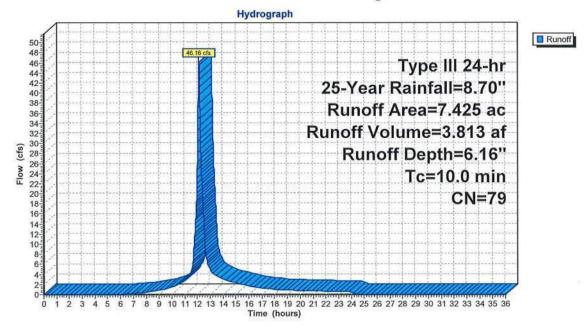
Runoff = 46.16 cfs @ 12.14 hrs, Volume=

3.813 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac) C	N Des	cription		
7.425 79 7.425		79 50-7	5% Grass	cover, Fair	HSG C
		100.	00% Pervi	ious Area	
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0		8	3	3 1 8	Direct Entry, A1T-Chute Flow Evaluation

Subcatchment A1T: A1T Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment A2S: A2 Drainage Area

Use Conservative Value of Tc=10 min.

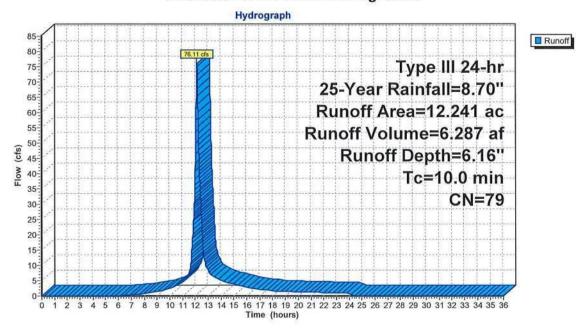
Runoff = 76.11 cfs @ 12.14 hrs, Volume=

6.287 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	CN Description						
12	12.241		79 50-75% Grass cover, Fair, HSG C						
12	241		100.	00% Pervi	ous Area				
Tc (min)	Lengt (fee		lope ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description			
10.0						Direct Entry, A2 Drainage Area			

Subcatchment A2S: A2 Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment A2T: A2 Drainage Area

Runoff

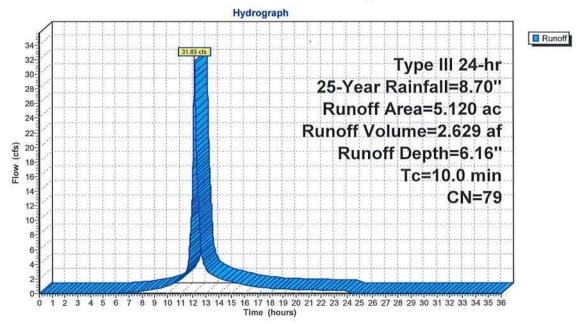
31.83 cfs @ 12.14 hrs, Volume=

2.629 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	c) CN Description								
5.120 79		79	50-75% Grass cover, Fair, HSG C							
5.120		100.00% Pervious Area								
Tc (min)	Lengtl (feet		ope ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description				
10.0					· · · · · · · · · · · · · · · · · · ·	Direct Entry, A2 Drainage Area				

Subcatchment A2T: A2 Drainage Area



Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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66.90 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment A3S: A3S Drainage Area

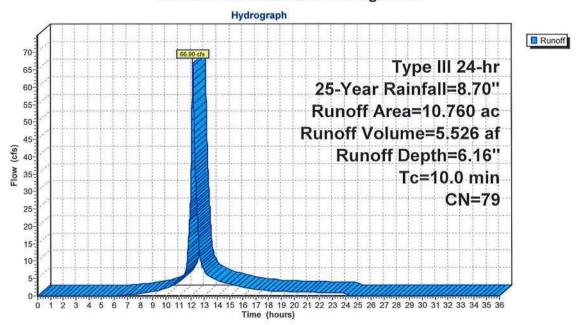
Use Conservative Value of Tc=10 min.

5.526 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN I	Desc	ription		
10.	760	79 5	50-75	5% Grass	cover, Fair	, HSG C
10.	760	8	100.0	00% Pervi	ous Area	
Tc (min)	Length (feet		ope t/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0						Direct Entry, A3S-Chute Flow Evaluation

Subcatchment A3S: A3S Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment A3T: A3T Drainage Area

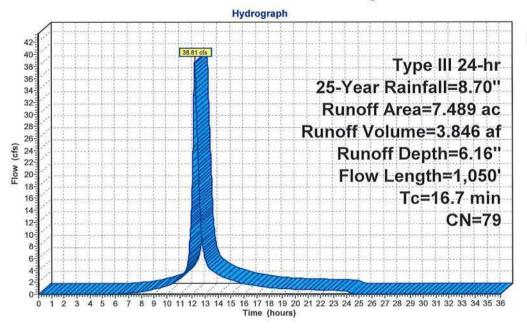
Runoff = 38.81 cfs @ 12.23 hrs, Volume=

3.846 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac) C	N Des	cription		
7.	7.489 7		5% Grass	cover, Fair	r, HSG C
7.489		100.	00% Pervi	ous Area	
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	750		1.30		Direct Entry, A3T-Chute Flow Evaluation
7.1	300		0.70		Direct Entry,
16.7	1 050	Total			

Subcatchment A3T: A3T Drainage Area



Runoff

Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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92.54 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment B1S: B1S Drainage Area

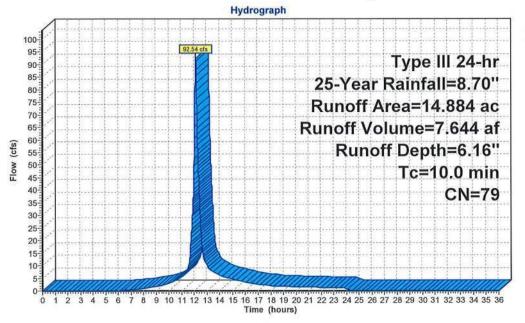
Use Conservative Value of Tc= 10 min.

7.644 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	cription						
14.	14.884		50-75% Grass cover, Fair, HSG C							
14.	884		100.	00% Pervi	ous Area					
Tc (min)	Length (feet	7.	ope ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description				
10.0						Direct Entry, B1S-Chute Flow Evaluation				

Subcatchment B1S: B1S Drainage Area



Runoff

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment B1T: B1T Drainage Area

Runoff

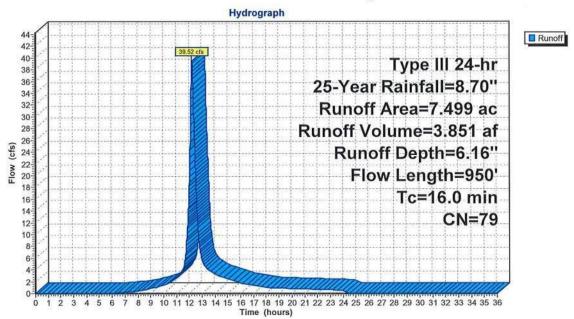
39.52 cfs @ 12.21 hrs, Volume=

3.851 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac) C	N Des	cription		
7.	499 7	9 50-7	5% Grass	cover, Fair	HSG C
7.	499	100.	00% Pervi	ous Area	
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	600	- W - ST	1.30		Direct Entry, B1T-Chute Flow Evaluation
8.3	350		0.70		Direct Entry,
16.0	950	Total			

Subcatchment B1T: B1T Drainage Area



Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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54.75 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment B2S: B2S Drainage Area

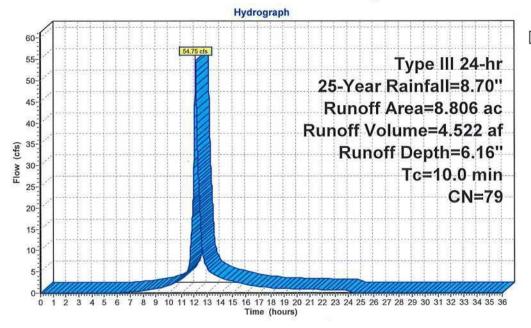
Use Conservative Value of Tc=10 min.

4.522 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	cription		
8.	.806	79	50-7	5% Grass	cover, Fair	, HSG C
8.	.806		100.	00% Pervi	ous Area	
Tc (min)	Lengtl (feet	200	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0						Direct Entry, B2S-Chute Flow Evaluation

Subcatchment B2S: B2S Drainage Area



Runoff

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment B2T: B2T Drainage Area

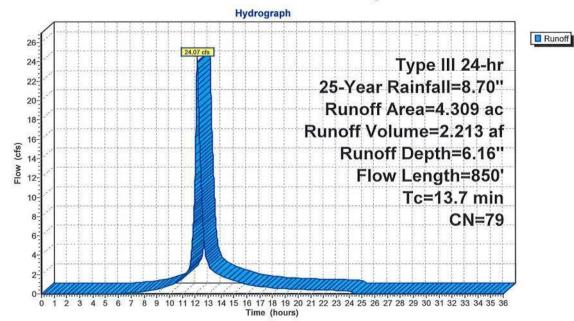
Runoff = 24.07 cfs @ 12.19 hrs, Volume=

2.213 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

0-0	Area	(ac) C	N Des	cription		
00	4.	.309 7	79 50-7	5% Grass	cover, Fair	HSG C
	4.	.309	100.	00% Pervi	ous Area	
	Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1	7.7	600		1.30		Direct Entry, B2T-Chute Flow Evaluation
	6.0	250		0.70		Direct Entry,
	13.7	850	Total			

Subcatchment B2T: B2T Drainage Area



Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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71.54 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment C1S: C1 Drainage Area

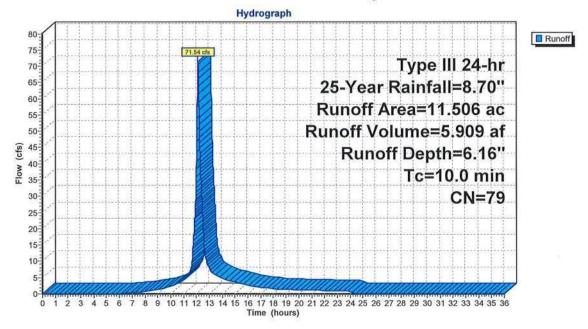
Use Conservative Value of Tc=10 min.

5.909 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac) (CN De	scription						
11	506	79 50-	50-75% Grass cover, Fair, HSG C 100.00% Pervious Area						
11	506	100	0.00% Perv	ious Area	19				
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description				
10.0					Direct Entry, C1 Drainage Area				

Subcatchment C1S: C1 Drainage Area



Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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1.55 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment C1SN1: C1SN1 Drainage Area

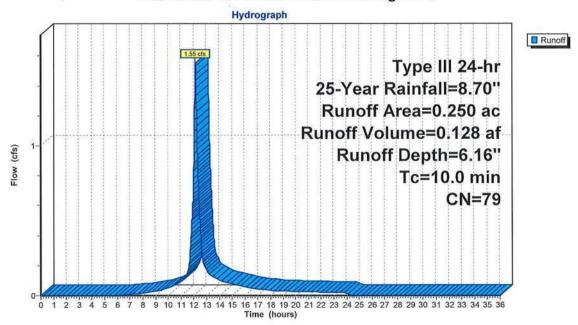
Use Conservative Value of Tc=10 min

0.128 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	cription		
0.	250	250 79 50-75% Grass cover, Fair, HSG C		250 79		
0.	250		100.	00% Pervi	ous Area	
Tc (min)	-		The state of the s		A CONTRACTOR OF THE PARTY OF TH	Description
10.0						Direct Entry, Drainage Area at Bottom of Slope

Subcatchment C1SN1: C1SN1 Drainage Area



Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment C1SN2: C1SN2 Drainage Area

Use Conservative Value of Tc=10 min

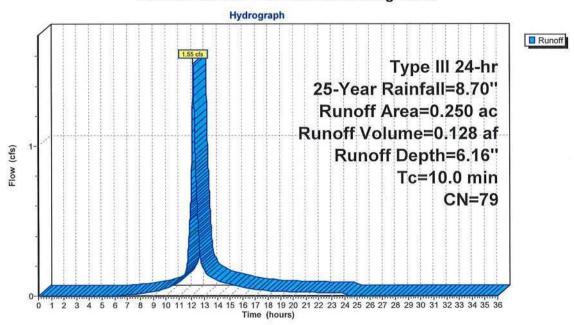
0.128 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

1.55 cfs @ 12.14 hrs, Volume=

Area	(ac)	CN	Desc	cription					
0.	0.250 79		50-75% Grass cover, Fair, HSG C						
0.	250		100.	00% Pervi	ous Area				
Tc (min)	Length (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description			
10.0						Direct Entry, Drainage Area at Bottom of Slope			

Subcatchment C1SN2: C1SN2 Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment C1SS1: C1SS1 Drainage Area

Use Conservative Value of Tc=10 min

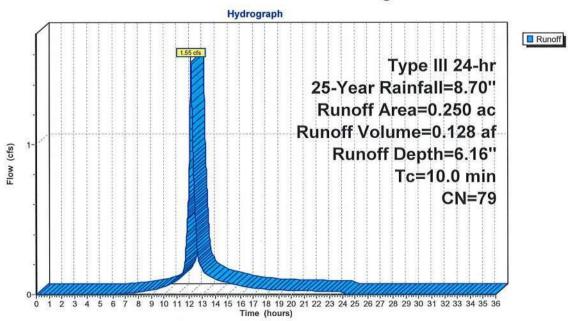
Runoff = 1.55 cfs @ 12.14 hrs, Volume=

0.128 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	cription						
0.	0.250 79		50-7	50-75% Grass cover, Fair, HSG C						
0.	250		100.	00% Pervi	ous Area					
Tc (min)	Lengt (feet		lope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description				
10.0						Direct Entry, Drainage Area at Bottom of Slope				

Subcatchment C1SS1: C1SS1 Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment C1SS2: C1SS2 Drainage Area

Use Conservative Value of Tc=10 min

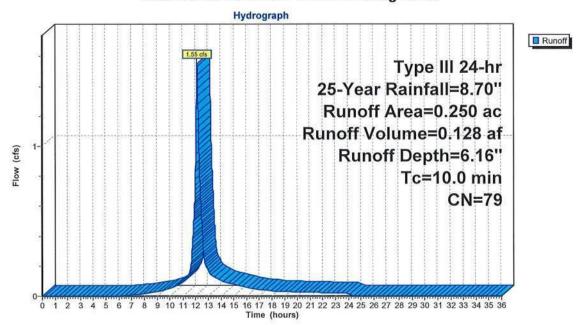
Runoff = 1.55 cfs @ 12.14 hrs, Volume=

0.128 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	cription						
0.250 79		79	50-7	50-75% Grass cover, Fair, HSG C						
0.	250		100.	00% Pervi	ous Area					
Tc (min)	Lengtl (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description				
10.0						Direct Entry, Drainage Area at Bottom of Slope				

Subcatchment C1SS2: C1SS2 Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment C1T: C1 Drainage Area

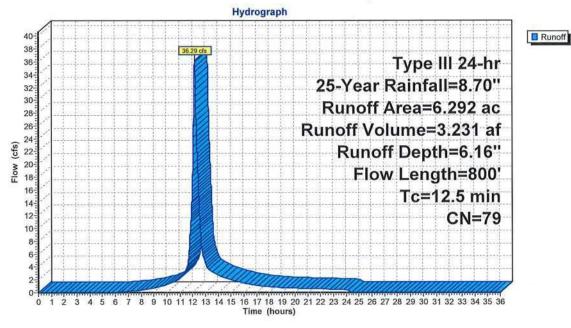
Runoff = 36.29 cfs @ 12.17 hrs, Volume=

3.231 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

	Area	(ac) C	N Des	cription			
000	6.	.292	79 50-7	5% Grass	cover, Fair	, HSG C	
	6.	6.292		00% Pervi	ious Area		
2	Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
Ò.	7.7	600		1.30		Direct Entry, C1 Drainage Area	
	4.8	200		0.70	A 67 - 17 - 17 - 17 - 17 - 17 - 17 - 17 -	Direct Entry,	
	12.5	800	Total				

Subcatchment C1T: C1 Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment C2S: C2 Drainage Area

Use Conservative Value of Tc=10 min.

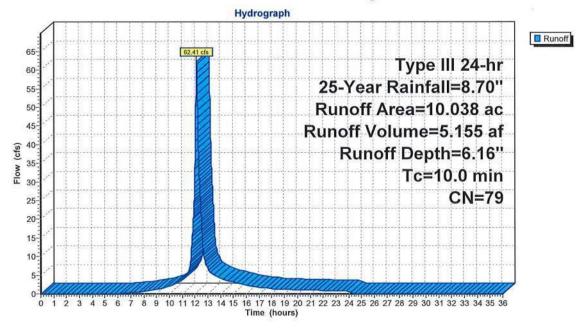
Runoff = 62.41 cfs @ 12.14 hrs, Volume= 5.155 af,

5.155 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac) (CN Des	cription						
10	.038	79 50-7	50-75% Grass cover, Fair, HSG C 100.00% Pervious Area						
10	.038	100	.00% Pervi	ous Area					
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description				
10.0					Direct Entry, C2 Drainage Area				

Subcatchment C2S: C2 Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment C2T: C2 Drainage Area

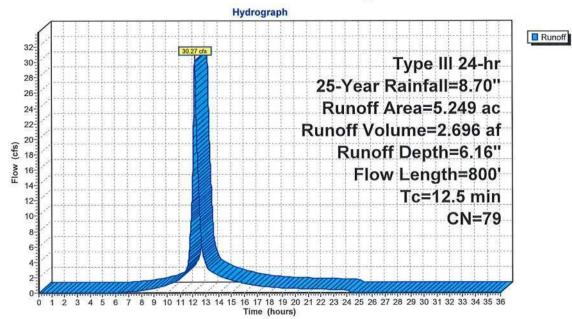
Runoff = 30.27 cfs @ 12.17 hrs, Volume=

2.696 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac) C	N Des	cription			
Area (ac) CN Description 5.249 79 50-75% Grass cover, Fair, HSG C 5.249 100.00% Pervious Area Tc Length Slope Velocity Capacity Description (min) (feet) (ft/ft) (ft/sec) (cfs) 7.7 600 1.30 Direct Entry, C2 Drainage Area 4.8 200 0.70 Direct Entry,						
5.	249	100.	00% Pervi	ous Area		
18 20000	-	1240010000	Service Control of the Control of th		Description	
7.7	600		1.30		Direct Entry, C2 Drainage Area	
4.8	200		0.70		Direct Entry,	
12.5	800	Total				

Subcatchment C2T: C2 Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment C3: C3 Drainage Area

Existing Drainage Area Surface Drains to the North, Into Existing Low-Lying Excavated Pit C4 Drainage

Runoff

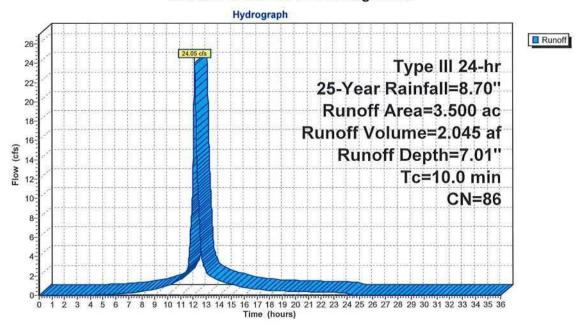
24.05 cfs @ 12.14 hrs, Volume=

2.045 af, Depth= 7.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN De	scription			
3	500	500 86 <50% Grass cover, Poor, HSG C 500 100.00% Pervious Area Length Slope Velocity Capacity Description (feet) (ft/ft) (ft/sec) (cfs)				
3	.500	100	0.00% Perv	ious Area		
Tc (min)	-				Description	
10.0				X	Direct Entry, C3 Drainage Area	

Subcatchment C3: C3 Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment C4: C4 Drainage Area

Existing Low-Lying Excavated Pit Area. Infiltration and Evaporation Occur Here.

Runoff

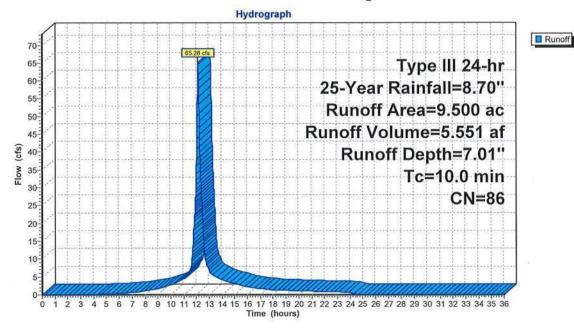
65.28 cfs @ 12.14 hrs, Volume=

5.551 af, Depth= 7.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	cription			
9	9.500 86		<50%	% Grass co	over, Poor,	HSG C	
9	.500		100.	00% Pervi	ous Area		
Tc (min)	Length (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
10.0			7/7: V			Direct Entry, C4 Drainage Area	

Subcatchment C4: C4 Drainage Area



Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment C5: C5 Drainage Area

Side Slope Drainage Area that Flows Into Pond C.

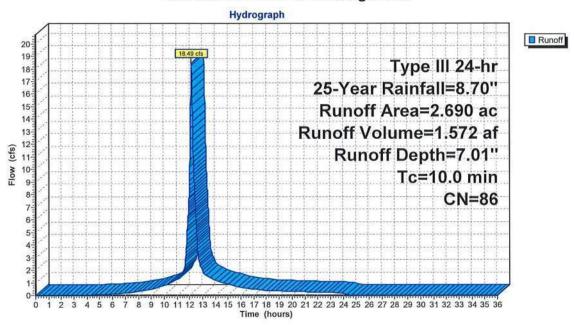
18.49 cfs @ 12.14 hrs, Volume=

1.572 af, Depth= 7.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	cription			
2	2.690 86 <50% Grass cover, Poor, HSG C						
2.	.690		100.	00% Pervi	ous Area		
Tc (min)	Lengt (fee	700	lope ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
10.0	(100	(1010	(10000)	(010)	Direct Entry, C5 Drainage Area	

Subcatchment C5: C5 Drainage Area



Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment C6: C6 Drainage Area

Surrounding Drainage Area that Flows Into Pond A.

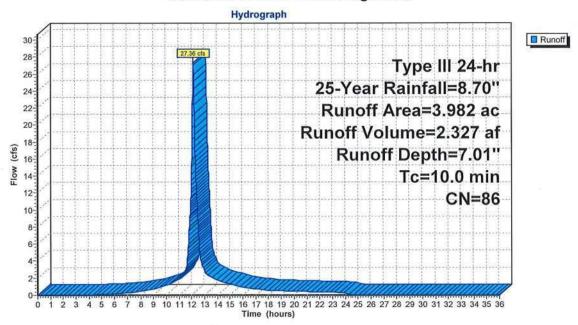
27.36 cfs @ 12.14 hrs, Volume=

2.327 af, Depth= 7.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	cription						
3.	3.982 86			<50% Grass cover, Poor, HSG C						
3.	.982		100.	00% Pervi	ous Area					
Tc (min)	Lengtl (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description				
10.0						Direct Entry, C6 Drainage Area				

Subcatchment C6: C6 Drainage Area



Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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77.55 cfs @ 12.00 hrs, Volume=

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Summary for Subcatchment PAR: PA Rainfall Area

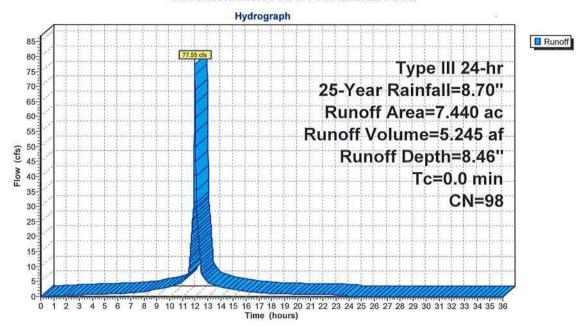
Use Conservative Value of Tc=10 min

5.245 af, Depth= 8.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Des	cription						
7	7.440 98			Water Surface, 0% imp, HSG C						
7	440		100.	00% Pervi	ous Area					
Tc (min)	Leng (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description				
0.0	1.5.		1/	1	(0.0)	Direct Entry, Rainfall at Pond A				

Subcatchment PAR: PA Rainfall Area



Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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44.71 cfs @ 12.00 hrs, Volume=

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Summary for Subcatchment PBR: PB Rainfall Area

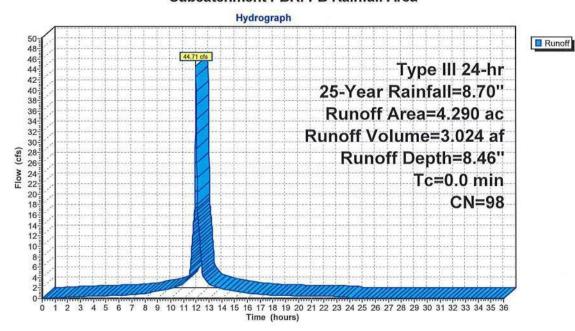
Use Conservative Value of Tc=10 min

3.024 af, Depth= 8.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac) Cl	V Des	cription		
4.	290 9	8 Wat	er Surface	, 0% imp, l	HSG C
4.	290	100.	00% Pervi	ous Area	
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					Direct Entry, Rainfall at Pond B

Subcatchment PBR: PB Rainfall Area



Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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47.32 cfs @ 12.00 hrs, Volume=

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Summary for Subcatchment PCR: PC Rainfall Area

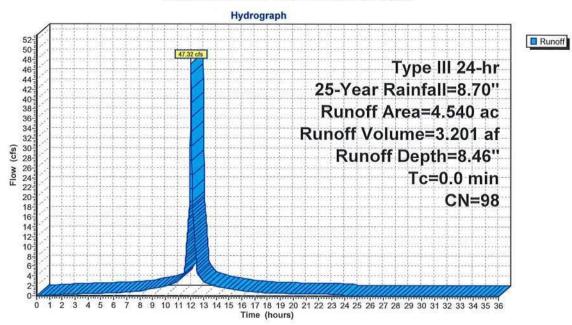
Use Conservative Value of Tc=10 min

3.201 af, Depth= 8.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	cription					
4	4.540 98		Water Surface, 0% imp, HSG C						
4.	.540		100.0	00% Pervi	ous Area				
Tc (min)	Lengt (feet		lope ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description			
0.0						Direct Entry, Rainfall at Pond C			

Subcatchment PCR: PC Rainfall Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach 1CC: 1CC Collector Channel

Inflow Area = 38.047 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 213.11 cfs @ 12.17 hrs, Volume= 19.540 af

Outflow = 211.91 cfs @ 12.20 hrs, Volume= 19.540 af, Atten= 1%, Lag= 1.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 3.89 fps, Min. Travel Time= 1.0 min Avg. Velocity = 1.32 fps, Avg. Travel Time= 2.8 min

Peak Storage= 12,092 cf @ 12.19 hrs Average Depth at Peak Storage= 4.52'

Bank-Full Depth= 11.73' Flow Area= 310.4 sf, Capacity= 2,157.50 cfs

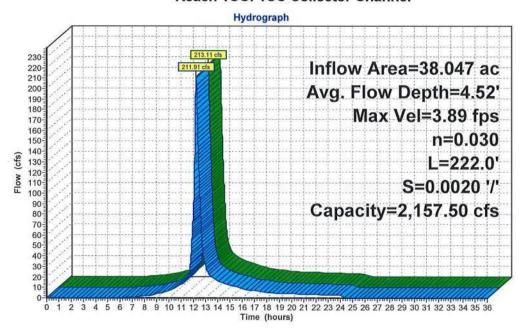
3.00' x 11.73' deep channel, n= 0.030 Earth, grassed & winding

Side Slope Z-value= 2.0 '/' Top Width= 49.92'

Length= 222.0' Slope= 0.0020 '/'
Inlet Invert= 53.89', Outlet Invert= 53.45'



Reach 1CC: 1CC Collector Channel



Inflow
Outflow

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach 2CC: 2CC Collector Channel

Inflow Area = 1.480 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow 9.20 cfs @ 12.14 hrs, Volume= 0.760 af

Outflow 7.72 cfs @ 12.32 hrs, Volume= 0.760 af, Atten= 16%, Lag= 11.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.58 fps, Min. Travel Time= 6.8 min Avg. Velocity = 0.52 fps, Avg. Travel Time= 20.9 min

Peak Storage= 3,170 cf @ 12.21 hrs Average Depth at Peak Storage= 1.28'

Bank-Full Depth= 2.50' Flow Area= 18.8 sf, Capacity= 46.53 cfs

0.00' x 2.50' deep channel, n= 0.030 Earth, grassed & winding

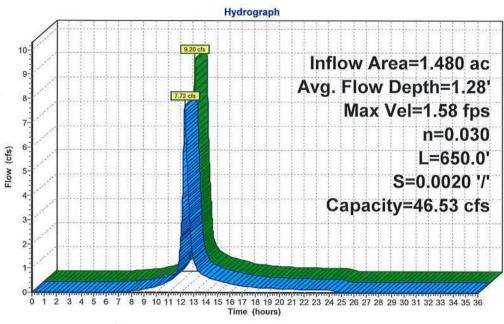
Side Slope Z-value= 3.0 '/' Top Width= 15.00'

Length= 650.0' Slope= 0.0020 '/'

Inlet Invert= 54.50', Outlet Invert= 53.20'



Reach 2CC: 2CC Collector Channel



Inflow
Outflow

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach 5CC: A2 Collector Channel

Inflow Area = 1.000 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 6.22 cfs @ 12.14 hrs, Volume= 0.514 af

Outflow = 5.17 cfs @ 12.33 hrs, Volume= 0.514 af, Atten= 17%, Lag= 11.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.36 fps, Min. Travel Time= 7.3 min

Avg. Velocity = 0.42 fps, Avg. Travel Time= 23.7 min

Peak Storage= 2,258 cf @ 12.21 hrs Average Depth at Peak Storage= 0.97

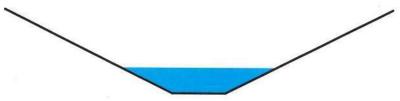
Bank-Full Depth= 3.14' Flow Area= 26.0 sf, Capacity= 68.72 cfs

2.00' x 3.14' deep channel, n= 0.030 Earth, grassed & winding

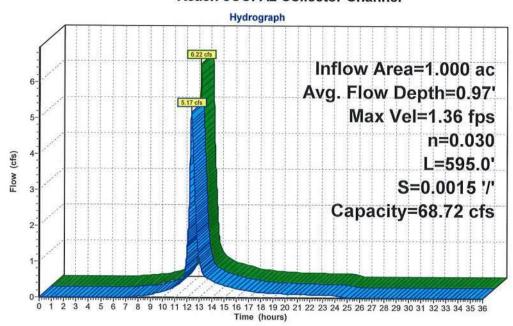
Side Slope Z-value= 2.0 '/' Top Width= 14.56'

Length= 595.0' Slope= 0.0015 '/'

Inlet Invert= 58.50', Outlet Invert= 57.61'



Reach 5CC: A2 Collector Channel



Inflow
Outflow

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach 6CC: A3 Collector Channel

Inflow Area = 1.000 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 6.22 cfs @ 12.14 hrs, Volume= 0.514 af

Outflow = 5.34 cfs @ 12.30 hrs, Volume= 0.514 af, Atten= 14%, Lag= 10.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.97 fps, Min. Travel Time= 6.3 min Avg. Velocity = 0.58 fps, Avg. Travel Time= 21.1 min

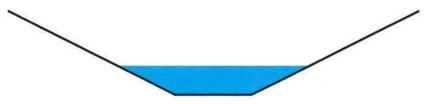
Peak Storage= 2,006 cf @ 12.20 hrs Average Depth at Peak Storage= 0.77'

Bank-Full Depth= 2.21' Flow Area= 14.2 sf, Capacity= 50.02 cfs

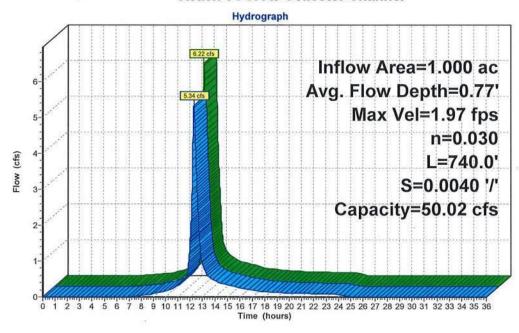
2.00' x 2.21' deep channel, n= 0.030 Earth, grassed & winding

Side Slope Z-value= 2.0 '/' Top Width= 10.84' Length= 740.0' Slope= 0.0040 '/'

Inlet Invert= 59.50', Outlet Invert= 56.54'



Reach 6CC: A3 Collector Channel



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach A2-1: A2-1 Channel

Inflow Area = 2.000 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 8.74 cfs @ 12.28 hrs, Volume= 1.027 af

Outflow = 8.70 cfs @ 12.35 hrs, Volume= 1.027 af, Atten= 0%, Lag= 3.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.57 fps, Min. Travel Time= 2.7 min Avg. Velocity = 0.51 fps, Avg. Travel Time= 8.2 min

Peak Storage= 1,387 cf @ 12.30 hrs Average Depth at Peak Storage= 1.24'

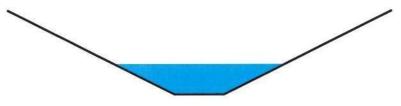
Bank-Full Depth= 3.40' Flow Area= 29.9 sf, Capacity= 83.47 cfs

2.00' x 3.40' deep channel, n= 0.030 Earth, grassed & winding

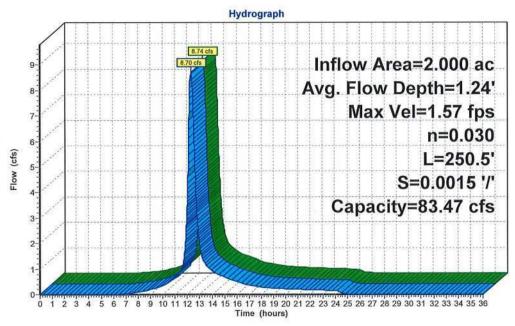
Side Slope Z-value= 2.0 '/' Top Width= 15.60'

Length= 250.5' Slope= 0.0015 '/'

Inlet Invert= 57.61', Outlet Invert= 57.23'



Reach A2-1: A2-1 Channel





Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach A2-2: A2-2 Channel

Inflow Area = 19.361 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 114.51 cfs @ 12.15 hrs, Volume= 9.943 af

Outflow = 113.50 cfs @ 12.19 hrs, Volume= 9.943 af, Atten= 1%, Lag= 2.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 3.72 fps, Min. Travel Time= 1.2 min Avg. Velocity = 1.00 fps, Avg. Travel Time= 4.3 min

Peak Storage= 7,841 cf @ 12.17 hrs Average Depth at Peak Storage= 2.53'

Bank-Full Depth= 4.34' Flow Area= 68.1 sf, Capacity= 338.68 cfs

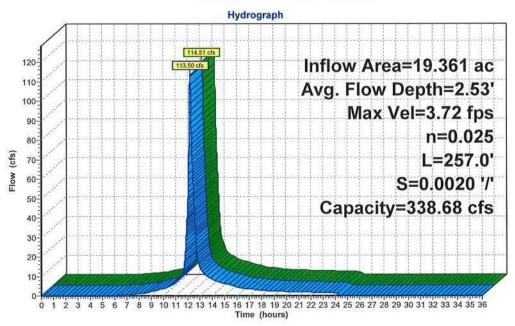
7.00' x 4.34' deep channel, n= 0.025 Rubble masonry, cemented

Side Slope Z-value= 2.0 '/' Top Width= 24.36'

Length= 257.0' Slope= 0.0020 '/' Inlet Invert= 55.84', Outlet Invert= 55.33'



Reach A2-2: A2-2 Channel



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach A2-3: A2-3 Channel

Inflow Area = 19.361 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 113.50 cfs @ 12.19 hrs, Volume= 9.943 af

Outflow = 108.05 cfs @ 12.27 hrs, Volume= 9.943 af, Atten= 5%, Lag= 5.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 3.19 fps, Min. Travel Time= 3.0 min Avg. Velocity = 0.86 fps, Avg. Travel Time= 11.3 min

Peak Storage= 19,700 cf @ 12.22 hrs Average Depth at Peak Storage= 2.57

Bank-Full Depth= 5.65' Flow Area= 109.0 sf, Capacity= 532.10 cfs

8.00' x 5.65' deep channel, n= 0.030 Earth, grassed & winding

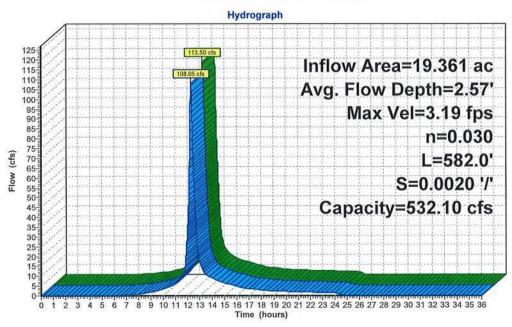
Side Slope Z-value= 2.0 '/' Top Width= 30.60'

Length= 582.0' Slope= 0.0020 '/'

Inlet Invert= 55.33', Outlet Invert= 54.17'



Reach A2-3: A2-3 Channel





Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach A2-4: Chute-Concrete Block Open Cell

Inflow Area = 19.361 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 108.05 cfs @ 12.27 hrs, Volume= 9.943 af

Outflow = 107.90 cfs @ 12.28 hrs, Volume= 9.943 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 11.15 fps, Min. Travel Time= 0.4 min Avg. Velocity = 2.81 fps, Avg. Travel Time= 1.5 min

Peak Storage= 2,420 cf @ 12.28 hrs Average Depth at Peak Storage= 0.75

Bank-Full Depth= 2.00' Flow Area= 36.0 sf, Capacity= 692.98 cfs

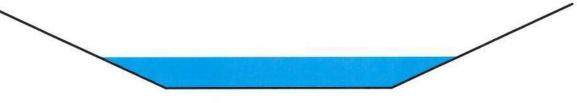
10.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

Side Slope Z-value= 4.0 '/' Top Width= 26.00'

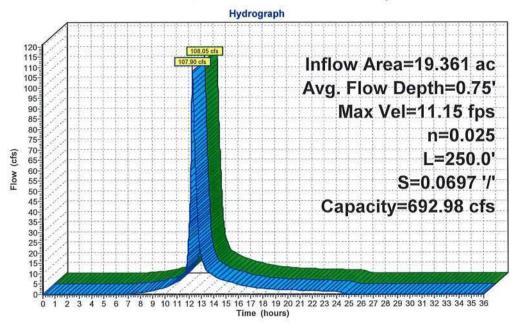
Length= 250.0' Slope= 0.0697 '/'

#

Inlet Invert= 54.17', Outlet Invert= 36.75'



Reach A2-4: Chute-Concrete Block Open Cell





Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach A2-5: Cocrete Block-Channel Transition

Inflow Area = 2.000 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 8.70 cfs @ 12.35 hrs, Volume= 1.027 af

Outflow = 8.70 cfs @ 12.35 hrs, Volume= 1.027 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Max. Velocity= 11.21 fps, Min. Travel Time= 0.0 min

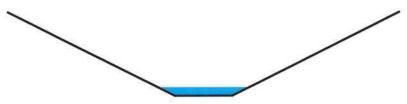
Avg. Velocity = 3.73 fps, Avg. Travel Time= 0.0 min

Peak Storage= 4 cf @ 12.35 hrs Average Depth at Peak Storage= 0.30' Bank-Full Depth= 2.93' Flow Area= 23.0 sf, Capacity= 903.50 cfs

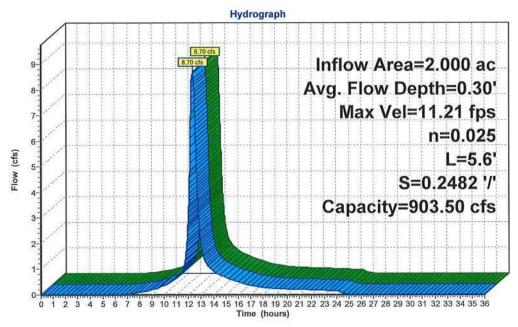
2.00' x 2.93' deep channel, n= 0.025 Rubble masonry, cemented Side Slope Z-value= 2.0 '/' Top Width= 13.72'

Length= 5.6' Slope= 0.2482 '/'

Inlet Invert= 57.23', Outlet Invert= 55.84'



Reach A2-5: Cocrete Block-Channel Transition



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach B1: 5' x 4' Box Culvert

Inflow Area = 19.249 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 103.76 cfs @ 12.17 hrs, Volume= 9.886 af

Outflow = 103.38 cfs @ 12.20 hrs, Volume= 9.886 af, Atten= 0%, Lag= 1.5 min

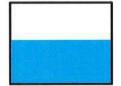
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 9.54 fps, Min. Travel Time= 0.8 min Avg. Velocity = 2.65 fps, Avg. Travel Time= 2.9 min

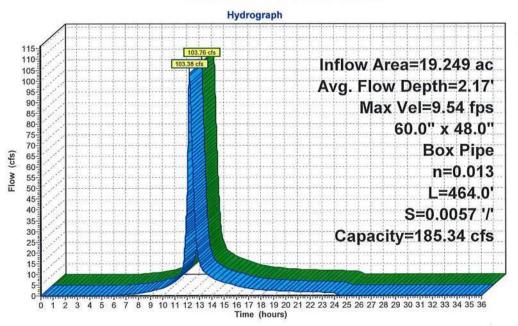
Peak Storage= 5,030 cf @ 12.18 hrs Average Depth at Peak Storage= 2.17

Bank-Full Depth= 4.00' Flow Area= 20.0 sf, Capacity= 185.34 cfs

60.0" W x 48.0" H Box Pipe n= 0.013 Concrete pipe, bends & connections Length= 464.0' Slope= 0.0057 '/' Inlet Invert= 56.54', Outlet Invert= 53.89'



Reach B1: 5' x 4' Box Culvert



Inflow
Outflow

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach B2: 5' x 4' Box Culvert

Inflow Area = 38.047 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 211.91 cfs @ 12.20 hrs, Volume= 19.540 af

Outflow = 211.71 cfs @ 12.21 hrs, Volume= 19.540 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 17.67 fps, Min. Travel Time= 0.2 min Avg. Velocity = 4.94 fps, Avg. Travel Time= 0.7 min

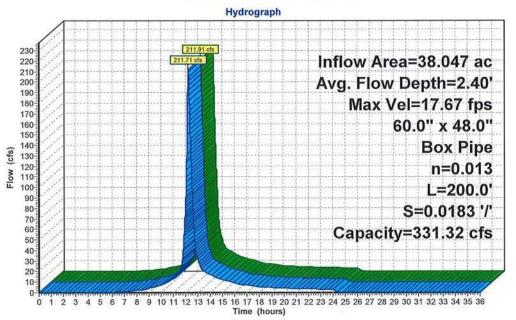
Peak Storage= 2,398 cf @ 12.20 hrs Average Depth at Peak Storage= 2.40'

Bank-Full Depth= 4.00' Flow Area= 20.0 sf, Capacity= 331.32 cfs

60.0" W x 48.0" H Box Pipe n= 0.013 Concrete pipe, bends & connections Length= 200.0' Slope= 0.0183 '/' Inlet Invert= 53.45', Outlet Invert= 49.80'



Reach B2: 5' x 4' Box Culvert



Inflow
Outflow

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach C1-4: Chute-Concrete Block Open Cell

Inflow Area = 38.047 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 211.71 cfs @ 12.21 hrs, Volume= 19.540 af

Outflow = 211.66 cfs @ 12.21 hrs, Volume= 19.540 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 23.03 fps, Min. Travel Time= 0.1 min Avg. Velocity = 6.80 fps, Avg. Travel Time= 0.2 min

Peak Storage= 699 cf @ 12.21 hrs Average Depth at Peak Storage= 1.01

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 872.67 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

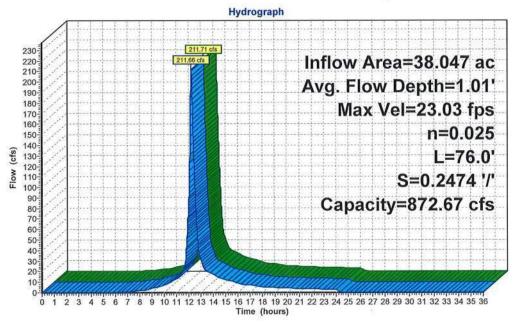
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 76.0' Slope= 0.2474 '/'

Inlet Invert= 49.80', Outlet Invert= 31.00'



Reach C1-4: Chute-Concrete Block Open Cell



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach C1SCCN1: C1SCCN1 Collector Channel

Inflow Area = 0.250 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 1.55 cfs @ 12.14 hrs, Volume= 0.128 af

Outflow = 1.44 cfs @ 12.25 hrs, Volume= 0.128 af, Atten= 7%, Lag= 6.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.19 fps, Min. Travel Time= 4.0 min Avg. Velocity = 0.33 fps, Avg. Travel Time= 14.4 min

Peak Storage= 344 cf @ 12.18 hrs Average Depth at Peak Storage= 0.33'

Bank-Full Depth= 1.50' Flow Area= 9.0 sf, Capacity= 24.47 cfs

3.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding

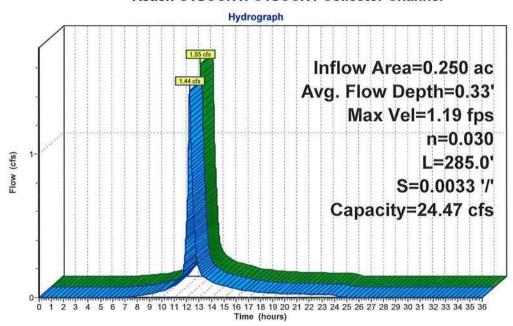
Side Slope Z-value= 2.0 '/' Top Width= 9.00'

Length= 285.0' Slope= 0.0033 '/'

Inlet Invert= 58.50', Outlet Invert= 57.55'



Reach C1SCCN1: C1SCCN1 Collector Channel





Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach C1SCCN2: C1SCCN2 Collector Channel

Inflow Area = 0.250 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 1.55 cfs @ 12.14 hrs, Volume= 0.128 af

Outflow = 1.44 cfs @ 12.25 hrs, Volume= 0.128 af, Atten= 7%, Lag= 6.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.19 fps, Min. Travel Time= 4.0 min Avg. Velocity = 0.33 fps, Avg. Travel Time= 14.6 min

Peak Storage= 348 cf @ 12.18 hrs Average Depth at Peak Storage= 0.33'

Bank-Full Depth= 1.50' Flow Area= 9.0 sf, Capacity= 24.36 cfs

3.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding

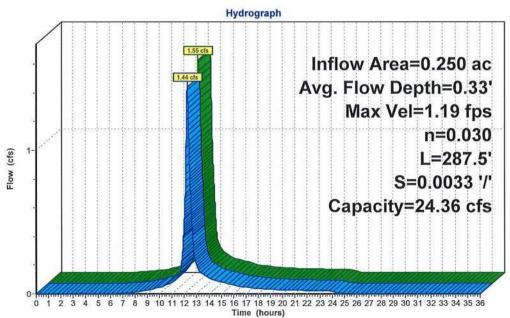
Side Slope Z-value= 2.0 '/' Top Width= 9.00'

Length= 287.5' Slope= 0.0033 '/'

Inlet Invert= 58.50', Outlet Invert= 57.55'



Reach C1SCCN2: C1SCCN2 Collector Channel





Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach C1SCCS1: C1SCCS1 Collector Channel

Inflow Area = 0.250 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 1.55 cfs @ 12.14 hrs, Volume= 0.128 af

Outflow = 1.44 cfs @ 12.24 hrs, Volume= 0.128 af, Atten= 7%, Lag= 6.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.19 fps, Min. Travel Time= 3.9 min Avg. Velocity = 0.33 fps, Avg. Travel Time= 14.2 min

Peak Storage= 340 cf @ 12.18 hrs Average Depth at Peak Storage= 0.33'

Bank-Full Depth= 1.50' Flow Area= 9.0 sf, Capacity= 24.30 cfs

3.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding

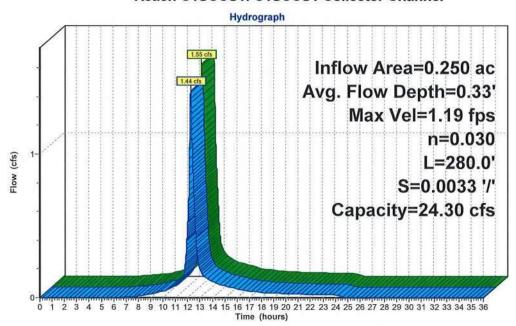
Side Slope Z-value= 2.0 '/' Top Width= 9.00'

Length= 280.0' Slope= 0.0033 '/'

Inlet Invert= 58.50', Outlet Invert= 57.58'



Reach C1SCCS1: C1SCCS1 Collector Channel



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach C1SCCS2: C1SCCS2 Collector Channel

Inflow Area = 0.250 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 1.55 cfs @ 12.14 hrs, Volume= 0.128 af

Outflow = 1.44 cfs @ 12.24 hrs, Volume= 0.128 af, Atten= 7%, Lag= 6.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.19 fps, Min. Travel Time= 3.9 min Avg. Velocity = 0.33 fps, Avg. Travel Time= 14.2 min

Peak Storage= 340 cf @ 12.18 hrs Average Depth at Peak Storage= 0.33'

Bank-Full Depth= 1.50' Flow Area= 9.0 sf, Capacity= 24.30 cfs

3.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding

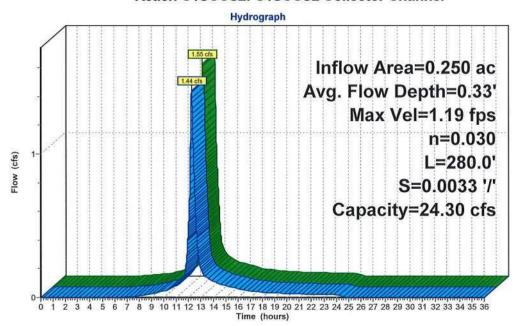
Side Slope Z-value= 2.0 '/' Top Width= 9.00'

Length= 280.0' Slope= 0.0033 '/'

Inlet Invert= 58.50', Outlet Invert= 57.58'



Reach C1SCCS2: C1SCCS2 Collector Channel



Inflow
Outflow

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach C2-3: C2-3 Channel

Inflow Area = 15.287 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 91.74 cfs @ 12.16 hrs, Volume= 7.851 af

Outflow = 82.99 cfs @ 12.29 hrs, Volume= 7.851 af, Atten= 10%, Lag= 8.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 3.06 fps, Min. Travel Time= 4.8 min Avg. Velocity = 0.88 fps, Avg. Travel Time= 16.8 min

Peak Storage= 23,911 cf @ 12.21 hrs Average Depth at Peak Storage= 2.82

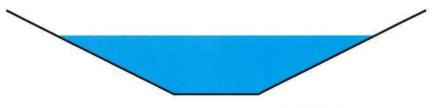
Bank-Full Depth= 4.00' Flow Area= 48.0 sf, Capacity= 178.76 cfs

4.00' x 4.00' deep channel, n= 0.030 Earth, grassed & winding

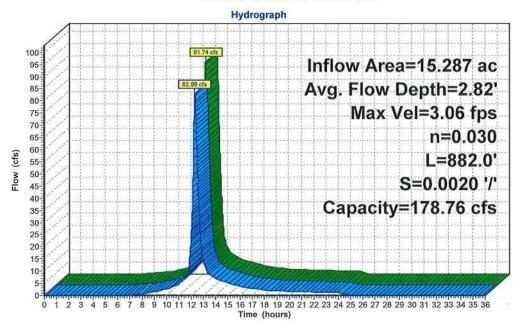
Side Slope Z-value= 2.0 '/' Top Width= 20.00'

Length= 882.0' Slope= 0.0020 '/'

Inlet Invert= 53.50', Outlet Invert= 51.75'



Reach C2-3: C2-3 Channel





Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach C2-4: Chute-Concrete Block Open Cell

Inflow Area = 15.287 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 82.89 cfs @ 12.30 hrs, Volume= 7.851 af

Outflow = 82.88 cfs @ 12.30 hrs, Volume= 7.851 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 19.49 fps, Min. Travel Time= 0.0 min Avg. Velocity = 5.37 fps, Avg. Travel Time= 0.2 min

Peak Storage= 221 cf @ 12.30 hrs Average Depth at Peak Storage= 0.58

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 1,003.23 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

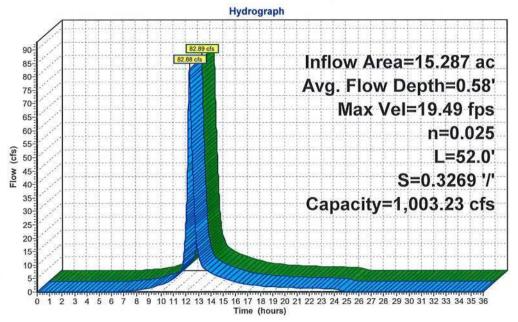
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 52.0' Slope= 0.3269 '/'

Inlet Invert= 48.00', Outlet Invert= 31.00'



Reach C2-4: Chute-Concrete Block Open Cell



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach C2-5: C2-5 Channel

Inflow Area = 15.287 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 82.96 cfs @ 12.29 hrs, Volume= 7.851 af

Outflow = 82.89 cfs @ 12.30 hrs, Volume= 7.851 af, Atten= 0%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 8.22 fps, Min. Travel Time= 0.2 min Avg. Velocity = 2.31 fps, Avg. Travel Time= 0.8 min

Peak Storage= 1,070 cf @ 12.30 hrs Average Depth at Peak Storage= 1.08'

Bank-Full Depth= 2.50' Flow Area= 37.5 sf, Capacity= 492.25 cfs

5.00' x 2.50' deep channel, n= 0.025 Rubble masonry, cemented

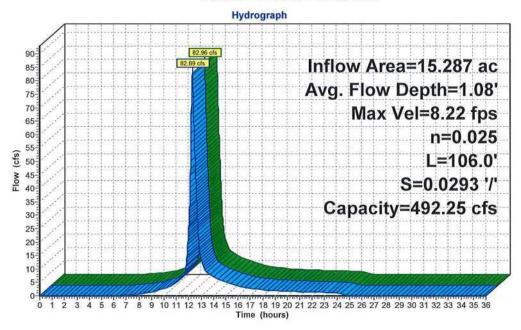
Side Slope Z-value= 4.0 '/' Top Width= 25.00'

Length= 106.0' Slope= 0.0293 '/'

Inlet Invert= 51.11', Outlet Invert= 48.00'



Reach C2-5: C2-5 Channel



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach CC: Chute-Concrete Block Open Cell

Inflow Area = 1.480 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 7.72 cfs @ 12.32 hrs, Volume= 0.760 af

Outflow = 7.71 cfs @ 12.33 hrs, Volume= 0.760 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 6.18 fps, Min. Travel Time= 0.4 min Avg. Velocity = 1.85 fps, Avg. Travel Time= 1.4 min

Peak Storage= 200 cf @ 12.32 hrs Average Depth at Peak Storage= 0.21

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 562.60 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

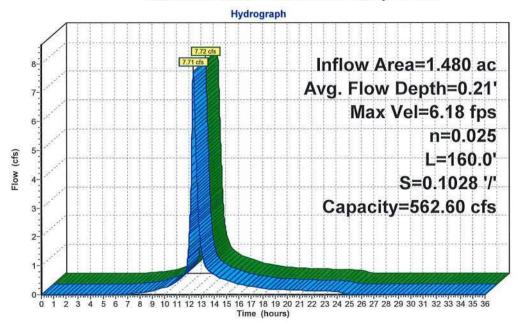
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 160.0' Slope= 0.1028 '/'

Inlet Invert= 53.20', Outlet Invert= 36.75'



Reach CC: Chute-Concrete Block Open Cell



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach E: Chute-Concrete Block Open Cell

Inflow Area = 17.798 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 106.93 cfs @ 12.15 hrs, Volume= 9.140 af

Outflow = 106.72 cfs @ 12.16 hrs, Volume= 9.140 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 19.11 fps, Min. Travel Time= 0.4 min Avg. Velocity = 5.96 fps, Avg. Travel Time= 1.3 min

Peak Storage= 2,582 cf @ 12.15 hrs Average Depth at Peak Storage= 0.71'

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 879.20 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

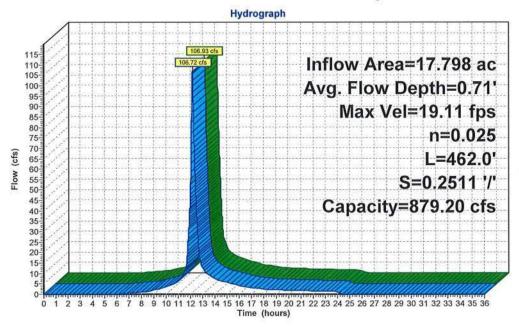
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 462.0' Slope= 0.2511 '/'

Inlet Invert= 174.00', Outlet Invert= 58.00'



Reach E: Chute-Concrete Block Open Cell





Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach NE: Chute-Concrete Block Open Cell

Inflow Area = 15.287 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 91.93 cfs @ 12.15 hrs, Volume= 7.851 af

Outflow = 91.74 cfs @ 12.16 hrs, Volume= 7.851 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 18.27 fps, Min. Travel Time= 0.4 min Avg. Velocity = 5.65 fps, Avg. Travel Time= 1.4 min

Peak Storage= 2,332 cf @ 12.15 hrs Average Depth at Peak Storage= 0.66

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.30 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

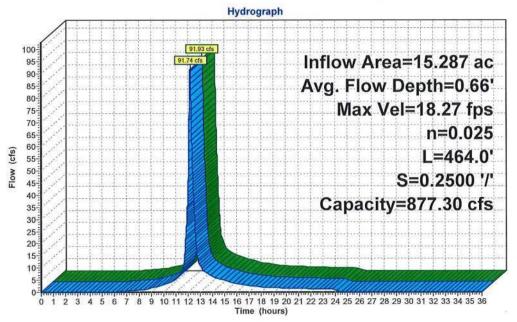
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 464.0' Slope= 0.2500 '/'

Inlet Invert= 174.00', Outlet Invert= 58.00'



Reach NE: Chute-Concrete Block Open Cell



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach NW: Chute-Concrete Block Open Cell

Inflow Area = 13.115 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 77.52 cfs @ 12.15 hrs, Volume= 6.735 af

Outflow = 77.39 cfs @ 12.16 hrs, Volume= 6.735 af, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 17.38 fps, Min. Travel Time= 0.4 min Avg. Velocity = 5.36 fps, Avg. Travel Time= 1.4 min

Peak Storage= 2,067 cf @ 12.15 hrs Average Depth at Peak Storage= 0.60'

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.30 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

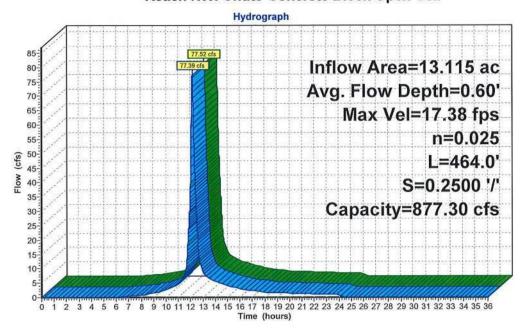
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 464.0' Slope= 0.2500 '/'

Inlet Invert= 174.00', Outlet Invert= 58.00'



Reach NW: Chute-Concrete Block Open Cell



Type III 24-hr 25-Year Rainfall=8.70"

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Inflow
Outflow

Summary for Reach OC: Existing Offsite Channel

Inflow Area = 42.338 ac, 0.00% Impervious, Inflow Depth > 6.18" for 25-Year event

Inflow = 33.70 cfs @ 12.91 hrs, Volume= 21.821 af

Outflow = 32.78 cfs @ 14.06 hrs, Volume= 21.722 af, Atten= 3%, Lag= 68.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.72 fps, Min. Travel Time= 27.1 min Avg. Velocity = 0.84 fps, Avg. Travel Time= 55.4 min

Peak Storage= 53,292 cf @ 13.60 hrs Average Depth at Peak Storage= 1.82

Bank-Full Depth= 2.10' Flow Area= 23.7 sf, Capacity= 44.23 cfs

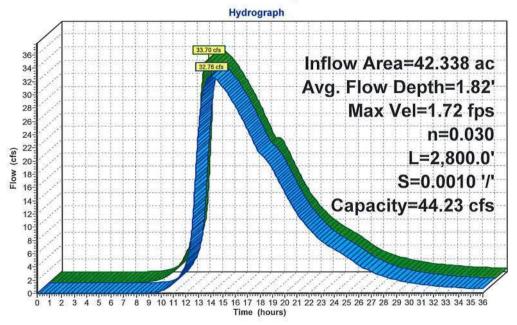
5.00' x 2.10' deep channel, n= 0.030 Earth, grassed & winding

Side Slope Z-value= 3.0 '/' Top Width= 17.60'

Length= 2,800.0' Slope= 0.0010 '/' Inlet Invert= 46.66', Outlet Invert= 43.86'



Reach OC: Existing Offsite Channel



Part III, Attachment 6, Appendix 6B.4, p.g.-66

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach P1: Culvert

Inflow Area =

15.287 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow

82.99 cfs @ 12.29 hrs, Volume=

7.851 af

Outflow

82.96 cfs @ 12.29 hrs, Volume=

7.851 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 13.43 fps, Min. Travel Time= 0.1 min Avg. Velocity = 4.02 fps, Avg. Travel Time= 0.3 min

Peak Storage= 395 cf @ 12.29 hrs Average Depth at Peak Storage= 1.97'

Bank-Full Depth= 4.00' Flow Area= 12.6 sf, Capacity= 169.76 cfs

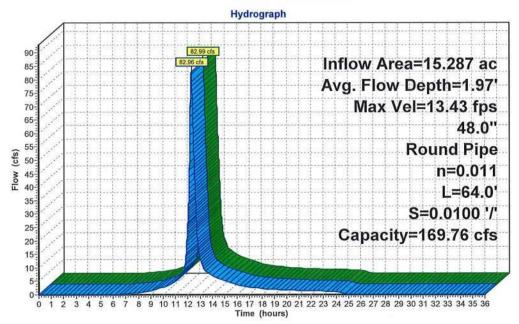
48.0" Round Pipe

n= 0.011 Concrete pipe, straight & clean Length= 64.0' Slope= 0.0100 '/'

Inlet Invert= 51.75', Outlet Invert= 51.11'



Reach P1: Culvert





Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach P2: Culvert

Inflow Area = 0.500 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 2.88 cfs @ 12.25 hrs, Volume= 0.257 af

Outflow = 2.88 cfs @ 12.25 hrs, Volume= 0.257 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 6.62 fps, Min. Travel Time= 0.2 min Avg. Velocity = 2.18 fps, Avg. Travel Time= 0.6 min

Peak Storage= 31 cf @ 12.25 hrs Average Depth at Peak Storage= 0.44'

Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 15.20 cfs

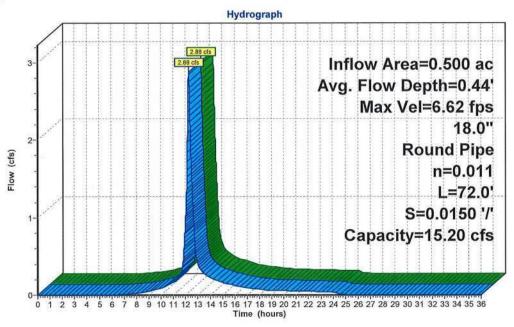
18.0" Round Pipe

n= 0.011 Concrete pipe, straight & clean Length= 72.0' Slope= 0.0150 '/'

Inlet Invert= 54.39', Outlet Invert= 53.31'



Reach P2: Culvert



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach P2-1: Chute-Concrete Block Open Cell

Inflow Area = 0.500 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 2.88 cfs @ 12.25 hrs, Volume= 0.257 af

Outflow = 2.88 cfs @ 12.25 hrs, Volume= 0.257 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 8.63 fps, Min. Travel Time= 0.1 min Avg. Velocity = 2.71 fps, Avg. Travel Time= 0.4 min

Peak Storage= 20 cf @ 12.25 hrs Average Depth at Peak Storage= 0.14'

Bank-Full Depth= 1.50' Flow Area= 9.8 sf, Capacity= 316.81 cfs

2.00' x 1.50' deep channel, n= 0.025 Rubble masonry, cemented

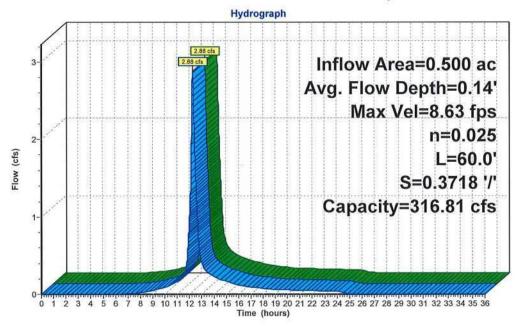
Side Slope Z-value= 3.0 '/' Top Width= 11.00'

Length= 60.0' Slope= 0.3718 '/'

Inlet Invert= 53.31', Outlet Invert= 31.00'



Reach P2-1: Chute-Concrete Block Open Cell



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach P3: Culvert

Inflow Area = 0.500 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 2.89 cfs @ 12.24 hrs, Volume= 0.257 af

Outflow = 2.89 cfs @ 12.25 hrs, Volume= 0.257 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 6.62 fps, Min. Travel Time= 0.2 min Avg. Velocity = 2.18 fps, Avg. Travel Time= 0.6 min

Peak Storage= 31 cf @ 12.25 hrs Average Depth at Peak Storage= 0.44'

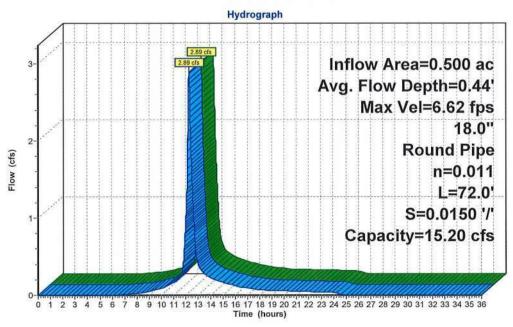
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 15.20 cfs

18.0" Round Pipe

n= 0.011 Concrete pipe, straight & clean Length= 72.0' Slope= 0.0150 '/' Inlet Invert= 55.41', Outlet Invert= 54.33'



Reach P3: Culvert





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Summary for Reach P3-1: Chute-Concrete Block Open Cell

Inflow Area = 0.500 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 2.89 cfs @ 12.25 hrs, Volume= 0.257 af

Outflow = 2.89 cfs @ 12.25 hrs, Volume= 0.257 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 8.81 fps, Min. Travel Time= 0.1 min Avg. Velocity = 2.78 fps, Avg. Travel Time= 0.4 min

Peak Storage= 20 cf @ 12.25 hrs Average Depth at Peak Storage= 0.14'

Bank-Full Depth= 1.50' Flow Area= 9.8 sf. Capacity= 326.18 cfs

2.00' x 1.50' deep channel, n= 0.025 Rubble masonry, cemented

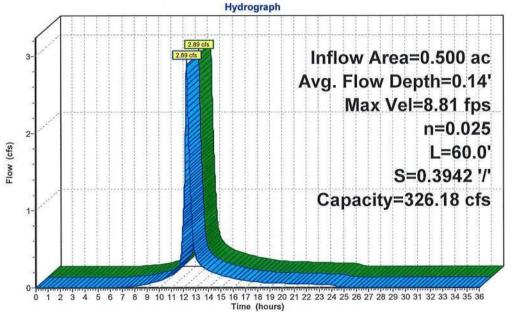
Side Slope Z-value= 3.0 '/' Top Width= 11.00'

Length= 60.0' Slope= 0.3942 '/'

Inlet Invert= 54.65', Outlet Invert= 31.00'



Reach P3-1: Chute-Concrete Block Open Cell



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach S: Chute-Concrete Block Open Cell

Inflow Area = 17.361 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 107.94 cfs @ 12.14 hrs, Volume= 8.916 af

Outflow = 107.70 cfs @ 12.15 hrs, Volume= 8.916 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 19.13 fps, Min. Travel Time= 0.4 min Avg. Velocity = 5.91 fps, Avg. Travel Time= 1.3 min

Peak Storage= 2,586 cf @ 12.14 hrs Average Depth at Peak Storage= 0.72'

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.30 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

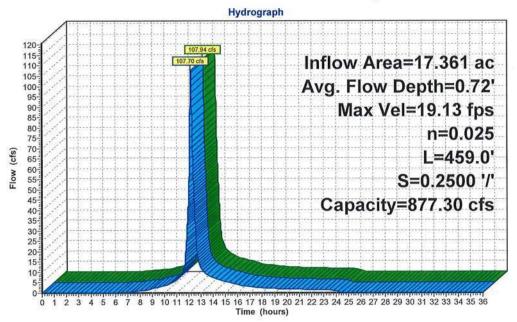
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 459.0' Slope= 0.2500 '/'

Inlet Invert= 174.00', Outlet Invert= 59.25'



Reach S: Chute-Concrete Block Open Cell



Type III 24-hr 25-Year Rainfall=8.70"

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Inflow
Outflow

Summary for Reach SE: Chute-Concrete Block Open Cell

Inflow Area = 18.249 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 100.71 cfs @ 12.16 hrs, Volume= 9.372 af

Outflow = 100.58 cfs @ 12.17 hrs, Volume= 9.372 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 18.76 fps, Min. Travel Time= 0.4 min Avg. Velocity = 5.97 fps, Avg. Travel Time= 1.3 min

Peak Storage= 2,415 cf @ 12.16 hrs Average Depth at Peak Storage= 0.69

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.14 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

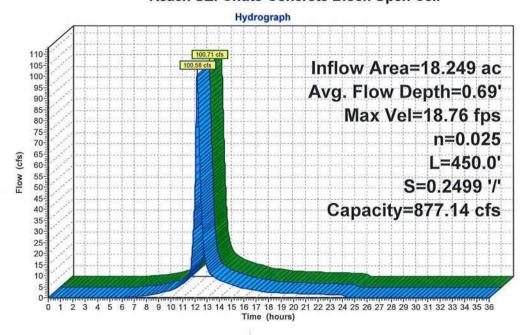
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 450.0' Slope= 0.2499 '/'

Inlet Invert= 174.00', Outlet Invert= 61.54'



Reach SE: Chute-Concrete Block Open Cell



Part III, Attachment 6, Appendix 6B.4, p.g.-73

Submittal Date: September 2018

Revision: 0

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach SE1: Chute-Concrete Block Open Cell

Inflow Area = 18.249 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 100.58 cfs @ 12.17 hrs, Volume= 9.372 af

Outflow = 100.54 cfs @ 12.17 hrs, Volume= 9.372 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 12.50 fps, Min. Travel Time= 0.1 min Avg. Velocity = 4.11 fps, Avg. Travel Time= 0.3 min

Peak Storage= 499 cf @ 12.17 hrs Average Depth at Peak Storage= 0.92

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 498.27 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

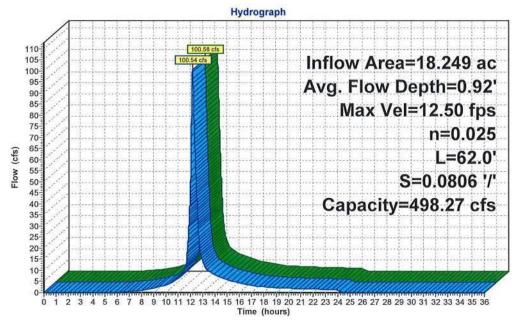
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 62.0' Slope= 0.0806 '/'

Inlet Invert= 61.54', Outlet Invert= 56.54'



Reach SE1: Chute-Concrete Block Open Cell



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Summary for Reach SW: Chute-Concrete Block Open Cell

Inflow Area = 15.434 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 95.96 cfs @ 12.14 hrs, Volume= 7.926 af

Outflow = 95.76 cfs @ 12.15 hrs, Volume= 7.926 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 18.50 fps, Min. Travel Time= 0.4 min Avg. Velocity = 5.68 fps, Avg. Travel Time= 1.2 min

Peak Storage= 2,094 cf @ 12.14 hrs Average Depth at Peak Storage= 0.67

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.30 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

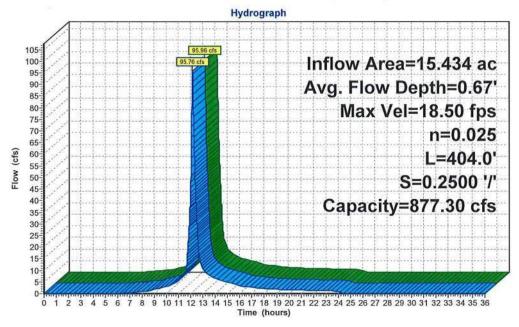
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 404.0' Slope= 0.2500 '/'

Inlet Invert= 174.00', Outlet Invert= 73.00'



Reach SW: Chute-Concrete Block Open Cell



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Summary for Reach SW-1: Chute-Concrete Block Open Cell

Inflow Area =

15.434 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = Outflow

95.76 cfs @ 12.15 hrs, Volume=

95.59 cfs @ 12.16 hrs, Volume=

7.926 af 7.926 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 14.51 fps, Min. Travel Time= 0.3 min Avg. Velocity = 4.54 fps, Avg. Travel Time= 1.0 min

Peak Storage= 1,754 cf @ 12.15 hrs Average Depth at Peak Storage= 0.80'

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 624.99 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

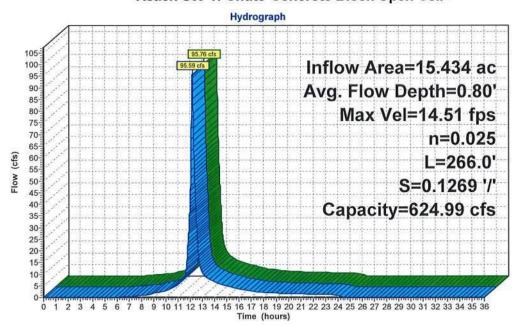
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 266.0' Slope= 0.1269 '/'

Inlet Invert= 70.50', Outlet Invert= 36.75'



Reach SW-1: Chute-Concrete Block Open Cell



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach W: Chute-Concrete Block Open Cell

Inflow Area = 22.383 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 127.46 cfs @ 12.15 hrs, Volume= 11.495 af

Outflow = 127.27 cfs @ 12.16 hrs, Volume= 11.495 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 20.06 fps, Min. Travel Time= 0.4 min Avg. Velocity = 6.41 fps, Avg. Travel Time= 1.2 min

Peak Storage= 2,946 cf @ 12.15 hrs Average Depth at Peak Storage= 0.78'

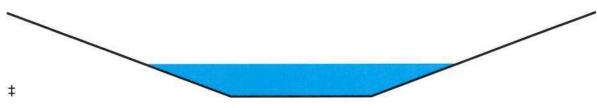
Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.30 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

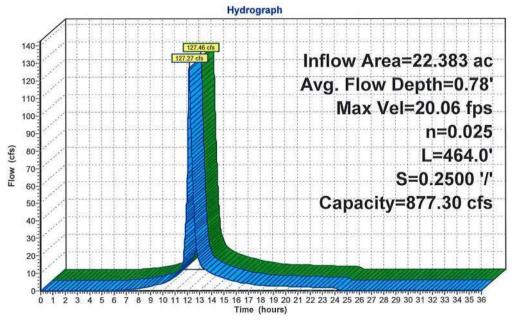
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 464.0' Slope= 0.2500 '/'

Inlet Invert= 174.00', Outlet Invert= 58.00'



Reach W: Chute-Concrete Block Open Cell



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Pond PA: Retention Pond A

No Discharge, Reshaping of Existing Pond A Bottom Required.

Inflow Area = 47.697 ac, 0.00% Impervious, Inflow Depth = 6.59" for 25-Year event

Inflow = 225.75 cfs @ 12.22 hrs, Volume= 26.201 af

Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Peak Elev= 47.33' @ 36.00 hrs Surf.Area= 4.028 ac Storage= 26.200 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert Av	ail.Storage	Storage Descrip	tion		
#1	36.75'	82.379 af	Custom Stage [Data (Irregular) i	Listed below (Recalc)	
Elevation	Surf,Area	Perim.	Inc.Store	Cum.Store	Wet.Area	
(feet)	(acres)	(feet)	(acre-feet)	(acre-feet)	(acres)	
36.75	1.340	1,049.8	0.000	0.000	1.340	
37.00	1.380	1,064.9	0.340	0.340	1.399	
38,00	1.540	1,125.4	1.459	1.799	1.642	
39.00	1.720	1,171.5	1.629	3.428	1.837	
40.00	1.890	1,216.8	1.804	5.233	2.037	
41.00	2.120	1,292.5	2.004	7.237	2.385	
42.00	2.360	1,370.6	2.239	9.476	2.766	
43.00	2.620	1,447.9	2.489	11.964	3.166	
44.00	2.900	1,537.3	2.759	14.723	3.654	
45.00	3.210	1,623.3	3.054	17.777	4.152	
46.00	3,550	1,699.4	3,379	21,156	4.616	
47.00	3.910	1,769.6	3.729	24,884	5.062	
48.00	4.270	1,832.8	4.089	28.973	5.480	
49.00	4.640	1,894.6	4,454	33,426	5.903	
50.00	5.020	1,956.1	4.829	38.255	6.338	
51.00	5.450	2,024.3	5.234	43.489	6.836	
52.00	5.860	2,075.6	5.654	49.143	7.223	
53.00	6.180	2,125.3	6.019	55.162	7.608	
54.00	6.490	2,167.2	6.334	61.496	7.940	
55.00	6.800	2,209.1	6.644	68 .1 41	8.279	
56.00	7.120	2,250.9	6.959	75.100	8.623	
57.00	7.440	2,292.6	7.279	82.379	8.973	

Type III 24-hr 25-Year Rainfall=8.70"

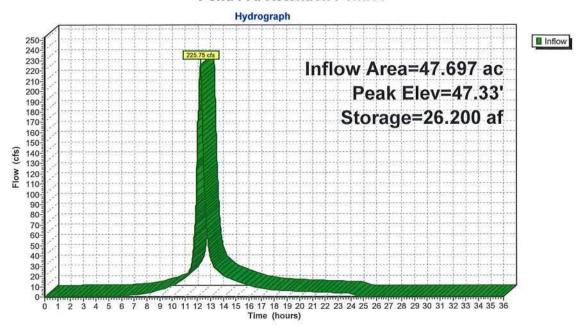
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Pond PA: Retention Pond A



Volume

#1

Post Development 25 Yr Drainage

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Pond PB: Detention Pond B

Inflow Area = 42.338 ac. 0.00% Impervious, Inflow Depth = 6.40" for 25-Year event

Inflow 235,89 cfs @ 12.16 hrs, Volume= 22.565 af

Outflow 33.70 cfs @ 12.91 hrs, Volume= 21.821 af, Atten= 86%, Lag= 45.0 min

Primary 33.70 cfs @ 12.91 hrs, Volume= 21.821 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Peak Elev= 50.87' @ 12.91 hrs Surf.Area= 3.532 ac Storage= 11.562 af

Plug-Flow detention time= 244.2 min calculated for 21.821 af (97% of inflow)

Avail.Storage Storage Description

Center-of-Mass det. time= 224.8 min (1,023.3 - 798.5)

Invert

47.00"

Elevation	on Surf.A	Area	Perim	n. Inc.Store	Cum.Store	Wet.Area		
(fee	et) (ac	res)	(feet) (acre-feet)	(acre-feet)	(acres)		
47.0	00 2.	.450	3,998.	7 0.000	0.000	2,450		
48.0	00 2.	.730	4,022.	7 2.589	2.589	2.814		
49.0	00 3.	.010	4,046.	7 2.869	5.45 8	3.179		
50.0	00 3.	.290	4,070.	7 3.149	8.607	3.547		
51.0	00 3.	.570	4,094.	6 3.429	12.036	3.916		
52.0	00 3.	.850	4,118.	8 3.709	15,745	4.291		
53.0	00 4.	.140	4,158.	1 3.994	19.739	4.893		
Device	Routing		Invert	Outlet Devices				
#1	Primary		47.00'	21.0" Round RCF	P_Round 21"			
				L= 128.0' RCP, g				
						S= 0.0020 '/' Cc= 0.900		
						onnections, Flow Area= 2.	.41 s	
#2	Primary		47.00'	21.0" Round RCP_Round 21" L= 128.0' RCP, groove end projecting, Ke= 0.200				
				Inlet / Outlet Inven	t= 47.00' / 46.75'	S= 0.0020 \(\text{Cc} = 0.900 \)		
				n= 0.013 Concret	e pipe, bends & c	onnections, Flow Area≒ 2.	.41 s	

19,739 af Custom Stage Data (Irregular) Listed below (Recalc)

Primary OutFlow Max=33.70 cfs @ 12.91 hrs HW=50.87' (Free Discharge)

-1=RCP_Round 21" (Barrel Controls 16.85 cfs @ 7.00 fps)
-2=RCP_Round 21" (Barrel Controls 16.85 cfs @ 7.00 fps)

Type III 24-hr 25-Year Rainfall=8.70"

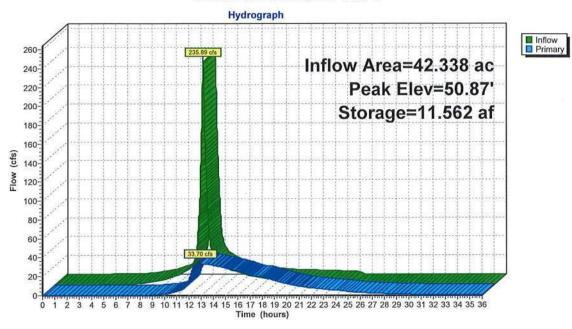
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Pond PB: Detention Pond B



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Pond PC: Retention Pond C

No Discharge, Constructrion of Perimeter Berm to Elevation 48 ft. Required.

Inflow Area = 61.564 ac, 0.00% Impervious, Inflow Depth = 6.37" for 25-Year event

Inflow = 313.19 cfs @ 12.23 hrs, Volume= 32.676 af

Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Peak Elev= 42.36' @ 36.00 hrs Surf.Area= 3.718 ac Storage= 32.676 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= (not calculated: no outflow)

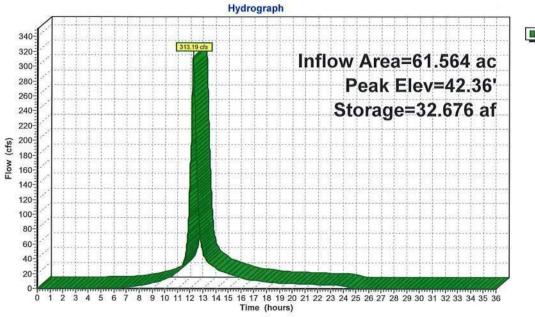
Volume	Invert Av	/ail.Storage	Storage Descrip	tion		
#1	31.00'	56.115 af	Custom Stage I	Data (Irregular)	Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)	
31.00	2.060	2,014.1	0.000	0.000	2.060	
32.00	2.200	2,032.9	2.130	2.130	2.207	
33.00	2.340	2,051.7	2.270	4.399	2.354	
34.00	2.480	2,070.5	2.410	6.809	2.504	
35.00	2.630	2,089.2	2.555	9.364	2.654	
36.00	2.770	2,108.0	2.700	12.063	2.806	
37.00	2.920	2,126.8	2.845	14.908	2.959	
38.00	3.060	2,145.6	2.990	17.898	3.114	
39.00	3.210	2,164.4	3,135	21,032	3.270	
40.00	3.360	2,183.2	3.285	24.317	3.427	
41.00	3.510	2,201.9	3.435	27.752	3.585	
42.00	3.660	2,220.7	3,585	31.337	3.745	
43.00	3,820	2,239.5	3.740	35.076	3.907	
44.00	3.970	2,258.3	3,895	38.971	4.070	
45.00	4.130	2,277.1	4.050	43.021	4.234	
46.00	4,290	2,295.9	4,210	47,230	4.400	
47.00	4.440	2,314.6	4.365	51.595	4.566	
48.00	4.600	2,333.4	4.520	56.115	4.734	

Type III 24-hr 25-Year Rainfall=8.70"

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Pond PC: Retention Pond C



■ Inflow

Part III

APPENDIX 6B.5 HYDROCAD MODEL POST DEVELOPMENT-100 YEAR



Submittal Date: September 2018

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Area Listing (all nodes)

	Area (acres)	CN	Description (subcatchment-numbers)
•	128.657	79	50-75% Grass cover, Fair, HSG C (1C, 2C, 3C, 4C, 5C, 6C, 7C, A1S, A1T, A2S, A2T, A3S, A3T, B1S, B1T, B2S, B2T, C1S, C1SN1, C1SN2, C1SS1, C1SS2, C1T, C2S, C2T)
	19.672	86	<50% Grass cover, Poor, HSG C (C3, C4, C5, C6)
	16.270	98	Water Surface, 0% imp, HSG C (PAR, PBR, PCR)
	164.599	82	TOTAL AREA

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Soil Listing (all nodes)

Area	Soil	Subcatchment
(acres)	Group	Numbers
0.000	HSG A	
0.000	HSG B	
164.599	HSG C	1C, 2C, 3C, 4C, 5C, 6C, 7C, A1S, A1T, A2S, A2T, A3S, A3T, B1S, B1T, B2S, B2T, C1S, C1SN1, C1SN2, C1SS1, C1SS2, C1T, C2S, C2T, C3, C4, C5, C6, PAR, PBR, PCR
0.000	HSG D	
0.000	Other	
164.599		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (acres)	H\$G-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
 0.000	0.000	128.657	0.000	0.000	128.657	50-75% Grass cover, Fair	1C. 2C.
		•				•	3C, 4C,
							5C, 6C,
							7C,
							A1S,
							A1T,
							A2S,
							A2T,
							A3S,
							A3T,
							B1S,
							B1T,
							B2S,
							B2T,
							C1S,
							C1SN1,
							C1SN2,
							C1SS1,
							C1SS2,
							C1T,
							C2S,
							C2T
0.000	0.000	19.672	0.000	0.000	19. 6 72	<50% Grass cover, Poor	C3, C4,
							C5, C6
0.000	0.000	16.270	0.000	0.000	16.270	Water Surface, 0% imp	PAR,
							PBR,
							PCR
0.000	0.000	164.599	0.000	0.000	164.599	TOTAL AREA	

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Pipe Listing (all nodes)

	Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	inside-Fill (inches)
_	1	B1	56,54	53.89	464.0	0.0057	0.013	60.0	48.0	0.0
	2	B2	53.45	49.80	200.0	0.0182	0.013	60.0	48.0	0.0
	3	P1	51.75	51, 1 1	64.0	0.0100	0.011	48.0	0.0	0.0
	4	P2	54.39	53.31	72.0	0.0150	0.011	18.0	0.0	0.0
	5	P3	55.41	54.33	72.0	0.0150	0.011	18.0	0.0	0.0
	6	PB	47.00	46.75	128.0	0.0020	0.013	21.0	0.0	0.0
	7	PB	47.00	46.75	128.0	0.0020	0.013	21.0	0.0	0.0

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points Runoff by SCS TR-20 method, UH=SCS, Weighted-CN Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1C: 1C Drainage Area	Runoff Area=1,000 ac 0.00% Impervious Runoff Depth=8.83" To=10.0 min CN=79 Runoff=8.77 cfs 0.736 af
Subcatchment 2C: 2C Drainage Area	Runoff Area=1.480 ac 0.00% Impervious Runoff Depth=8.83" Tc=10.0 min CN=79 Runoff=12.98 cfs 1.089 af
Subcatchment 3C: 3C Drainage Area	Runoff Area=1.640 ac 0.00% Impervious Runoff Depth=8.83" Tc=10.0 min CN=79 Runoff=14.38 cfs 1.207 af
Subcatchment 4C: 4C Drainage Area	Runoff Area=0.910 ac 0.00% Impervious Runoff Depth=8.83" Tc=10.0 min CN=79 Runoff=7.98 cfs 0.670 af
Subcatchment 5C: A2 Drainage Area	Runoff Area=1.000 ac 0.00% Impervious Runoff Depth=8.83" To=10.0 min CN=79 Runoff=8.77 cfs 0.736 af
Subcatchment 6C: A3 Drainage Area	Runoff Area=1.000 ac 0.00% Impervious Runoff Depth=8.83" Tc=10.0 min CN=79 Runoff=8.77 cfs 0.736 af
Subcatchment 7C: A2 Drainage Area	Runoff Area=1.000 ac 0.00% Impervious Runoff Depth⇒8.83" Tc=10.0 min CN=79 Runoff=8.77 cfs 0.736 af
Subcatchment A1S: A1S Drainage Area	Runoff Area=8.009 ac 0.00% Impervious Runoff Depth=8.83" Tc=10.0 min CN=79 Runoff=70.23 cfs 5.892 af
Subcatchment A1T: A1T Drainage Area	Runoff Area=7.425 ac 0.00% Impervious Runoff Depth=8.83" Tc=10.0 min CN=79 Runoff=65,11 cfs 5.463 af
Subcatchment A2S: A2 Drainage Area	Runoff Area=12.241 ac 0.00% Impervious Runoff Depth=8.83" Tc=10.0 min CN=79 Runoff=107.35 cfs 9.006 af
Subcatchment A2T: A2 Drainage Area	Runoff Area=5.120 ac 0.00% Impervious Runoff Depth=8.83" Tc=10.0 min CN=79 Runoff=44.90 cfs 3.767 af
Subcatchment A3S: A3S Drainage Area	Runoff Area=10.760 ac 0.00% Impervious Runoff Depth=8.83" Tc=10.0 min CN=79 Runoff=94.36 cfs 7.916 af
Subcatchment A3T: A3T Drainage Area Flow	Runoff Area=7.489 ac 0.00% Impervious Runoff Depth=8.83" Length=1,050' Tc=16.7 min CN=79 Runoff=54.75 cfs 5.510 af
Subcatchment B1S: B1S Drainage Area	Runoff Area=14.884 ac 0.00% Impervious Runoff Depth=8.83" Tc=10.0 min CN=79 Runoff=130.52 cfs 10.951 af
Subcatchment B1T: B1T Drainage Area Flow	Runoff Area=7.499 ac 0.00% Impervious Runoff Depth=8.83" w Length=950' Tc=16.0 min CN=79 Runoff=55.80 cfs 5.517 af
Subcatchment B2S: B2S Drainage Area	Runoff Area=8.806 ac 0.00% Impervious Runoff Depth=8.83" Tc=10.0 min CN=79 Runoff=77.22 cfs 6.479 af

Part III, Attachment 6, Appendix 6B.5, p.g.-6

Part III

Subcatchment PAR: PA Rainfall Area

Subcatchment PBR: PB Rainfall Area

Subcatchment PCR: PC Rainfall Area

Post Development 100 Yr Drainag Prepared by Hanson Professional Ser HydroCAD® 10.00-17 s/n 09651 © 2016 H	rvices Inc. Printed 8/20/2018
Subcatchment B2T: B2T Drainage Area	Runoff Area=4.309 ac 0.00% Impervious Runoff Depth=8.83" Flow Length=850' Tc=13.7 min CN=79 Runoff=33.95 cfs 3.170 af
Subcatchment C1S: C1 Drainage Area	Runoff Area=11.506 ac 0.00% Impervious Runoff Depth=8.83" Tc=10.0 min CN=79 Runoff=100.90 cfs 8.465 af
Subcatchment C1SN1: C1SN1 Drainage	Area Runoff Area=0.250 ac 0.00% Impervious Runoff Depth=8.83" Tc=10.0 min CN=79 Runoff=2.19 cfs 0.184 af
Subcatchment C1SN2: C1SN2 Drainage	Area Runoff Area=0.250 ac 0.00% Impervious Runoff Depth=8.83" Tc=10.0 min CN=79 Runoff=2.19 cfs 0.184 af
Subcatchment C1SS1: C1SS1 Drainage	Area Runoff Area=0.250 ac 0.00% Impervious Runoff Depth=8.83" Tc=10.0 min CN=79 Runoff=2.19 cfs 0.184 af
Subcatchment C1SS2: C1SS2 Drainage	Area Runoff Area=0.250 ac 0.00% Impervious Runoff Depth=8.83" Tc=10.0 min CN=79 Runoff=2.19 cfs 0.184 af
Subcatchment C1T: C1 Drainage Area	Runoff Area=6.292 ac 0.00% Impervious Runoff Depth=8.83" Flow Length=800' Tc=12.5 min CN=79 Runoff=51.20 cfs 4.629 af
Subcatchment C2S: C2 Drainage Area	Runoff Area=10.038 ac 0.00% Impervious Runoff Depth=8.83" Tc=10.0 min CN=79 Runoff=88.03 cfs 7.385 af
Subcatchment C2T: C2 Drainage Area	Runoff Area=5.249 ac 0.00% Impervious Runoff Depth=8.83" Flow Length=800' Tc=12.5 min CN=79 Runoff=42.72 cfs 3.862 af
Subcatchment C3: C3 Drainage Area	Runoff Area=3.500 ac 0.00% Impervious Runoff Depth=9.75" Tc=10.0 min CN=86 Runoff=32.84 cfs 2.845 af

Runoff Area=7,440 ac 0.00% Impervious Runoff Depth=11.26"

Runoff Area=4.290 ac 0.00% Impervious Runoff Depth=11.26"

Runoff Area=4,540 ac 0.00% Impervious Runoff Depth=11.26"

Tc=0.0 min CN=98 Runoff=102.59 cfs 6.980 af

Tc=0.0 min CN=98 Runoff=59.15 cfs 4.025 af

Tc=0.0 min CN=98 Runoff=62.60 cfs 4.260 af

Subcatchment C2S: C2 Drainage Area Runoff Area=10 Subcatchment C2T: C2 Drainage Area Runoff Area=5 Flow Length=800' Subcatchment C3: C3 Drainage Area Runoff Area≖3 Runoff Area=9.500 ac 0.00% Impervious Runoff Depth=9.75" Subcatchment C4: C4 Drainage Area Tc=10.0 min CN=86 Runoff=89.15 cfs 7.722 af Runoff Area=2.690 ac 0.00% Impervious Runoff Depth=9.75" Subcatchment C5: C5 Drainage Area Tc=10.0 min CN=86 Runoff=25.24 cfs 2.186 af Runoff Area=3.982 ac 0.00% Impervious Runoff Depth=9.75" Subcatchment C6: C6 Drainage Area Tc=10.0 min CN=86 Runoff=37.37 cfs 3.237 af

Reach 1CC: 1CC Collector Channel Avg. Flow Depth=5.24' Max Vel=4.25 fps Inflow=301.75 cfs 27.992 af n=0.030 L=222.0' S=0.0020'/ Capacity=2,157.50 cfs Outflow=300.25 cfs 27.992 af

> Hanson Professional Services Inc. Submittal Date: September 2018

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Type III 24-hr 100-Year Rainfall=11.50"

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- Reach 2CC: 2CC Collector Channel Avg. Flow Depth=1.46' Max Vel=1.74 fps inflow=12.98 cfs 1.089 af n=0.030 L=650.0' S=0.0020'' Capacity=46.53 cfs Outflow=11.11 cfs 1.089 af
- Reach 5CC: A2 Collector Channel Avg. Flow Depth=1.15′ Max Vel=1.50 fps Inflow=8.77 cfs 0.736 af n=0.030 L=595.0′ S=0.0015 '/′ Capacity=68.72 cfs Outflow=7.45 cfs 0.736 af
- Reach 6CC: A3 Collector Channel Avg. Flow Depth=0.92' Max Vel=2.17 fps Inflow=8.77 cfs 0.736 af n=0,030 L=740.0' S=0.0040 '/' Capacity=50.02 cfs Outflow=7.67 cfs 0.736 af
- Reach A2-1: A2-1 Channel Avg. Flow Depth=1.48' Max Vel=1.73 fps Inflow=12.75 cfs 1.471 af n=0.030 L=250.5' S=0.0015 '/' Capacity=83.47 cfs Outflow=12.71 cfs 1.471 af
- Reach A2-2: A2-2 Channel Avg. Flow Depth=3.02' Max Vel=4.09 fps Inflow=162.11 cfs 14.244 af n=0.025 L=257.0' S=0.0020 7' Capacity=338.68 cfs Outflow=160.83 cfs 14.244 af
- Reach A2-3: A2-3 Channel Avg. Flow Depth=3.09' Max Vel=3.52 fps Inflow=160.83 cfs 14.244 af n=0.030 L=582.0' S=0.0020 '/' Capacity=532.10 cfs Outflow=154.07 cfs 14.244 af
- Reach A2-4; Chute-Concrete Block Avg. Flow Depth=0.91' Max Vel=12.45 fps Inflow=154.07 cfs 14.244 af n=0.025 L=250.0' S=0.0697 '/' Capacity=692.98 cfs Outflow=153.86 cfs 14.244 af
- Reach A2-5: Cocrete Block-Channel Avg. Flow Depth=0.37' Max Vel=12.58 fps Inflow=12.71 cfs 1.471 af n=0.025 L=5.6' S=0.2482 // Capacity=903.50 cfs Outflow=12.71 cfs 1.471 af
- Reach B1: 5' x 4' Box Culvert Avg. Flow Depth=2.81' Max Vel=10.42 fps Inflow=146.99 cfs 14.162 af 60.0" x 48.0" Box Pipe n=0.013 L=464.0' S=0.0057 '/' Capacity=185.34 cfs Outflow=146.52 cfs 14.162 af
- Reach B2: 5' x 4' Box Culvert Avg. Flow Depth=3.12' Max Vel=19.22 fps Inflow=300.25 cfs 27.992 af 60.0" x 48.0" Box Pipe n=0.013 L=200.0' S=0.0182 '/ Capacity=331.32 cfs Outflow=300.01 cfs 27.992 af
- Reach C1-4: Chute-Concrete Block Avg. Flow Depth=1.21' Max Vel=25.32 fps inflow=300.01 cfs 27.992 af n=0.025 L=76.0' S=0.2474 '/' Capacity=872.67 cfs Outflow=299.94 cfs 27.992 af
- Reach C1SCCN1: C1SCCN1 Collector Avg. Flow Depth=0.40' Max Vel=1.34 fps Inflow=2.19 cfs 0.184 af n=0.030 L=285.0' S=0.0033 '/' Capacity=24.47 cfs Outflow=2.06 cfs 0.184 af
- Reach C1SCCN2: C1SCCN2 Collector Avg. Flow Depth=0.40' Max Vel=1.33 fps Inflow=2.19 cfs 0.184 af n=0.030 L=287.5' S=0.0033 '/' Capacity=24.36 cfs Outflow=2.06 cfs 0.184 af
- Reach C1SCCS1: C1SCCS1 Collector Avg. Flow Depth=0.41' Max Vel=1.33 fps Inflow=2.19 cfs 0.184 af n=0.030 L=280.0' S=0.0033 'f' Capacity=24.30 cfs Outflow=2.06 cfs 0.184 af
- Reach C1SCCS2: C1SCCS2 Collector Avg. Ftow Depth=0.41¹ Max Vel=1.33 fps Inflow=2.19 cfs 0.184 af n=0,030 L=280.0¹ S=0.0033 ¹/ Capacity=24.30 cfs Outflow=2.06 cfs 0.184 af
- Reach C2-3: C2-3 Channel Avg. Flow Depth=3.32' Max Vel=3.35 fps Inflow=129.45 cfs 11.247 af n=0.030 L=882.0' S=0.0020 '/' Capacity=178.76 cfs Outflow=118.51 cfs 11.247 af
- Reach C2-4: Chute-Concrete Block Avg. Flow Depth=0.70' Max Vel=21.63 fps Inflow=118.38 cfs 11.247 af n=0.025 L=52.0' S=0.3269 '/' Capacity=1,003.23 cfs Outflow=118.36 cfs 11.247 af

Type III 24-hr 100-Year Rainfall=11.50"

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- Avg. Flow Depth=1.29' Max Vel=9.05 fps Inflow=118.48 cfs 11.247 af Reach C2-5: C2-5 Channel n=0.025 L=106,0' S=0.0293'7' Capacity=492.25 cfs Outflow=118.38 cfs 11.247 af
- Avg. Flow Depth=0.26' Max Vel=6.99 fps Inflow=11.11 cfs 1.089 af Reach CC: Chute-Concrete Block n=0.025 L=160.0' S=0.1028'/ Capacity=562.60 cfs Outflow=11.10 cfs 1.089 af
- Avg. Flow Depth=0.85' Max Vel=21.08 fps Inflow=150.87 cfs 13.094 af Reach E: Chute-Concrete Block n=0.025 L=462.0' S=0.2511 '/' Capacity=879.20 cfs Outflow=150.58 cfs 13.094 af
- Reach NE: Chute-Concrete Block Avg. Flow Depth=0.79' Max Vel=20.16 fps Inflow=129.70 cfs 11.247 af n=0.025 L=464.0' S=0.2500 // Capacity=877.30 cfs Outflow=129.45 cfs 11.247 af
- Avg. Flow Depth=0.72' Max Vel=19.21 fps inflow=109.40 cfs 9.649 af Reach NW: Chute-Concrete Block n=0.025 L=464.0' S=0.2500 '/ Capacity=877.30 cfs Outflow=109.21 cfs 9.649 af
- Reach OC: Existing Offsite Channel Avg. Flow Depth=2.04' Max Vel=1.83 fps Inflow=42.26 cfs 31.217 af n=0.030 L=2,800.0' S=0.0010 '/' Capacity=44.23 cfs Outflow=41.59 cfs 31.108 af
- Reach P1: Culvert Avg. Flow Depth=2.46' Max Vel=14.61 fps Inflow=118.51 cfs 11.247 af 48.0" Round Pipe n=0.011 L=64.0' S=0.0100 '/ Capacity=169.76 cfs Outflow=118.48 cfs 11.247 af
- Reach P2: Culvert Avg. Flow Depth=0.53' Max Vel=7.31 fps Inflow=4.12 cfs 0.368 af 18.0" Round Pipe n=0.011 L=72.0' S=0.0150 "/ Capacity=15.20 cfs Outflow=4.11 cfs 0.368 af
- Avg. Flow Depth=0.17' Max Vel=9.69 fps Inflow=4.11 cfs 0.368 af Reach P2-1: Chute-Concrete Block n=0.025 L=60.0' S=0.3718 // Capacity=316.81 cfs Outflow=4.11 cfs 0.368 af
- Avg. Flow Depth=0.53' Max Vel=7.31 fps Inflow=4.12 cfs 0.368 af Reach P3: Culvert 18.0" Round Pipe n=0.011 L=72.0' S=0.0150 " Capacity=15.20 cfs Outflow=4.12 cfs 0.368 af
- Avg. Flow Depth=0.17' Max Vel=9.89 fps Inflow=4.12 cfs 0.368 af Reach P3-1: Chute-Concrete Block n=0.025 L=60.0' S=0.3942'/ Capacity=326.18 cfs Outflow=4.12 cfs 0.368 af
- Reach S: Chute-Concrete Block Avg. Flow Depth=0.86' Max Vel=21.09 fps Inflow=152.24 cfs 12.773 af n=0.025 L=459.0' S=0.2500'/' Capacity=877.30 cfs Outflow=151.93 cfs 12.773 af
- Reach SE: Chute-Concrete Block Avg. Flow Depth=0.831 Max Vel=20.70 fps Inflow=142.28 cfs 13.426 af n=0.025 L=450.0' S=0.2499 '/' Capacity=877.14 cfs Outflow=142.07 cfs 13.426 af
- Reach SE1: Chute-Concrete Block Avg. Flow Depth=1.101 Max Vel=13.74 fps Inflow=142.07 cfs 13.426 af n=0.025 L=62.0' S=0.0806'/ Capacity=498.27 cfs Outflow=142.01 cfs 13.426 af
- Reach SW: Chute-Concrete Block Avg. Flow Depth=0.81' Max Vel=20.41 fps Inflow=135.35 cfs 11.355 af n=0.025 L=404.0' S=0.2500 '/' Capacity=877.30 efs Outflow=135.10 efs 11.355 af
- Reach SW-1: Chute-Concrete Block Avg. Flow Depth=0.96' Max Vel=15.98 fps Inflow=135.10 cfs 11.355 af n=0.025 L=266.0' S=0.1269'/' Capacity=624.99 cfs Outflow=134.87 cfs 11.355 af
- Avg. Flow Depth=0.93' Max Vel=22.10 fps Inflow=179.96 cfs 16.468 af Reach W: Chute-Concrete Block n=0.025 L=464.0' S=0.2500 '/' Capacity=877.30 cfs Outflow=179.70 cfs 16.468 af

Type III 24-hr 100-Year Rainfall≔11.50"

Post Development 100 Yr Drainage Prepared by Hanson Professional Services Inc.

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Pond PA: Retention Pond A Peak Elev=49.73' Storage=36.905 af Inflow=324.39 cfs 36.905 af

Outflow=0.00 cfs 0.000 af

Pond PB: Detention Pond B Peak Elev=52.22 Storage=16.607 af Inflow=331.73 cfs 32.018 af

Outflow=42.26 cfs 31.217 af

Pond PC: Retention Pond C Peak Elev=45.81' Storage=46.421 af Inflow=446.58 cfs 46.421 af

Outflow=0.00 cfs 0.000 at

Total Runoff Area = 164.599 ac Runoff Volume = 125.910 af Average Runoff Depth = 9.18" 100.00% Pervious = 164.599 ac 0.00% Impervious = 0.000 ac

Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment 1C: 1C Drainage Area

Use Conservative Value of Tc=10 min

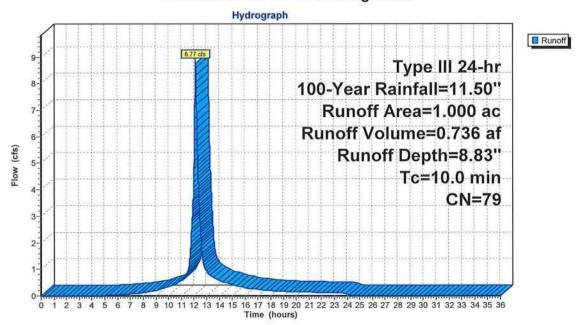
Runoff = 8.77 cfs @ 12.14 hrs, Volume=

0.736 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac)	CN	Desc	cription			
1.	.000	0 79 50-75% Grass cover, Fair, HSG C					
1.	.000		100.	00% Pervi	ous Area		
Tc (min)	Lengt (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
10.0						Direct Entry, Drainage Area at Bottom of Slope	

Subcatchment 1C: 1C Drainage Area



Post Development 100 Yr Drainage

Type III 24-hr 100-Year Rainfall=11.50"

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12.98 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment 2C: 2C Drainage Area

Use Conservative Value of Tc=10 min

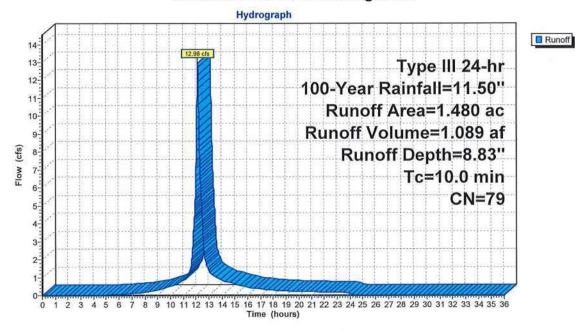
A5

1.089 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac)	CN	Desc	cription		
1.480 79 50-75% Grass cover, Fair, HSG C						HSG C
1.	480		100.	00% Pervi	ous Area	
Tc (min)	Leng		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0						Direct Entry, Drainage Area at Bottom of Slope

Subcatchment 2C: 2C Drainage Area



Post Development 100 Yr Drainage

Type III 24-hr 100-Year Rainfall=11.50"

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14.38 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment 3C: 3C Drainage Area

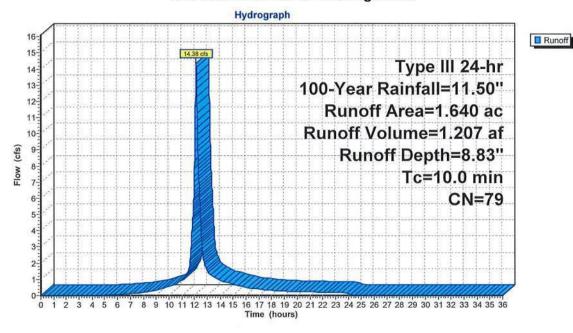
Use Conservative Value of Tc=10 min

1.207 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac)	CN	Desc	cription		
1.	640	79	50-7	5% Grass	cover, Fair	, HSG C
1.	640		100.	00% Pervi	ous Area	
Tc (min)	Length (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0						Direct Entry, Surface Drainage to Pond B

Subcatchment 3C: 3C Drainage Area



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment 4C: 4C Drainage Area

Use Conservative Value of Tc=10 min

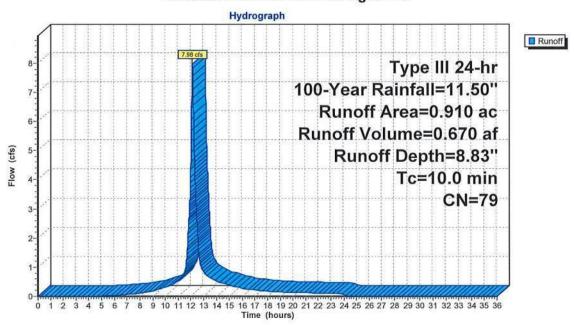
Runoff = 7.98 cfs @ 12.14 hrs, Volume=

0.670 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac)	CN	Desc	cription			
0.	.910	79 50-75% Grass cover, Fair, HSG C					
0.	910		100.	00% Pervi	ous Area		
Tc (min)	Lengti (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
10.0						Direct Entry, Surface Drainage to Pond B	

Subcatchment 4C: 4C Drainage Area



Post Development 100 Yr Drainage

Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment 5C: A2 Drainage Area

Use Conservative Value of Tc=10 min

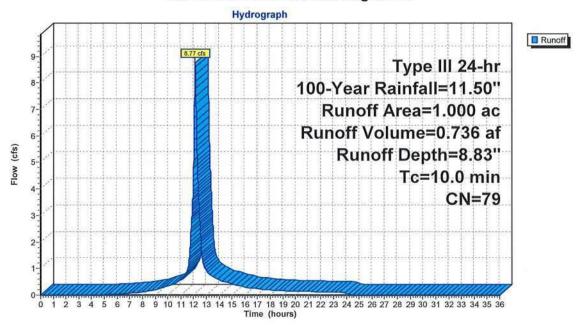
0.736 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

8.77 cfs @ 12.14 hrs, Volume=

Area	(ac)	CN	Desc	cription		4		
1	.000	79	50-75% Grass cover, Fair, HSG C					
1	1.000		100.	00% Pervi	ous Area			
Tc (min)	Lengt (feet		lope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description		
10.0						Direct Entry, Drainage Area at Bottom of Slope		

Subcatchment 5C: A2 Drainage Area



Post Development 100 Yr Drainage

Type III 24-hr 100-Year Rainfall=11.50"

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8.77 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment 6C: A3 Drainage Area

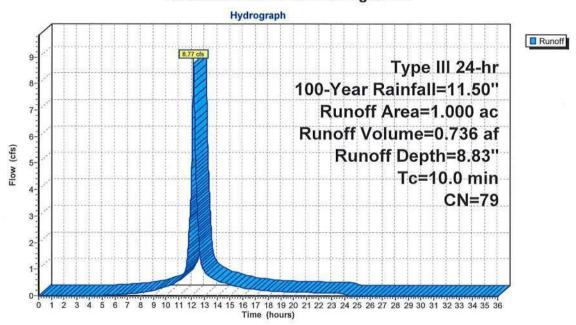
Use Conservative Value of Tc=10 min

0.736 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac)	CN	Des	cription		
1	.000	79	50-7	5% Grass	cover, Fair	, HSG C
1	.000		100.	00% Pervi	ous Area	
Tc (min)	Lengt (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0						Direct Entry, Drainage Area at Bottom of Slope

Subcatchment 6C: A3 Drainage Area



Post Development 100 Yr Drainage

Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment 7C: A2 Drainage Area

Use Conservative Value of Tc=10 min

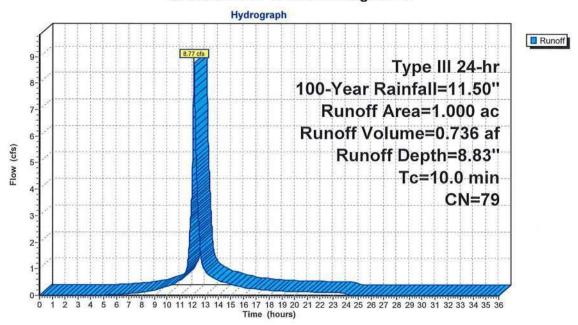
0.736 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

8.77 cfs @ 12.14 hrs, Volume=

Area (ac) CN Description						
1.000 79 50-75% Grass cover, Fa				5% Grass	cover, Fair	, HSG C
1.	000		100.	00% Pervi	ous Area	
Tc (min)	Lengt		lope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					, , , , , , , , , , , , , , , , , , , ,	Direct Entry Drainage Area at Bottom of Slone

Subcatchment 7C: A2 Drainage Area



Post Development 100 Yr Drainage

Type III 24-hr 100-Year Rainfall=11.50"

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70.23 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment A1S: A1S Drainage Area

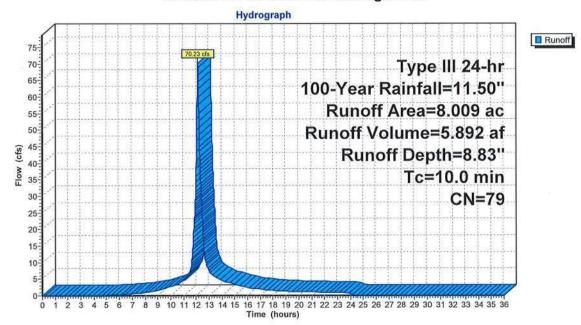
Use Conservative Value of Tc=10 min.

5.892 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area (ac) CN Description						
8.009 79 50-75% Grass cover, Fair, HSG (cover, Fair	, HSG C
8.	009		100.	00% Pervi	ous Area	***
Tc (min)	Lengt (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0						Direct Entry A1S-Chute Flow Evaluation

Subcatchment A1S: A1S Drainage Area



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment A1T: A1T Drainage Area

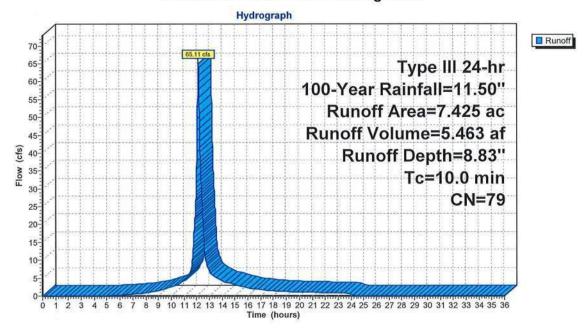
Runoff = 65.11 cfs @ 12.14 hrs, Volume=

5.463 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area (ac) CN Description										
7.425		79	79 50-75% Grass cover, Fair, HSG C							
7.	425		100.	00% Pervi	ous Area					
Tc (min)	Lengt (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description				
10.0	<u> </u>					Direct Entry, A1T-Chute Flow Evaluation				

Subcatchment A1T: A1T Drainage Area



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment A2S: A2 Drainage Area

Use Conservative Value of Tc=10 min.

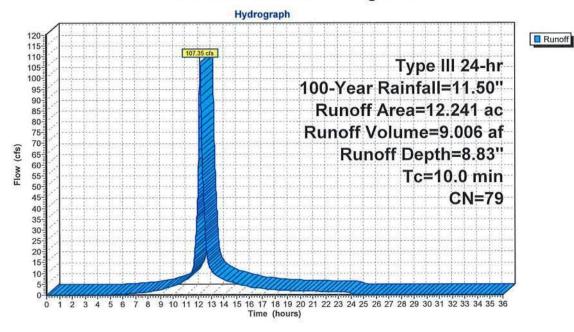
Runoff = 107.35 cfs @ 12.14 hrs, Volume=

9.006 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Are	ea (ac)	CN	Des	Description						
122	12.241	79	50-7	5% Grass	*					
	12.241		100.	00% Pervi	ious Area					
T (mir	c Leng		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description				
10	0					Direct Entry A2 Drainage Area				

Subcatchment A2S: A2 Drainage Area



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment A2T: A2 Drainage Area

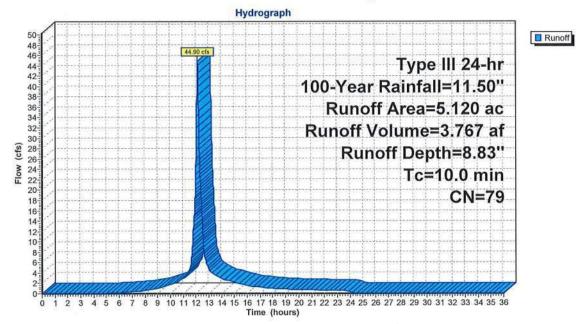
Runoff = 44.90 cfs @ 12.14 hrs, Volume=

3.767 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	Area (ac) CN Description									
5.120 7		79 50-7	50-75% Grass cover, Fair, HSG C							
5.	.120	100.00% Pervious Area								
Tc (min)	Length (feet)		Velocity (ft/sec)	Capacity (cfs)	Description					
10.0										

Subcatchment A2T: A2 Drainage Area



Post Development 100 Yr Drainage

Type III 24-hr 100-Year Rainfall=11.50"

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94.36 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment A3S: A3S Drainage Area

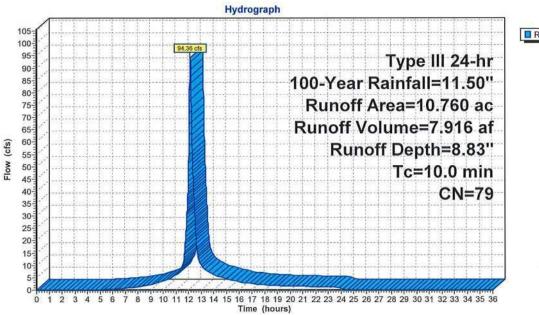
Use Conservative Value of Tc=10 min.

7.916 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area (ac) CN Description				ription		
10.760		79	50-7	5% Grass	cover, Fair	, HSG C
10.	760	85	100.	00% Pervi	ous Area	
Tc (min)	Length (feet)		ope ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0						Direct Entry, A3S-Chute Flow Evaluation

Subcatchment A3S: A3S Drainage Area



Runoff

Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment A3T: A3T Drainage Area

Runoff

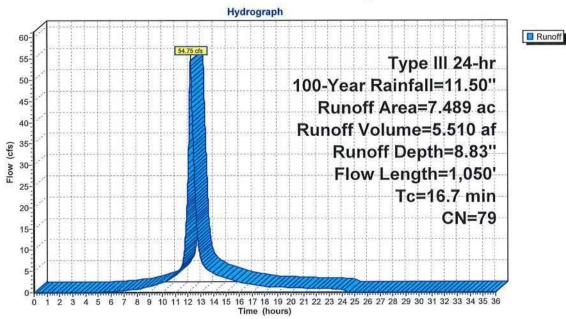
54.75 cfs @ 12.22 hrs, Volume=

5.510 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac) C	N Des	cription		
7.	489	79 50-7	5% Grass	cover, Fair	HSG C
7.489		100.	00% Pervi	ous Area	
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	750		1.30		Direct Entry, A3T-Chute Flow Evaluation
7.1	300		0.70		Direct Entry,
16.7	1.050	Total			

Subcatchment A3T: A3T Drainage Area



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment B1S: B1S Drainage Area

Use Conservative Value of Tc= 10 min.

Runoff =

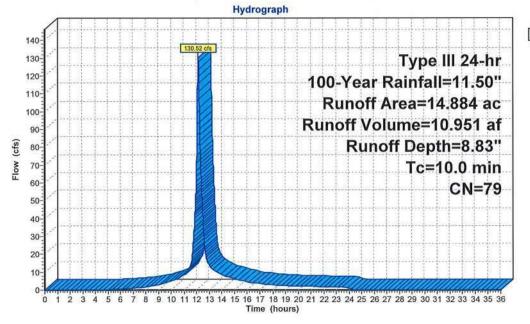
130.52 cfs @ 12.14 hrs, Volume=

10.951 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area (ac) CN Description				cription		*
14.884		79	50-7	5% Grass	cover, Fair	, HSG C
14.	884		100.00% Pervious Area			
Tc (min)	Length (feet		lope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0						Direct Entry, B1S-Chute Flow Evaluation

Subcatchment B1S: B1S Drainage Area



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment B1T: B1T Drainage Area

Runoff

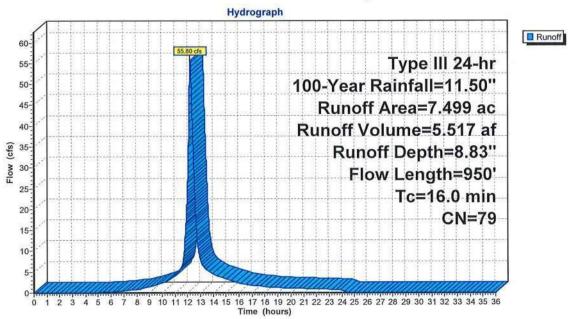
55.80 cfs @ 12.21 hrs, Volume=

5.517 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac) (CN Des	cription		
7.	499	79 50-	75% Grass	cover, Fair	, HSG C
7.	499	100	.00% Pervi	ous Area	
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	600		1.30		Direct Entry, B1T-Chute Flow Evaluation
8.3	350		0.70		Direct Entry,
16.0	950	Total			

Subcatchment B1T: B1T Drainage Area



Post Development 100 Yr Drainage

Type III 24-hr 100-Year Rainfall=11.50"

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77.22 cfs @ 12.14 hrs, Volume=

Summary for Subcatchment B2S: B2S Drainage Area

Use Conservative Value of Tc=10 min.

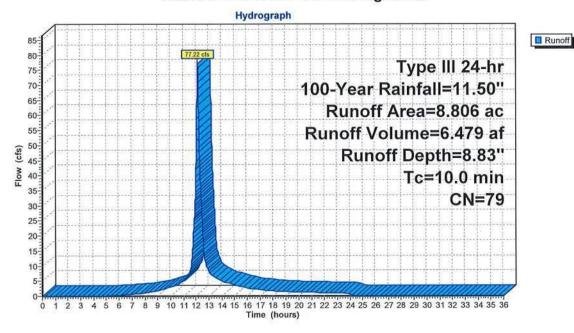
.

6.479 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

	Area	(ac)	CN	Desc	cription		
	8.	806	79	50-7	5% Grass	cover, Fair	, HSG C
	8.	806		100.	00% Pervi	ous Area	
	Tc (min)	Lengt (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3	10.0						Direct Entry, B2S-Chute Flow Evaluation

Subcatchment B2S: B2S Drainage Area



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment B2T: B2T Drainage Area

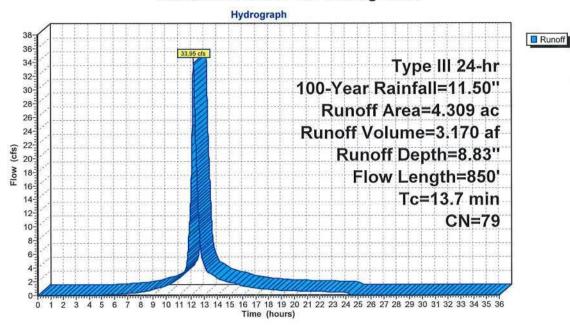
Runoff = 33.95 cfs @ 12.18 hrs, Volume=

3.170 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

	Area	(ac) C	N Des	cription		
990	4.	.309	79 50-7	5% Grass	cover, Fair	HSG C
	4.309		100.	00% Pervi	ious Area	
	Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
	7.7	600		1.30		Direct Entry, B2T-Chute Flow Evaluation
2	6.0	250		0.70		Direct Entry,
10.	13.7	850	Total			

Subcatchment B2T: B2T Drainage Area



Part III, Attachment 6, Appendix 6B.5, p.g.-27

Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment C1S: C1 Drainage Area

Use Conservative Value of Tc=10 min.

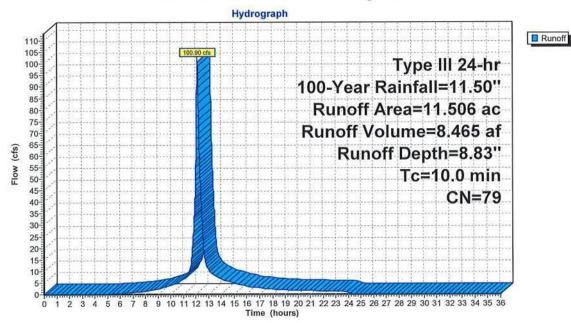
Runoff = 100.90 cfs @ 12.14 hrs, Volume=

8.465 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac) (CN Des	Description						
11.	.506	79 50-7	75% Grass	cover, Fair	HSG C				
11.	.506	100	.00% Perv	ious Area					
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description				
10.0					Direct Entry, C1 Drainage Area				

Subcatchment C1S: C1 Drainage Area



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment C1SN1: C1SN1 Drainage Area

Use Conservative Value of Tc=10 min

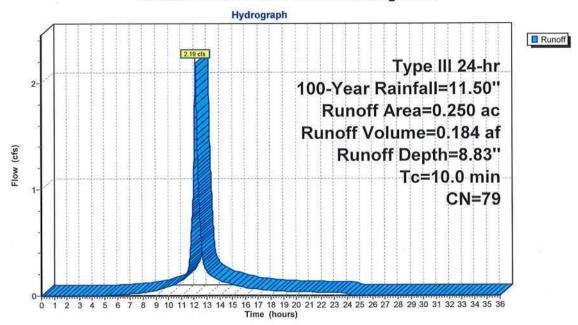
Runoff = 2.19 cfs @ 12.14 hrs, Volume=

0.184 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac)	CN	Desc	cription		
0.	0.250 79		50-7	5% Grass	cover, Fair	HSG C
0.	.250		100.	00% Pervi	ous Area	
Tc (min)	Length (feet	19.0	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	-					Direct Entry, Drainage Area at Bottom of Slope

Subcatchment C1SN1: C1SN1 Drainage Area



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment C1SN2: C1SN2 Drainage Area

Use Conservative Value of Tc=10 min

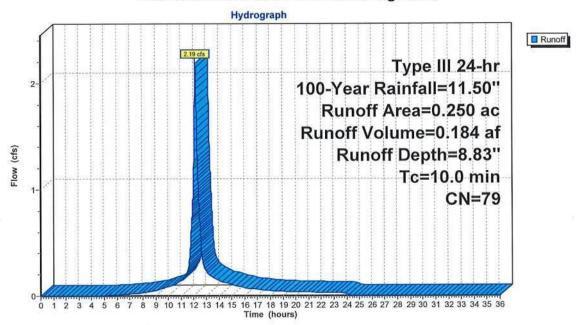
Runoff 2.19 cfs @ 12.14 hrs, Volume=

0.184 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac)	CN	Desc	cription				
0.	0.250 79		50-7	5% Grass	cover, Fair	r, HSG C		
0.	250		100.	00% Pervi	ous Area			
Tc (min)	Length (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description		
10.0						Direct Entry, Drainage Area at Bottom of Slope		

Subcatchment C1SN2: C1SN2 Drainage Area



Post Development 100 Yr Drainage

Type III 24-hr 100-Year Rainfall=11.50"

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2.19 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment C1SS1: C1SS1 Drainage Area

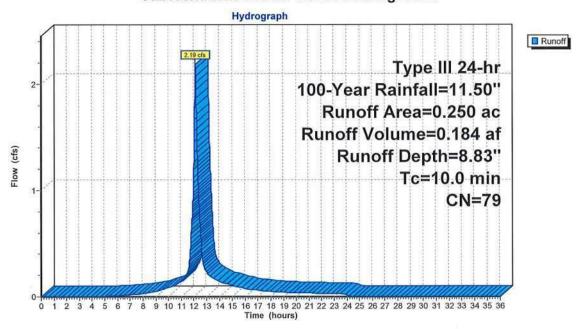
Use Conservative Value of Tc=10 min

0.184 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

	Area	(ac)	CN	Desc	cription		
915	0.250 79 0.250		50-7	5% Grass	cover, Fair	, HSG C	
				100.00% Pervious Ar		ous Area	
702	Tc (min)	Lengt (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
	10.0						Direct Entry, Drainage Area at Bottom of Slope

Subcatchment C1SS1: C1SS1 Drainage Area



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment C1SS2: C1SS2 Drainage Area

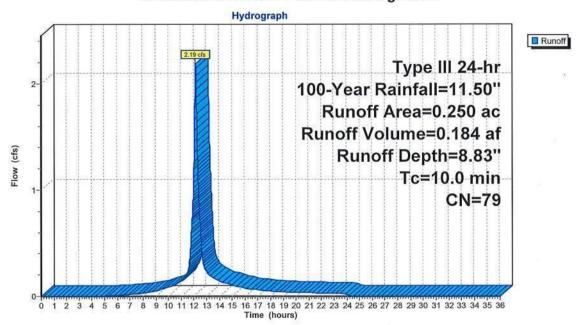
Use Conservative Value of Tc=10 min

Runoff = 2.19 cfs @ 12.14 hrs, Volume= 0.184 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac)	CN	Desc	cription		
0.	250	79	50-7	5% Grass	cover, Fair,	, HSG C
0.	250		100.	00% Pervi	ous Area	
Tc (min)	Length (feet		lope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0						Direct Entry, Drainage Area at Bottom of Slope

Subcatchment C1SS2: C1SS2 Drainage Area



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment C1T: C1 Drainage Area

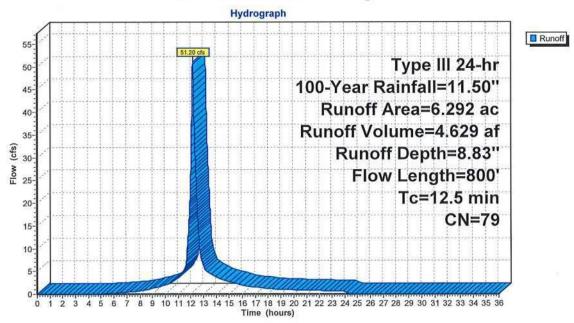
Runoff = 51.20 cfs @ 12.17 hrs, Volume=

4.629 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac) C	N Des	cription			
6.292 79		79 50-7	5% Grass	cover, Fair	; HSG C	
6.	292	100.	00% Pervi	ious Area		
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
7.7	600		1.30		Direct Entry, C1 Drainage Area	
4.8	200		0.70		Direct Entry,	
12.5	800	Total				

Subcatchment C1T: C1 Drainage Area



Post Development 100 Yr Drainage

Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment C2S: C2 Drainage Area

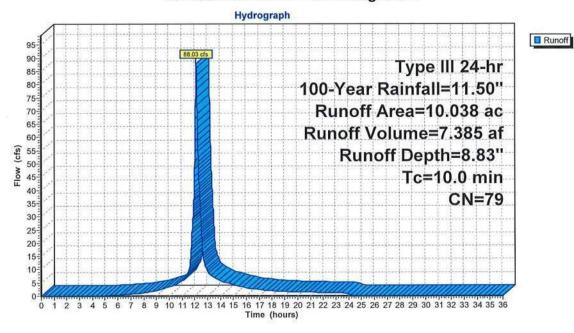
Use Conservative Value of Tc=10 min.

88.03 cfs @ 12.14 hrs, Volume= 7.385 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac)	CN	Desc	cription				
10	10.038 7		50-7	5% Grass	cover, Fair,	r, HSG C		
10	.038		100.	00% Pervi	ous Area			
Tc (min)	Lengt (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description		
10.0						Direct Entry, C2 Drainage Area		

Subcatchment C2S: C2 Drainage Area



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment C2T: C2 Drainage Area

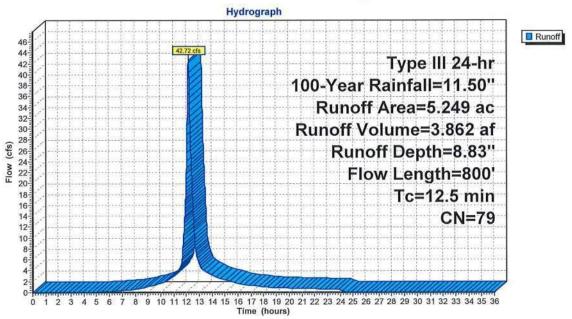
Runoff = 42.72 cfs @ 12.17 hrs, Volume=

3.862 af, Depth= 8.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac) C	N Des	cription			
5.	249	79 50-7	5% Grass	cover, Fair	, HSG C	
5.	249	100.	00% Pervi	ous Area		
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
7.7	600		1.30		Direct Entry, C2 Drainage Area	
4.8	200		0.70		Direct Entry,	
12.5	800	Total				

Subcatchment C2T: C2 Drainage Area



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment C3: C3 Drainage Area

Existing Drainage Area Surface Drains to the North, Into Existing Low-Lying Excavated Pit C4 Drainage Area.

Runoff

3

32.84 cfs @ 12.13 hrs, Volume=

2.845 af, Depth= 9.75"

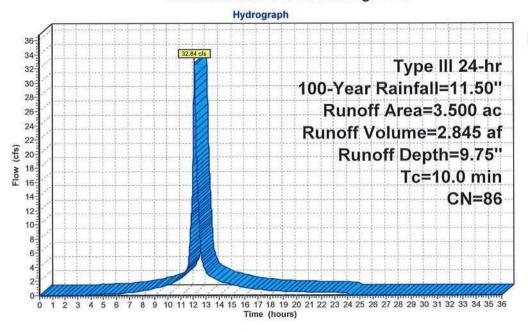
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac)	CN	Des	cription					
3.	500	86	<509	% Grass co	over, Poor,	HSG C			
3.500			100.	00% Pervi	ous Area				
Tc	Lengt	h S	Slope	Velocity	Capacity	Description			

(min) (feet) (ft/ft) (ft/sec) (cfs)

10.0 Direct Entry, C3 Drainage Area

Subcatchment C3: C3 Drainage Area



Runoff

Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment C4: C4 Drainage Area

Existing Low-Lying Excavated Pit Area. Infiltration and Evaporation Occur Here.

Runoff =

89.15 cfs @ 12.13 hrs, Volume=

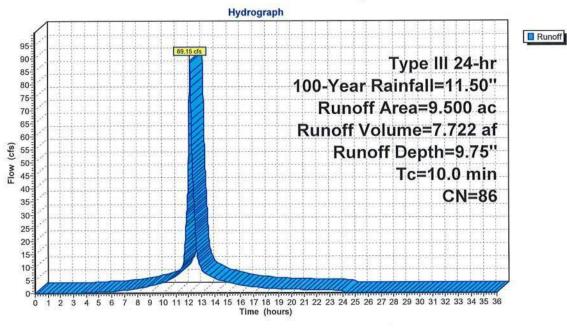
7.722 af, Depth= 9.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

 Area (ac)	CN	Description
9.500	86	<50% Grass cover, Poor, HSG C
9.500		100.00% Pervious Area

Tc (min)	Length (feet)	Velocity (ft/sec)	All Control of the Co	Description
10.0				Direct Entry, C4 Drainage Area

Subcatchment C4: C4 Drainage Area



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment C5: C5 Drainage Area

Side Slope Drainage Area that Flows Into Pond C.

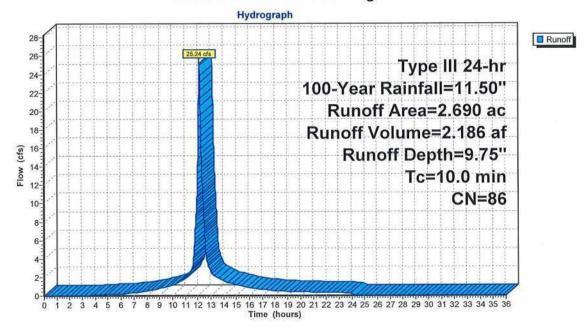
Runoff = 25.24 cfs @ 12.13 hrs, Volume=

2.186 af, Depth= 9.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac)	CN	Desc	cription		
2.	690	86	<50%	6 Grass co	over, Poor,	HSG C
2.	690		100.	00% Pervi	ous Area	
Tc (min)	Length (feet)		lope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	- 60	7	1	- 0		Direct Entry, C5 Drainage Area

Subcatchment C5: C5 Drainage Area



10.0

Post Development 100 Yr Drainage

Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Subcatchment C6: C6 Drainage Area

Surrounding Drainage Area that Flows Into Pond A.

Runoff = 37.37 cfs @ 12.13 hrs, Volume=

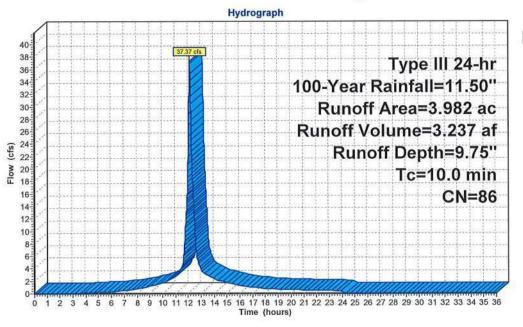
3.237 af, Depth= 9.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac)	CN	Desc	cription			
3.	982	86	<50%	6 Grass co	over, Poor,	HSG C	
3.	982		100.	00% Pervi	ous Area		
Tc (min)	Length (feet		lope ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	

Direct Entry, C6 Drainage Area

Subcatchment C6: C6 Drainage Area



Runoff

Post Development 100 Yr Drainage

Type III 24-hr 100-Year Rainfall=11.50"

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102.59 cfs @ 12.00 hrs, Volume=

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Summary for Subcatchment PAR: PA Rainfall Area

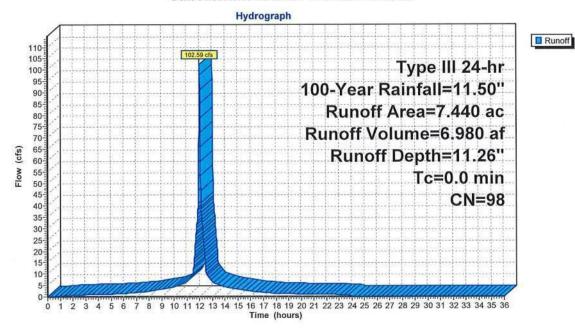
Use Conservative Value of Tc=10 min

6.980 af, Depth=11.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac)	CN	Desc	cription			
7	440	HSG C					
7	440		100.	00% Pervi	ous Area		
Tc (min)	Length (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
0.0						Direct Entry, Rainfall at Pond A	

Subcatchment PAR: PA Rainfall Area



Runoff

Post Development 100 Yr Drainage

Type III 24-hr 100-Year Rainfall=11.50"

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59.15 cfs @ 12.00 hrs, Volume=

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Summary for Subcatchment PBR: PB Rainfall Area

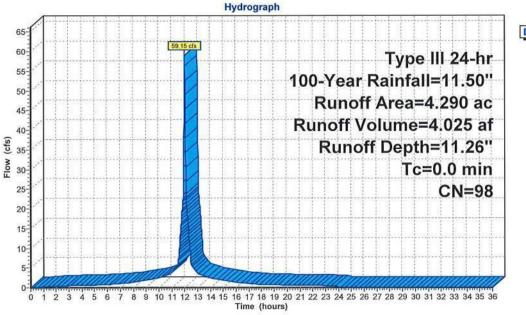
Use Conservative Value of Tc=10 min

4.025 af, Depth=11.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac)	CN	Desc	cription				
4.	290	98	98 Water Surface, 0% imp, HSG C					
4.	.290		100.	00% Pervi	ous Area			
Tc (min)	Lengt (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)			
0.0		-				Direct Entry, Rainfall at Pond B		

Subcatchment PBR: PB Rainfall Area



Runoff

Post Development 100 Yr Drainage

Type III 24-hr 100-Year Rainfall=11.50"

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62.60 cfs @ 12.00 hrs, Volume=

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Summary for Subcatchment PCR: PC Rainfall Area

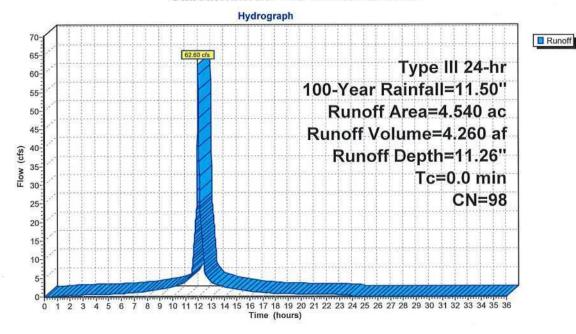
Use Conservative Value of Tc=10 min

4.260 af, Depth=11.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=11.50"

Area	(ac)	CN	Desc	cription			
4.	540	98 Water Surface, 0% imp, HSG C					
4.	540		100.	00% Pervi	ous Area		
Tc (min)	Lengti (feet		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)		
0.0	(1001	/	(ivit)	(10300)	(013)	Direct Entry, Rainfall at Pond C	

Subcatchment PCR: PC Rainfall Area



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Reach 1CC: 1CC Collector Channel

Inflow Area = 38.047 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 301.75 cfs @ 12.17 hrs, Volume= 27.992 af

Outflow = 300.25 cfs @ 12.20 hrs, Volume= 27.992 af, Atten= 0%, Lag= 1.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 4.25 fps, Min. Travel Time= 0.9 min Avg. Velocity = 1.43 fps, Avg. Travel Time= 2.6 min

Peak Storage= 15,702 cf @ 12.18 hrs Average Depth at Peak Storage= 5.24'

Bank-Full Depth= 11.73' Flow Area= 310.4 sf, Capacity= 2,157.50 cfs

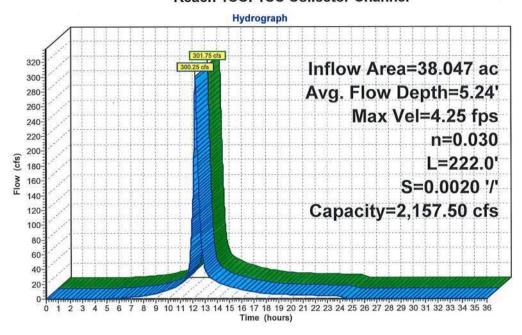
3.00' x 11.73' deep channel, n= 0.030 Earth, grassed & winding

Side Slope Z-value= 2.0 '/' Top Width= 49.92'

Length= 222.0' Slope= 0.0020 '/' Inlet Invert= 53.89', Outlet Invert= 53.45'



Reach 1CC: 1CC Collector Channel





Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Reach 2CC: 2CC Collector Channel

Inflow Area = 1.480 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 12.98 cfs @ 12.14 hrs, Volume= 1.089 af

Outflow = 11.11 cfs @ 12.30 hrs, Volume= 1.089 af, Atten= 14%, Lag= 10.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.74 fps, Min. Travel Time= 6.2 min Avg. Velocity = 0.56 fps, Avg. Travel Time= 19.4 min

Peak Storage= 4,166 cf @ 12.20 hrs Average Depth at Peak Storage= 1.46'

Bank-Full Depth= 2.50' Flow Area= 18.8 sf, Capacity= 46.53 cfs

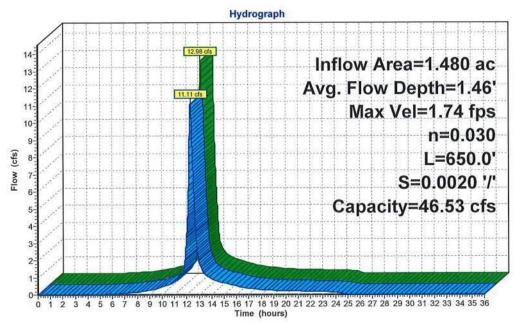
0.00' x 2.50' deep channel, n= 0.030 Earth, grassed & winding

Side Slope Z-value= 3.0 '/' Top Width= 15.00'

Length= 650.0' Slope= 0.0020 '/' Inlet Invert= 54.50', Outlet Invert= 53.20'



Reach 2CC: 2CC Collector Channel



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Reach 5CC: A2 Collector Channel

1.000 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event Inflow Area =

8.77 cfs @ 12.14 hrs, Volume= 0.736 af Inflow

7.45 cfs @ 12.31 hrs, Volume= 0.736 af, Atten= 15%, Lag= 10.5 min Outflow

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.50 fps, Min. Travel Time= 6.6 min Avg. Velocity = 0.46 fps, Avg. Travel Time= 21.6 min

Peak Storage= 2,954 cf @ 12.20 hrs Average Depth at Peak Storage= 1.15'

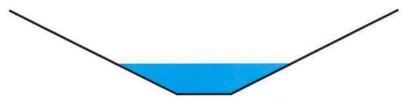
Bank-Full Depth= 3.14' Flow Area= 26.0 sf, Capacity= 68.72 cfs

2.00' x 3.14' deep channel, n= 0.030 Earth, grassed & winding

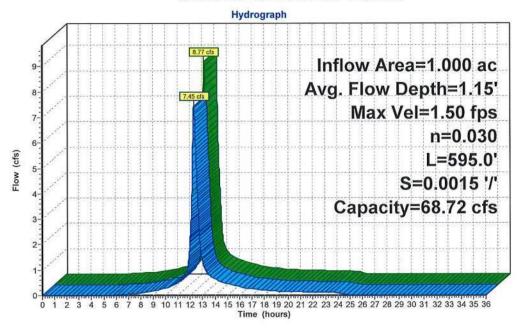
Side Slope Z-value= 2.0 '/' Top Width= 14.56'

Length= 595.0' Slope= 0.0015 '/'

Inlet Invert= 58.50', Outlet Invert= 57.61'



Reach 5CC: A2 Collector Channel





Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Reach 6CC: A3 Collector Channel

Inflow Area = 1.000 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 8.77 cfs @ 12.14 hrs, Volume= 0.736 af

Outflow = 7.67 cfs @ 12.29 hrs, Volume= 0.736 af, Atten= 13%, Lag= 9.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 2.17 fps, Min. Travel Time= 5.7 min Avg. Velocity = 0.64 fps, Avg. Travel Time= 19.2 min

Peak Storage= 2,614 cf @ 12.19 hrs Average Depth at Peak Storage= 0.92

Bank-Full Depth= 2.21' Flow Area= 14.2 sf, Capacity= 50.02 cfs

2.00' x 2.21' deep channel, n= 0.030 Earth, grassed & winding

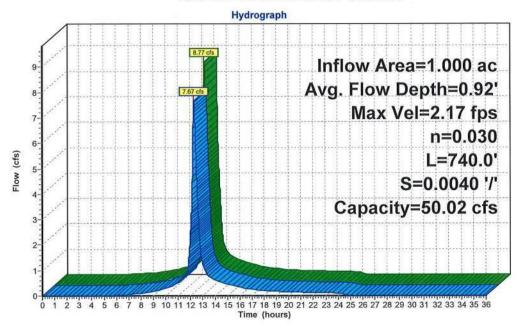
Side Slope Z-value= 2.0 '/' Top Width= 10.84'

Length= 740.0' Slope= 0.0040 '/'

Inlet Invert= 59.50', Outlet Invert= 56.54'



Reach 6CC: A3 Collector Channel



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Reach A2-1: A2-1 Channel

Inflow Area = 2.000 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 12.75 cfs @ 12.25 hrs, Volume= 1.471 af

Outflow = 12.71 cfs @ 12.31 hrs, Volume= 1.471 af, Atten= 0%, Lag= 3.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.73 fps, Min. Travel Time= 2.4 min Avg. Velocity = 0.56 fps, Avg. Travel Time= 7.5 min

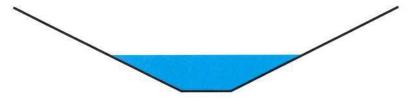
Peak Storage= 1,837 cf @ 12.27 hrs Average Depth at Peak Storage= 1.48'

Bank-Full Depth= 3.40' Flow Area= 29.9 sf, Capacity= 83.47 cfs

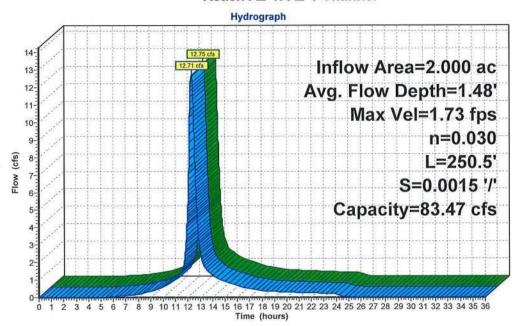
2.00' x 3.40' deep channel, n= 0.030 Earth, grassed & winding

Side Slope Z-value= 2.0 '/' Top Width= 15.60'

Length= 250.5' Slope= 0.0015 '/'
Inlet Invert= 57.61', Outlet Invert= 57.23'



Reach A2-1: A2-1 Channel





Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Reach A2-2: A2-2 Channel

Inflow Area = 19.361 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 162.11 cfs @ 12.15 hrs, Volume= 14.244 af

Outflow = 160.83 cfs @ 12.18 hrs, Volume= 14.244 af, Atten= 1%, Lag= 1.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 4.09 fps, Min. Travel Time= 1.0 min Avg. Velocity = 1.11 fps, Avg. Travel Time= 3.9 min

Peak Storage= 10,114 cf @ 12.16 hrs Average Depth at Peak Storage= 3.02'

Bank-Full Depth= 4.34' Flow Area= 68.1 sf, Capacity= 338.68 cfs

7.00' x 4.34' deep channel, n= 0.025 Rubble masonry, cemented

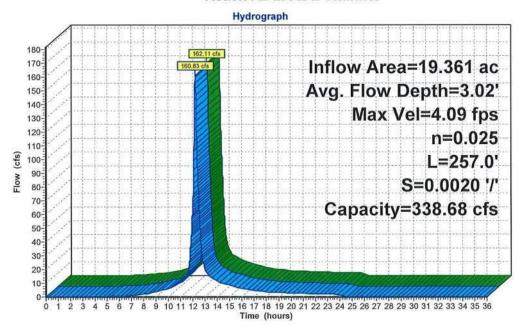
Side Slope Z-value= 2.0 '/' Top Width= 24.36'

Length= 257.0' Slope= 0.0020 '/'

Inlet Invert= 55.84', Outlet Invert= 55.33'



Reach A2-2: A2-2 Channel



Inflow
Outflow

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Summary for Reach A2-3: A2-3 Channel

Inflow Area = 19.361 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 160.83 cfs @ 12.18 hrs, Volume= 14.244 af

Outflow = 154.07 cfs @ 12.26 hrs, Volume= 14.244 af, Atten= 4%, Lag= 4.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 3.52 fps, Min. Travel Time= 2.8 min Avg. Velocity = 0.95 fps, Avg. Travel Time= 10.2 min

Peak Storage= 25,497 cf @ 12.21 hrs Average Depth at Peak Storage= 3.09'

Bank-Full Depth= 5.65' Flow Area= 109.0 sf, Capacity= 532.10 cfs

8.00' x 5.65' deep channel, n= 0.030 Earth, grassed & winding

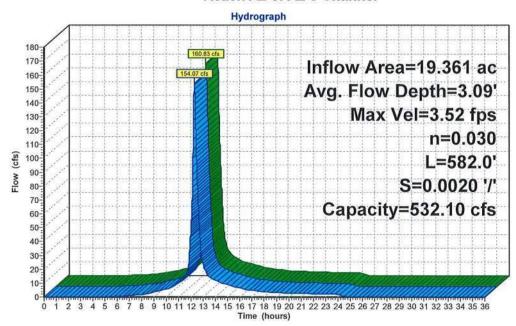
Side Slope Z-value= 2.0 '/' Top Width= 30.60'

Length= 582.0' Slope= 0.0020 '/'

Inlet Invert= 55.33', Outlet Invert= 54.17'



Reach A2-3: A2-3 Channel





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Summary for Reach A2-4: Chute-Concrete Block Open Cell

Inflow Area = 19.361 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 154.07 cfs @ 12.26 hrs, Volume= 14.244 af

Outflow = 153.86 cfs @ 12.27 hrs, Volume= 14.244 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 12.45 fps, Min. Travel Time= 0.3 min Avg. Velocity = 3.12 fps, Avg. Travel Time= 1.3 min

Peak Storage= 3,091 cf @ 12.26 hrs Average Depth at Peak Storage= 0.91

Bank-Full Depth= 2.00' Flow Area= 36.0 sf, Capacity= 692.98 cfs

10.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

Side Slope Z-value= 4.0 '/' Top Width= 26.00'

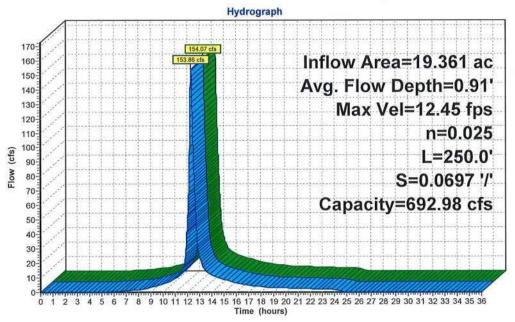
Length= 250.0' Slope= 0.0697 '/'

#

Inlet Invert= 54.17', Outlet Invert= 36.75'



Reach A2-4: Chute-Concrete Block Open Cell



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Summary for Reach A2-5: Cocrete Block-Channel Transition

Inflow Area = 2.000 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 12.71 cfs @ 12.31 hrs, Volume= 1.471 af

Outflow = 12.71 cfs @ 12.31 hrs, Volume= 1.471 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 12.58 fps, Min. Travel Time= 0.0 min Avg. Velocity = 4.06 fps, Avg. Travel Time= 0.0 min

Peak Storage= 6 cf @ 12.31 hrs Average Depth at Peak Storage= 0.37

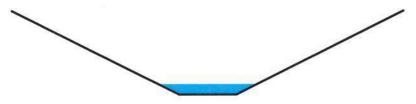
Bank-Full Depth= 2.93' Flow Area= 23.0 sf, Capacity= 903.50 cfs

2.00' x 2.93' deep channel, n= 0.025 Rubble masonry, cemented

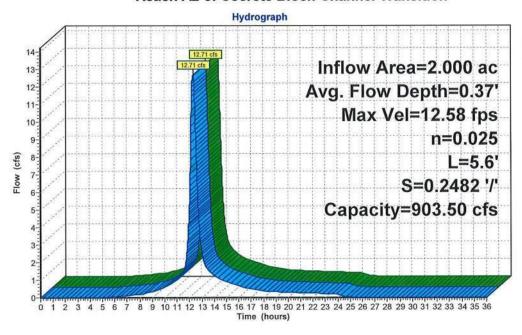
Side Slope Z-value= 2.0 '/' Top Width= 13.72'

Length= 5.6' Slope= 0.2482 '/'

Inlet Invert= 57.23', Outlet Invert= 55.84'



Reach A2-5: Cocrete Block-Channel Transition





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Summary for Reach B1: 5' x 4' Box Culvert

Inflow Area = 19.249 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 146.99 cfs @ 12.17 hrs, Volume= 14.162 af

Outflow = 146.52 cfs @ 12.19 hrs, Volume= 14.162 af, Atten= 0%, Lag= 1.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 10.42 fps, Min. Travel Time= 0.7 min Avg. Velocity = 2.94 fps, Avg. Travel Time= 2.6 min

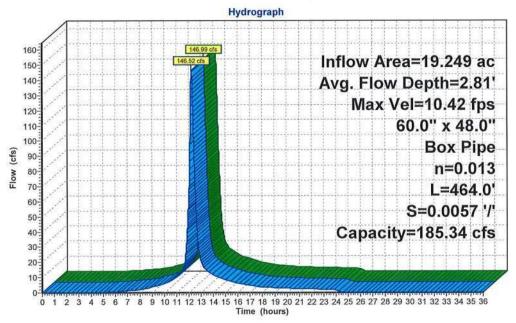
Peak Storage= 6,530 cf @ 12.18 hrs Average Depth at Peak Storage= 2.81'

Bank-Full Depth= 4.00' Flow Area= 20.0 sf, Capacity= 185.34 cfs

60.0" W x 48.0" H Box Pipe n= 0.013 Concrete pipe, bends & connections Length= 464.0' Slope= 0.0057 '/' Inlet Invert= 56.54', Outlet Invert= 53.89'



Reach B1: 5' x 4' Box Culvert



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Summary for Reach B2: 5' x 4' Box Culvert

Inflow Area = 38.047 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 300.25 cfs @ 12.20 hrs, Volume= 27.992 af

Outflow = 300.01 cfs @ 12.20 hrs, Volume= 27.992 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 19.22 fps, Min. Travel Time= 0.2 min Avg. Velocity = 5.48 fps, Avg. Travel Time= 0.6 min

Peak Storage= 3,124 cf @ 12.20 hrs Average Depth at Peak Storage= 3.12

Bank-Full Depth= 4.00' Flow Area= 20.0 sf, Capacity= 331.32 cfs

60.0" W x 48.0" H Box Pipe

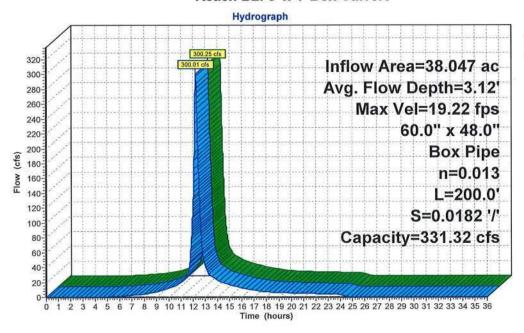
n= 0.013 Concrete pipe, bends & connections

Length= 200.0' Slope= 0.0182 '/'

Inlet Invert= 53.45', Outlet Invert= 49.80'



Reach B2: 5' x 4' Box Culvert



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Reach C1-4: Chute-Concrete Block Open Cell

Inflow Area = 38.047 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 300.01 cfs @ 12.20 hrs, Volume= 27.992 af

Outflow = 299.94 cfs @ 12.20 hrs, Volume= 27.992 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 25.32 fps, Min. Travel Time= 0.1 min Avg. Velocity = 7.50 fps, Avg. Travel Time= 0.2 min

Peak Storage= 900 cf @ 12.20 hrs Average Depth at Peak Storage= 1.21

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 872.67 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

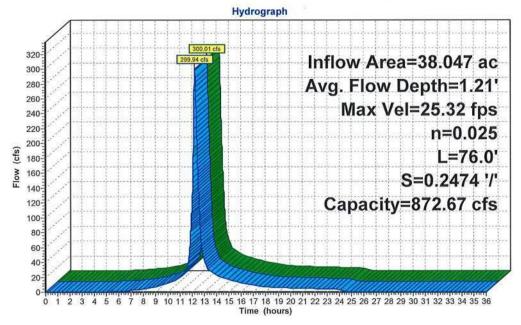
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 76.0' Slope= 0.2474 '/'

Inlet Invert= 49.80', Outlet Invert= 31.00'



Reach C1-4: Chute-Concrete Block Open Cell



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Reach C1SCCN1: C1SCCN1 Collector Channel

Inflow Area = 0.250 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 2.19 cfs @ 12.14 hrs, Volume= 0.184 af

Outflow = 2.06 cfs @ 12.23 hrs, Volume= 0.184 af, Atten= 6%, Lag= 5.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.34 fps, Min. Travel Time= 3.5 min Avg. Velocity = 0.36 fps, Avg. Travel Time= 13.0 min

Peak Storage= 439 cf @ 12.17 hrs Average Depth at Peak Storage= 0.40'

Bank-Full Depth= 1.50' Flow Area= 9.0 sf, Capacity= 24.47 cfs

3.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding

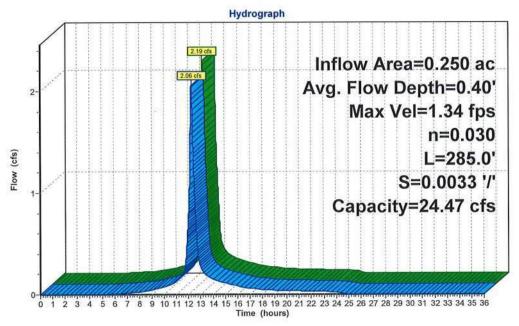
Side Slope Z-value= 2.0 '/' Top Width= 9.00'

Length= 285.0' Slope= 0.0033 '/'

Inlet Invert= 58.50', Outlet Invert= 57.55'



Reach C1SCCN1: C1SCCN1 Collector Channel



Type III 24-hr 100-Year Rainfall=11.50"

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Part III

Summary for Reach C1SCCN2: C1SCCN2 Collector Channel

Inflow Area = 0.250 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 2.19 cfs @ 12.14 hrs, Volume= 0.184 af

Outflow = 2.06 cfs @ 12.23 hrs, Volume= 0.184 af, Atten= 6%, Lag= 5.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.33 fps, Min. Travel Time= 3.6 min Avg. Velocity = 0.36 fps, Avg. Travel Time= 13.2 min

Peak Storage= 443 cf @ 12.17 hrs Average Depth at Peak Storage= 0.40'

Bank-Full Depth= 1.50' Flow Area= 9.0 sf, Capacity= 24.36 cfs

3.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding

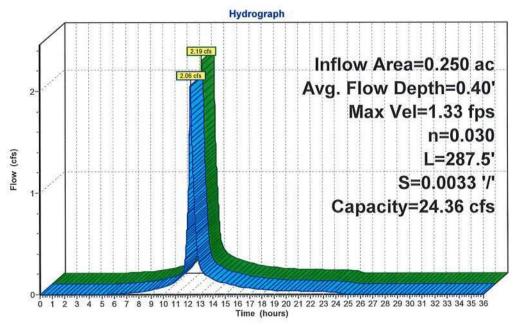
Side Slope Z-value= 2.0 '/' Top Width= 9.00'

Length= 287.5' Slope= 0.0033 '/'

Inlet Invert= 58.50', Outlet Invert= 57.55'



Reach C1SCCN2: C1SCCN2 Collector Channel





Submittal Date: September 2018

Revision: 0

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Summary for Reach C1SCCS1: C1SCCS1 Collector Channel

Inflow Area = 0.250 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 2.19 cfs @ 12.14 hrs, Volume= 0.184 af

Outflow = 2.06 cfs @ 12.23 hrs, Volume= 0.184 af, Atten= 6%, Lag= 5.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.33 fps, Min. Travel Time= 3.5 min Avg. Velocity = 0.36 fps, Avg. Travel Time= 12.9 min

Peak Storage= 433 cf @ 12.17 hrs Average Depth at Peak Storage= 0.41'

Bank-Full Depth= 1.50' Flow Area= 9.0 sf, Capacity= 24.30 cfs

3.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding

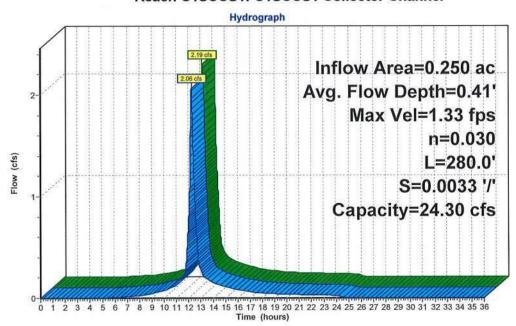
Side Slope Z-value= 2.0 '/' Top Width= 9.00'

Length= 280.0' Slope= 0.0033 '/'

Inlet Invert= 58.50', Outlet Invert= 57.58'



Reach C1SCCS1: C1SCCS1 Collector Channel



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Summary for Reach C1SCCS2: C1SCCS2 Collector Channel

Inflow Area = 0.250 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 2.19 cfs @ 12.14 hrs, Volume= 0.184 af

Outflow = 2.06 cfs @ 12.23 hrs, Volume= 0.184 af, Atten= 6%, Lag= 5.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.33 fps, Min. Travel Time= 3.5 min Avg. Velocity = 0.36 fps, Avg. Travel Time= 12.9 min

Peak Storage= 433 cf @ 12.17 hrs Average Depth at Peak Storage= 0.41'

Bank-Full Depth= 1.50' Flow Area= 9.0 sf, Capacity= 24.30 cfs

3.00' x 1.50' deep channel, n= 0.030 Earth, grassed & winding

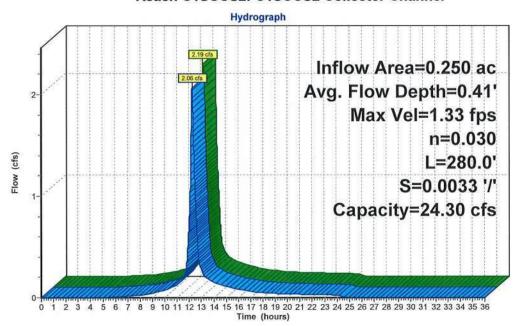
Side Slope Z-value= 2.0 '/' Top Width= 9.00'

Length= 280.0' Slope= 0.0033 '/'

Inlet Invert= 58.50', Outlet Invert= 57.58'



Reach C1SCCS2: C1SCCS2 Collector Channel





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Summary for Reach C2-3: C2-3 Channel

Inflow Area = 15.287 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 129.45 cfs @ 12.16 hrs, Volume= 11.247 af

Outflow = 118.51 cfs @ 12.28 hrs, Volume= 11.247 af, Atten= 8%, Lag= 7.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 3.35 fps, Min. Travel Time= 4.4 min Avg. Velocity = 0.96 fps, Avg. Travel Time= 15.3 min

Peak Storage= 31,176 cf @ 12.21 hrs Average Depth at Peak Storage= 3.32'

Bank-Full Depth= 4.00' Flow Area= 48.0 sf, Capacity= 178.76 cfs

4.00' x 4.00' deep channel, n= 0.030 Earth, grassed & winding

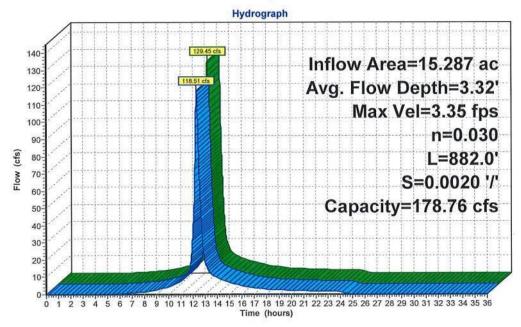
Side Slope Z-value= 2.0 '/' Top Width= 20.00'

Length= 882.0' Slope= 0.0020 '/'

Inlet Invert= 53.50', Outlet Invert= 51.75'



Reach C2-3: C2-3 Channel





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Summary for Reach C2-4: Chute-Concrete Block Open Cell

Inflow Area = 15.287 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 118.38 cfs @ 12.29 hrs, Volume= 11.247 af

Outflow = 118.36 cfs @ 12.29 hrs, Volume= 11.247 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 21.63 fps, Min. Travel Time= 0.0 min Avg. Velocity = 5.92 fps, Avg. Travel Time= 0.1 min

Peak Storage= 285 cf @ 12.29 hrs Average Depth at Peak Storage= 0.70

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 1,003.23 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

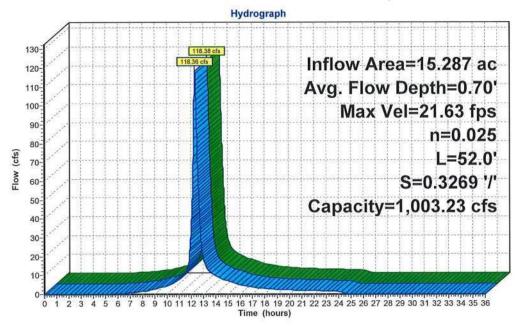
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 52.0' Slope= 0.3269 '/'

Inlet Invert= 48.00', Outlet Invert= 31.00'



Reach C2-4: Chute-Concrete Block Open Cell



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Summary for Reach C2-5: C2-5 Channel

Inflow Area = 15.287 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 118.48 cfs @ 12.28 hrs, Volume= 11.247 af

Outflow = 118.38 cfs @ 12.29 hrs, Volume= 11.247 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 9.05 fps, Min. Travel Time= 0.2 min Avg. Velocity = 2.55 fps, Avg. Travel Time= 0.7 min

Peak Storage= 1,388 cf @ 12.28 hrs Average Depth at Peak Storage= 1.29

Bank-Full Depth= 2.50' Flow Area= 37.5 sf, Capacity= 492.25 cfs

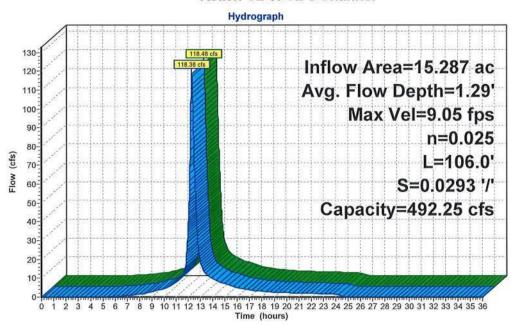
5.00' x 2.50' deep channel, n= 0.025 Rubble masonry, cemented

Side Slope Z-value= 4.0 '/' Top Width= 25.00'

Length= 106.0' Slope= 0.0293 '/' Inlet Invert= 51.11', Outlet Invert= 48.00'



Reach C2-5: C2-5 Channel



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Summary for Reach CC: Chute-Concrete Block Open Cell

Inflow Area = 1.480 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 11.11 cfs @ 12.30 hrs, Volume= 1.089 af

Outflow = 11.10 cfs @ 12.31 hrs, Volume= 1.089 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 6.99 fps, Min. Travel Time= 0.4 min Avg. Velocity = 2.01 fps, Avg. Travel Time= 1.3 min

Peak Storage= 254 cf @ 12.31 hrs Average Depth at Peak Storage= 0.26'

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 562.60 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

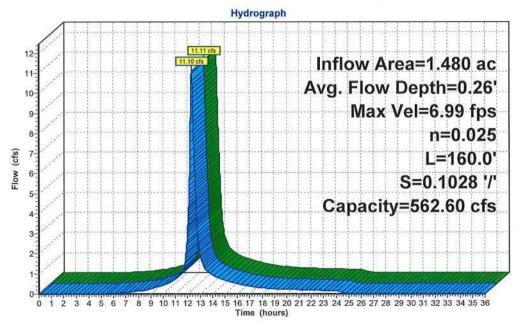
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 160.0' Slope= 0.1028 '/'

Inlet Invert= 53.20', Outlet Invert= 36.75'



Reach CC: Chute-Concrete Block Open Cell



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Reach E: Chute-Concrete Block Open Cell

Inflow Area = 17.798 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 150.87 cfs @ 12.14 hrs, Volume= 13.094 af

Outflow = 150.58 cfs @ 12.16 hrs, Volume= 13.094 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 21.08 fps, Min. Travel Time= 0.4 min Avg. Velocity = 6.60 fps, Avg. Travel Time= 1.2 min

Peak Storage= 3,305 cf @ 12.15 hrs Average Depth at Peak Storage= 0.85

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 879.20 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

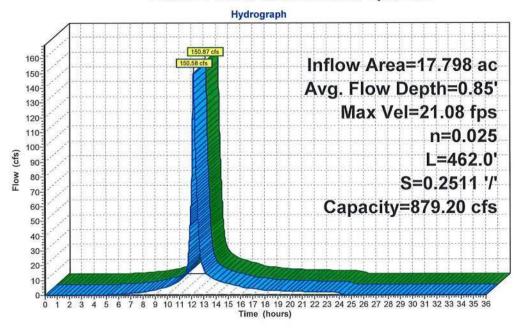
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 462.0' Slope= 0.2511 '/'

Inlet Invert= 174.00', Outlet Invert= 58.00'



Reach E: Chute-Concrete Block Open Cell



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Summary for Reach NE: Chute-Concrete Block Open Cell

Inflow Area = 15.287 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 129.70 cfs @ 12.14 hrs, Volume= 11.247 af

Outflow = 129.45 cfs @ 12.16 hrs, Volume= 11.247 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 20.16 fps, Min. Travel Time= 0.4 min Avg. Velocity = 6.26 fps, Avg. Travel Time= 1.2 min

Peak Storage= 2,982 cf @ 12.15 hrs Average Depth at Peak Storage= 0.79

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.30 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

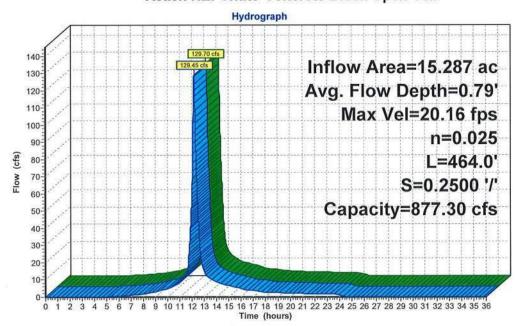
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 464.0' Slope= 0.2500 '/'

Inlet Invert= 174.00', Outlet Invert= 58.00'



Reach NE: Chute-Concrete Block Open Cell





Revision: 0

Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Reach NW: Chute-Concrete Block Open Cell

Inflow Area = 13.115 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 109.40 cfs @ 12.15 hrs, Volume= 9.649 af

Outflow = 109.21 cfs @ 12.16 hrs, Volume= 9.649 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 19.21 fps, Min. Travel Time= 0.4 min Avg. Velocity = 5.93 fps, Avg. Travel Time= 1.3 min

Peak Storage= 2,640 cf @ 12.15 hrs Average Depth at Peak Storage= 0.72

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.30 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

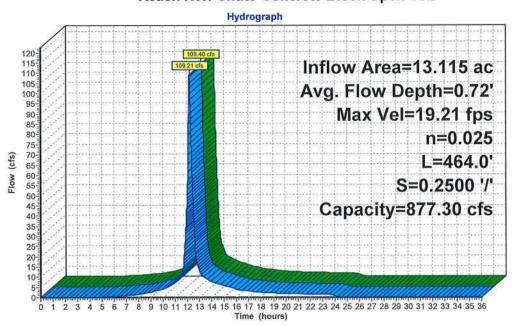
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 464.0' Slope= 0.2500 '/'

Inlet Invert= 174.00', Outlet Invert= 58.00'



Reach NW: Chute-Concrete Block Open Cell





Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Reach OC: Existing Offsite Channel

Inflow Area = 42.338 ac, 0.00% Impervious, Inflow Depth > 8.85" for 100-Year event

Inflow = 42.26 cfs @ 12.98 hrs, Volume= 31.217 af

Outflow = 41.59 cfs @ 14.06 hrs, Volume= 31.108 af, Atten= 2%, Lag= 64.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.83 fps, Min. Travel Time= 25.4 min Avg. Velocity = 0.95 fps, Avg. Travel Time= 49.3 min

Peak Storage= 63,491 cf @ 13.64 hrs Average Depth at Peak Storage= 2.04'

Bank-Full Depth= 2.10' Flow Area= 23.7 sf, Capacity= 44.23 cfs

5.00' x 2.10' deep channel, n= 0.030 Earth, grassed & winding

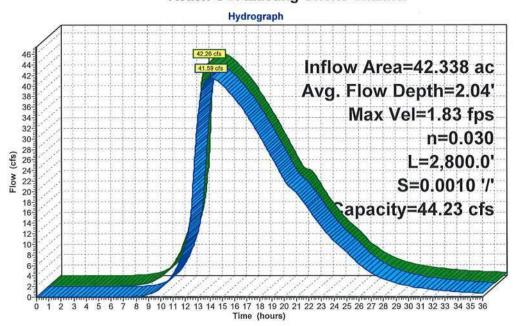
Side Slope Z-value= 3.0 '/' Top Width= 17.60'

Length= 2,800.0' Slope= 0.0010 '/'

Inlet Invert= 46.66', Outlet Invert= 43.86'



Reach OC: Existing Offsite Channel



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Reach P1: Culvert

Inflow Area = 15.287 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 118.51 cfs @ 12.28 hrs, Volume= 11.247 af

Outflow = 118.48 cfs @ 12.28 hrs, Volume= 11.247 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

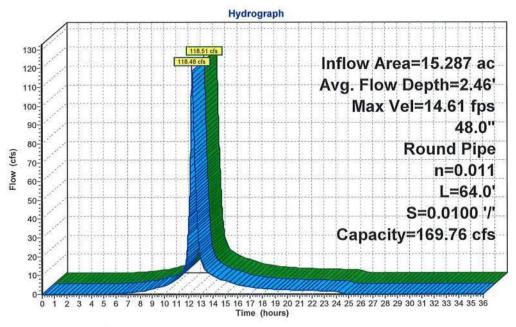
Max. Velocity= 14.61 fps, Min. Travel Time= 0.1 min Avg. Velocity = 4.39 fps, Avg. Travel Time= 0.2 min

Peak Storage= 519 cf @ 12.28 hrs Average Depth at Peak Storage= 2.46' Bank-Full Depth= 4.00' Flow Area= 12.6 sf, Capacity= 169.76 cfs

48.0" Round Pipe n= 0.011 Concrete pipe, straight & clean Length= 64.0' Slope= 0.0100 '/' Inlet Invert= 51.75', Outlet Invert= 51.11'



Reach P1: Culvert





Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Reach P2: Culvert

Inflow Area = 0.500 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 4.12 cfs @ 12.23 hrs, Volume= 0.368 af

Outflow = 4.11 cfs @ 12.24 hrs, Volume= 0.368 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 7.31 fps, Min. Travel Time= 0.2 min Avg. Velocity = 2.37 fps, Avg. Travel Time= 0.5 min

Peak Storage= 41 cf @ 12.24 hrs Average Depth at Peak Storage= 0.53'

Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 15.20 cfs

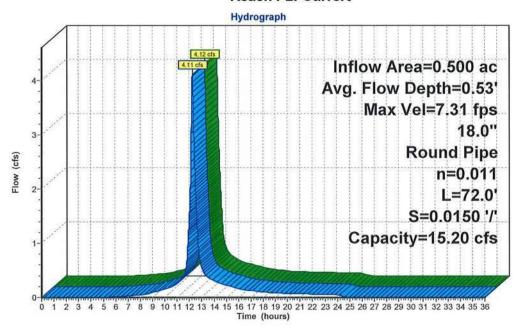
18.0" Round Pipe

n= 0.011 Concrete pipe, straight & clean Length= 72.0' Slope= 0.0150 '/'

Inlet Invert= 54.39', Outlet Invert= 53.31'



Reach P2: Culvert





Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Reach P2-1: Chute-Concrete Block Open Cell

Inflow Area = 0.500 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 4.11 cfs @ 12.24 hrs, Volume= 0.368 af

Outflow = 4.11 cfs @ 12.24 hrs, Volume= 0.368 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 9.69 fps, Min. Travel Time= 0.1 min Avg. Velocity = 2.91 fps, Avg. Travel Time= 0.3 min

Peak Storage= 25 cf @ 12.24 hrs Average Depth at Peak Storage= 0.17'

Bank-Full Depth= 1.50' Flow Area= 9.8 sf, Capacity= 316.81 cfs

2.00' x 1.50' deep channel, n= 0.025 Rubble masonry, cemented

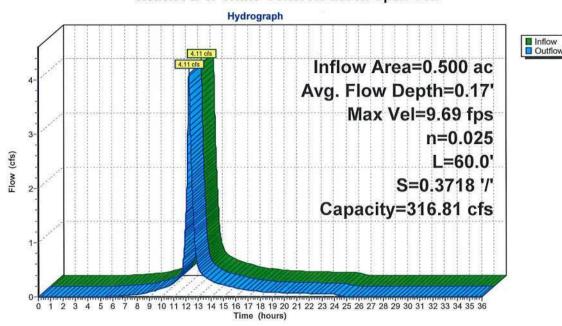
Side Slope Z-value= 3.0 '/' Top Width= 11.00'

Length= 60.0' Slope= 0.3718 '/'

Inlet Invert= 53.31', Outlet Invert= 31.00'



Reach P2-1: Chute-Concrete Block Open Cell



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Reach P3: Culvert

Inflow Area = 0.500 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 4.12 cfs @ 12.23 hrs, Volume= 0.368 af

Outflow = 4.12 cfs @ 12.24 hrs, Volume= 0.368 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 7.31 fps, Min. Travel Time= 0.2 min Avg. Velocity = 2.38 fps, Avg. Travel Time= 0.5 min

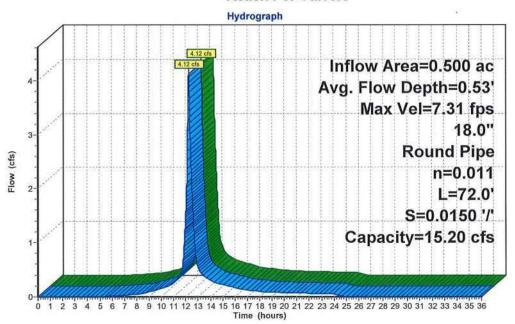
Peak Storage= 41 cf @ 12.23 hrs Average Depth at Peak Storage= 0.53'

Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 15.20 cfs

18.0" Round Pipe n= 0.011 Concrete pipe, straight & clean Length= 72.0' Slope= 0.0150 '/' Inlet Invert= 55.41', Outlet Invert= 54.33'



Reach P3: Culvert



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Summary for Reach P3-1: Chute-Concrete Block Open Cell

Inflow Area = 0.500 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 4.12 cfs @ 12.24 hrs, Volume= 0.368 af

Outflow = 4.12 cfs @ 12.24 hrs, Volume= 0.368 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 9.89 fps, Min. Travel Time= 0.1 min Avg. Velocity = 2.98 fps, Avg. Travel Time= 0.3 min

Peak Storage= 25 cf @ 12.24 hrs Average Depth at Peak Storage= 0.17

Bank-Full Depth= 1.50' Flow Area= 9.8 sf, Capacity= 326.18 cfs

2.00' x 1.50' deep channel, n= 0.025 Rubble masonry, cemented

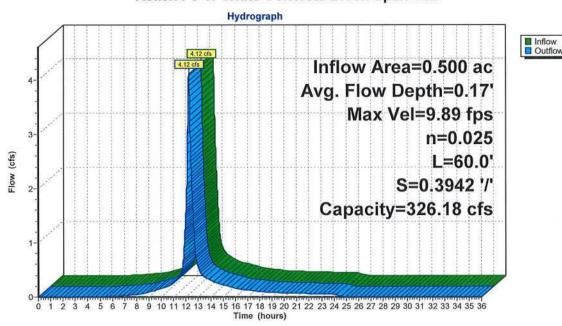
Side Slope Z-value= 3.0 '/' Top Width= 11.00'

Length= 60.0' Slope= 0.3942 '/'

Inlet Invert= 54.65', Outlet Invert= 31.00'



Reach P3-1: Chute-Concrete Block Open Cell



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Summary for Reach S: Chute-Concrete Block Open Cell

Inflow Area = 17.361 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 152.24 cfs @ 12.14 hrs, Volume= 12.773 af

Outflow = 151.93 cfs @ 12.15 hrs, Volume= 12.773 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 21.09 fps, Min. Travel Time= 0.4 min Avg. Velocity = 6.55 fps, Avg. Travel Time= 1.2 min

Peak Storage= 3,309 cf @ 12.14 hrs Average Depth at Peak Storage= 0.86

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.30 cfs

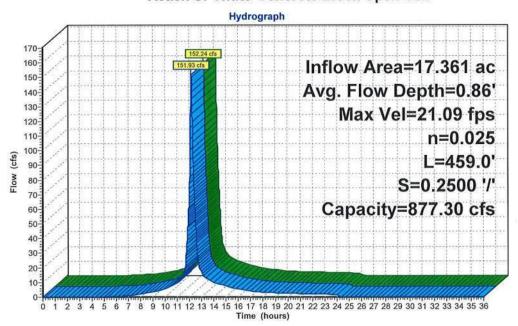
5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 459.0' Slope= 0.2500 '/'
Inlet Invert= 174.00', Outlet Invert= 59.25'



Reach S: Chute-Concrete Block Open Cell



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Summary for Reach SE: Chute-Concrete Block Open Cell

Inflow Area = 18.249 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 142.28 cfs @ 12.15 hrs, Volume= 13.426 af

Outflow = 142.07 cfs @ 12.17 hrs, Volume= 13.426 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 20.70 fps, Min. Travel Time= 0.4 min Avg. Velocity = 6.61 fps, Avg. Travel Time= 1.1 min

Peak Storage= 3,091 cf @ 12.16 hrs Average Depth at Peak Storage= 0.83'

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.14 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

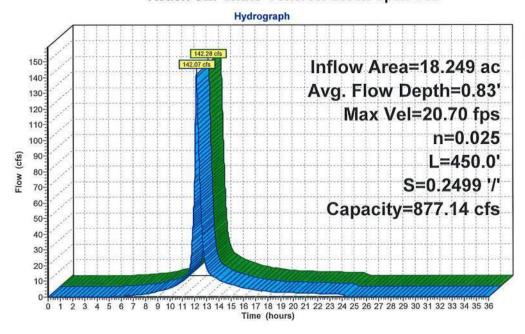
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 450.0' Slope= 0.2499 '/'

Inlet Invert= 174.00', Outlet Invert= 61.54'



Reach SE: Chute-Concrete Block Open Cell



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Reach SE1: Chute-Concrete Block Open Cell

Inflow Area = 18.249 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 142.07 cfs @ 12.17 hrs, Volume= 13.426 af

Outflow = 142.01 cfs @ 12.17 hrs, Volume= 13.426 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 13.74 fps, Min. Travel Time= 0.1 min Avg. Velocity = 4.54 fps, Avg. Travel Time= 0.2 min

Peak Storage= 641 cf @ 12.17 hrs Average Depth at Peak Storage= 1.10'

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 498.27 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

Side Slope Z-value= 4.0 '/' Top Width= 21.00'

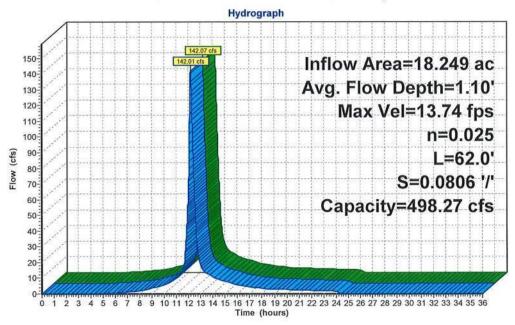
Length= 62.0' Slope= 0.0806 '/'

#

Inlet Invert= 61.54', Outlet Invert= 56.54'



Reach SE1: Chute-Concrete Block Open Cell





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Summary for Reach SW: Chute-Concrete Block Open Cell

Inflow Area = 15.434 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 135.35 cfs @ 12.14 hrs, Volume= 11.355 af

Outflow = 135.10 cfs @ 12.14 hrs, Volume= 11.355 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 20.41 fps, Min. Travel Time= 0.3 min Avg. Velocity = 6.30 fps, Avg. Travel Time= 1.1 min

Peak Storage= 2,677 cf @ 12.14 hrs Average Depth at Peak Storage= 0.81

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.30 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

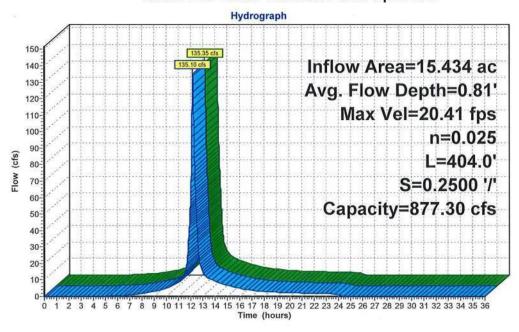
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 404.0' Slope= 0.2500 '/'

Inlet Invert= 174.00', Outlet Invert= 73.00'



Reach SW: Chute-Concrete Block Open Cell



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Summary for Reach SW-1: Chute-Concrete Block Open Cell

Inflow Area = 15.434 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 135.10 cfs @ 12.14 hrs, Volume= 11.355 af

Outflow = 134.87 cfs @ 12.15 hrs, Volume= 11.355 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 15.98 fps, Min. Travel Time= 0.3 min Avg. Velocity = 5.02 fps, Avg. Travel Time= 0.9 min

Peak Storage= 2,248 cf @ 12.15 hrs Average Depth at Peak Storage= 0.96'

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 624.99 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

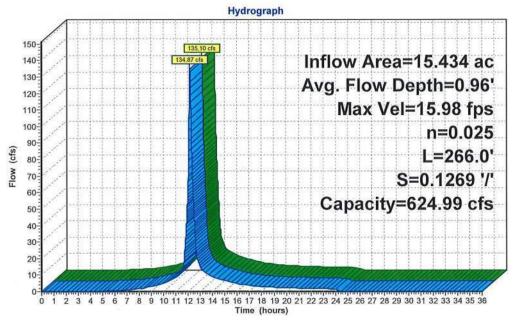
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 266.0' Slope= 0.1269 '/'

Inlet Invert= 70.50', Outlet Invert= 36.75'



Reach SW-1: Chute-Concrete Block Open Cell



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Inflow
Outflow

Summary for Reach W: Chute-Concrete Block Open Cell

Inflow Area = 22.383 ac, 0.00% Impervious, Inflow Depth = 8.83" for 100-Year event

Inflow = 179.96 cfs @ 12.15 hrs, Volume= 16.468 af

Outflow = 179.70 cfs @ 12.16 hrs, Volume= 16.468 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 22.10 fps, Min. Travel Time= 0.3 min Avg. Velocity = 7.09 fps, Avg. Travel Time= 1.1 min

Peak Storage= 3,776 cf @ 12.15 hrs Average Depth at Peak Storage= 0.93'

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.30 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

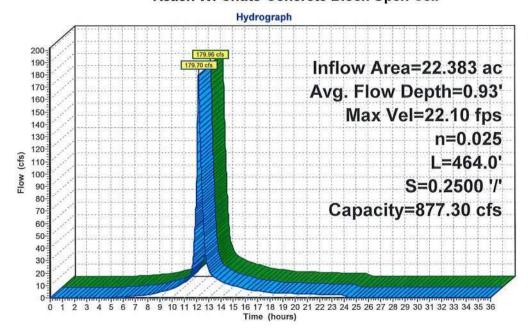
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 464.0' Slope= 0.2500 '/'

Inlet Invert= 174.00', Outlet Invert= 58.00'



Reach W: Chute-Concrete Block Open Cell



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Summary for Pond PA: Retention Pond A

No Discharge, Reshaping of Existing Pond A Bottom Required.

Inflow Area = 47.697 ac, 0.00% Impervious, Inflow Depth = 9.28" for 100-Year event

Inflow = 324.39 cfs @ 12.21 hrs, Volume= 36.905 af

Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Peak Elev= 49.73' @ 36.00 hrs Surf.Area= 4.915 ac Storage= 36.905 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert Av	/ail.Storage	Storage Descrip	tion		
#1	36.75'	82.379 af	Custom Stage I	Data (Irregular) i	Listed below (Recale	5)
Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)	
36.75	1.340	1,049.8	0.000	0.000	1.340	
37.00	1.380	1,064.9	0.340	0.340	1.399	
38.00	1.540	1,125.4	1.459	1.799	1.642	
39.00	1.720	1,171.5	1.629	3,428	1.837	
40.00	1.890	1,216.8	1.804	5.233	2.037	
41.00	2.120	1,292.5	2,004	7.237	2.385	
42.00	2.360	1,370.6	2.239	9.476	2,766	
43.00	2.620	1,447.9	2.489	11.964	3.166	
44.0 0	2.900	1,537.3	2.759	14.723	3.654	
45.00	3.210	1,623.3	3.054	17.777	4.152	
46.00	3.550	1,699.4	3.379	21.156	4.616	
47.00	3.910	1,769.6	3.729	24.884	5.062	
48.00	4.270	1,832.8	4.089	28.973	5.480	
49.00	4.640	1,894.6	4.454	33.426	5.903	
50.00	5.020	1,956.1	4.829	38.255	6.338	
51.00	5.450	2,024.3	5.234	43.489	6.836	
52.00	5.860	2,075.6	5.654	49.143	7.223	
53.00	6.180	2,125.3	6.019	55.162	7.608	
54.00	6.490	2,167.2	6.334	61.496	7.940	
55.00	6.800	2,209.1	6.644	68.141	8.279	
56.00	7.120	2,250.9	6.959	75.100	8.623	
57.00	7.440	2,292.6	7.279	82.379	8.973	

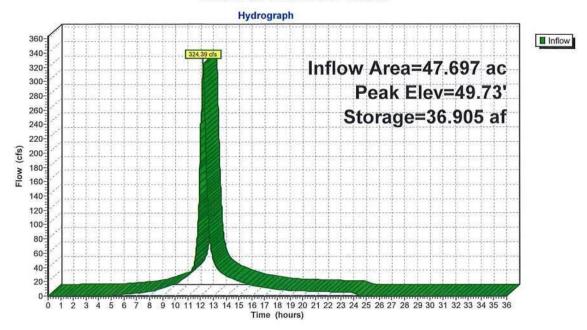
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Pond PA: Retention Pond A



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Summary for Pond PB: Detention Pond B

42,338 ac, 0.00% Impervious, Inflow Depth = 9.07" for 100-Year event Inflow Area =

331.73 cfs @ 12.16 hrs, Volume= 32.018 af Inflow =

42.26 cfs @ 12.98 hrs, Volume= Outflow = 31.217 af, Atten= 87%, Lag= 49.7 min

42.26 cfs @ 12.98 hrs, Volume= 31.217 af Primary

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Peak Elev= 52.22' @ 12.98 hrs Surf.Area= 3.914 ac Storage= 16.607 af

Plug-Flow detention time= 253.1 min calculated for 31.217 af (97% of inflow)

Center-of-Mass det. time= 237.9 min (1,027.8 - 789.9)

Volume	Invert	Avail.Stora	ge Storage Descri	ption		
#1	47.00'	19.739	af Custom Stage	Data (Irregular)	Listed below (Recalc))
Elevatio				Cum.Store (acre-feet)	Wet.Area (acres)	
47.0		50 3,998	**************************************	0.000	2,450	
48.0	0 2.7	30 4,022	7 2.589	2.589	2.814	
49.0	00 3.0	10 4,046	7 2.869	5.458	3.179	
50.0	00 3.2	90 4,070	7 3.149	8.607	3.547	
51.0	00 3.5	70 4,094	3.429	12,036	3.916	
52.0	00 3.8	50 4,118	3.709	15.745	4.291	
53.0	00 4.1	40 4,158	1 3.994	19.739	4.893	
Device	Routing	Invert	Outlet Devices			
#1	Primary	47.00'	21.0" Round RCP	Round 21"		
#2	Primary	47.00'	L= 128.0' RCP, gr Inlet / Outlet Invertane 0.013 Concrete 21.0" Round RCP, L= 128.0' RCP, gr Inlet / Outlet Invertance	oove end project = 47.00' / 46.75' pipe, bends & co _Round 21" oove end project = 47.00' / 46.75'	S= 0.0020 '/' Cc= 0. onnections, Flow Are	a= 2.41 sf 900

Primary OutFlow Max=42.26 cfs @ 12.98 hrs HW=52.22' (Free Discharge)

-1=RCP_Round 21" (Barrel Controls 21.13 cfs @ 8.78 fps)
-2=RCP_Round 21" (Barrel Controls 21.13 cfs @ 8.78 fps)

Part III, Attachment 6, Appendix 6B.5, p.g.-80

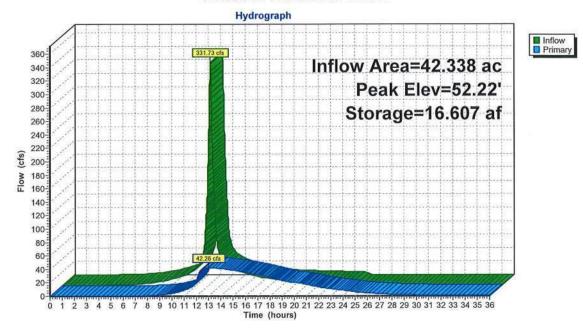
Type III 24-hr 100-Year Rainfall=11.50"

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Pond PB: Detention Pond B



Type III 24-hr 100-Year Rainfall=11.50"

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Summary for Pond PC: Retention Pond C

No Discharge, Constructrion of Perimeter Berm to Elevation 48 ft. Required.

61.564 ac, 0.00% Impervious, Inflow Depth = 9.05" for 100-Year event Inflow Area =

Inflow = 446.58 cfs @ 12.22 hrs, Volume= 46.421 af

Outflow 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Peak Elev= 45.81' @ 36.00 hrs Surf.Area= 4.259 ac Storage= 46.421 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= (not calculated: no outflow)

<u>Volume</u>	Invert Av	ail.Storage	Storage Descrip	tion		
#1	31.00'	56.115 af	Custom Stage I	Data (Irregular) l	Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)	
31.00	2.060	2,014.1	0.000	0.000	2.060	
32.00	2.200	2,032.9	2.130	2.130	2.207	
33.00	2.340	2,051.7	2.270	4.399	2,354	
34.00	2.480	2,070.5	2,410	6.809	2.504	
35.00	2.630	2,089.2	2.555	9,364	2.654	
36.00	2.770	2,108.0	2.700	12.063	2.806	
37.00	2.920	2,126.8	2.845	14,908	2.959	
38.00	3.060	2,145.6	2.990	17.898	3.114	
39.00	3,210	2,164.4	3.135	21.032	3.270	
40.00	3.360	2,183.2	3.285	24.317	3.427	
41.00	3,510	2,201.9	3.435	27.752	3.585	
42.00	3.660	2,220.7	3.585	31.337	3.745	
43.00	3.820	2,239.5	3.740	35.076	3.907	
44.00	3.970	2,258.3	3.895	38.971	4.070	
45.00	4.130	2,277.1	4.050	43.021	4.234	
46.00	4.290	2,295.9	4.210	47.230	4.400	
47.00	4.440	2,314.6	4.365	51.595	4.566	
48.00	4.600	2,333.4	4.520	56.115	4.734	

Type III 24-hr 100-Year Rainfall=11.50"

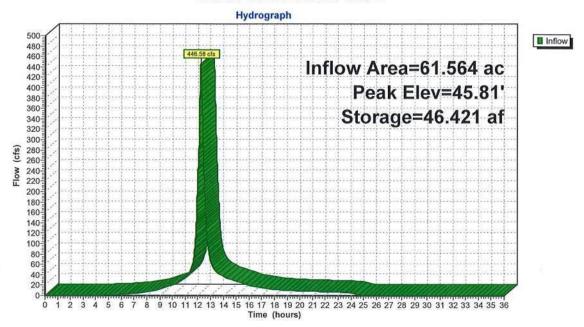
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Pond PC: Retention Pond C



APPENDIX 6B.6 HYDROCAD MODEL POST DEVELOPMENT 25 YEAR POND SUMMARY



25 YEAR POND SUMMARY

Retention Pond A (Irregular Shape)

Elevation (ft)	Surface Area (sf)	Surface Area (acres)	Perimeter (ft)	Cum. Store (Ac-ft)
36.75	58430.13	1.34	1049.83	0.00
37	60148.48	1.38	1064.95	0.34
38	67269.32	1.54	1125.40	1.80
39	74737.41	1.72	1171.54	3.43
40	82487.17	1.89	1216.78	5.23
41	92350.92	2.12	1292.54	7.24
42	102766.37	2.36	1370.62	9.48
43	114109.20	2.62	1447.92	11.96
44	126406.25	2.90	1537.27	14.72
45	139784.84	3.21	1623.30	17.78
46	154666.98	3.55	1699.39	21.16
47	170157.85	3.91	1769.61	24.88
48	185990.18	4.27	1832.75	28.97
49	201992.64	4.64	1894.58	33.43
50	218522.96	5.02	1956.10	38.26
51	237214.05	5.45	2024.29	43.49
52	255380.19	5.86	2075.63	49.14
53	268998.35	6.18	2125.30	55.16
54	282587.03	6.49	2167.18	61.50
55	296319.75	6.80	2209.05	68.14
56	310196.38	7.12	2250.89	75.10
57	324212.86	7.44	2292.64	82.38

Summary

Pond Depth = 20.25 ft Peak Elevation = 47.33 ft

Peak Inflow = 225.75 cfs
Peak Outflow = No Discharge

Peak Storage = 26.20 Ac-ft Freeboard = 9.67 ft

Detention Pond B (Irregular Shape)

Elevation (ft)	Surface Area (sf)	Surface Area (acres)	Perimeter (ft)	Cum. Store (Ac-ft)
47	106908.62	2.45	3998.70	0.00
48	118939.02	2.73	4022.70	2.59
49	131040.75	3.01	4046.70	5.46
50	143213.79	3.29	4070.70	8.61
51	155458.15	3.57	4094.60	12.04
52	167773.82	3.85	4118.80	15.75
53	180160.81	4.14	4158.10	19.74

Summary

Pond Depth = 6 ft

 Peak Elevation =
 50.87 ft

 Peak Inflow =
 235.89 cfs

 Peak Outflow =
 33.70 cfs

Peak Storage = 11.56 Ac-ft

Culvert size = 2 X 21 in x 128 ft RCP

Culvert Slope = 0.20% Freeboard = 2.13 ft

Retention Pond C (Irregular Shape)

Elevation (ft)	Surface Area (sf)	Surface Area (acres)	Perimeter (ft)	Cum. Store (Ac-ft)
31	89848.61	2.06	2014.10	0.00
32	95917.31	2.20	2032.90	2.13
33	102041.29	2.34	2051.70	4.40
34	108220.56	2.48	2070.50	6,81
35	114455.12	2.63	2089.20	9.36
36	120744.98	2.77	2108.00	12.06
37	127090.14	2.92	2126.80	14.91
38	133490.60	3.06	2145.60	17.90
39	139946.35	3.21	2164.40	21.03
40	146457.40	3.36	2183.20	24.32
41	153023.74	3.51	2201.90	27.75
42	159645.38	3.66	2220.70	31.34
43	166322.32	3.82	2239.50	35.08
44	173054.56	3.97	2258.30	38.97
45	179842.09	4.13	2277.10	43.02
46	186684.91	4.29	2295.90	47.23
47	193583.04	4.44	2314.60	51.60
48	200536.46	4.60	2333.40	56.12

Summary

Pond Depth = 17 ft

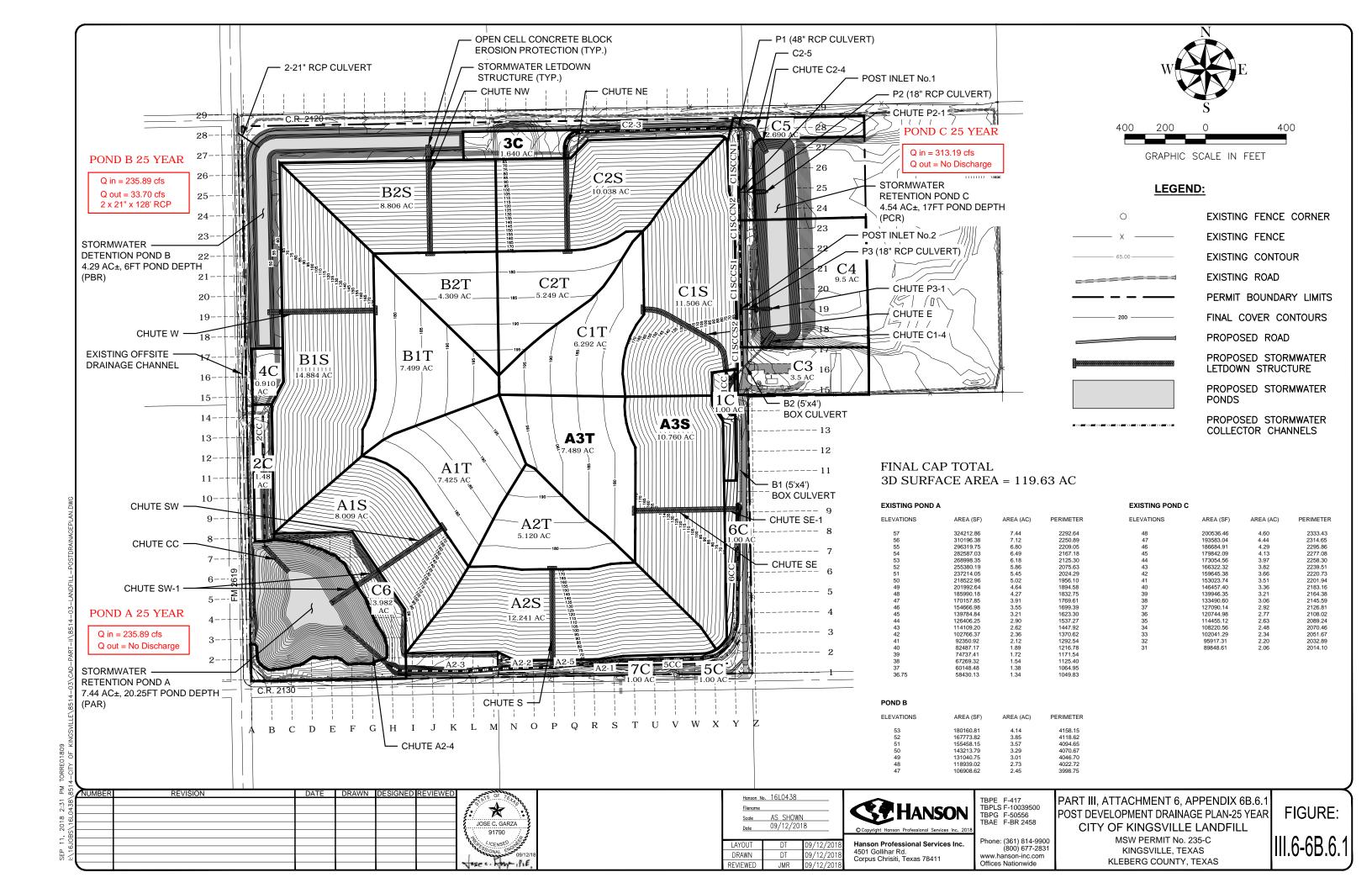
Peak Elevation = 42.36 ft
Peak Inflow = 313.19 cfs

Peak Outflow = No Discharge Peak Storage = 32.68 Ac-ft

Freeboard = 5.64 ft

APPENDIX 6B.6.1 POST DEVELOPMENT DRAINAGE PLAN-25 YEAR





APPENDIX 6B.7 HYDROCAD MODEL POST DEVELOPMENT 100 YEAR POND SUMMARY



100 YEAR POND SUMMARY

Retention Pond A (Irregular Shape)

Elevation (ft)	Surface Area (sf)	Surface Area (acres)	Perimeter (ft)	Cum. Store (Ac-ft)
36.75	58430.13	1.34	1049.83	0.00
37	60148.48	1.38	1064.95	0.34
38	67269.32	1.54	1125.40	1.80
39	74737.41	1.72	1171.54	3.43
40	82487.17	1.89	1216.78	5.23
41	92350.92	2.12	1292.54	7.24
42	102766.37	2.36	1370.62	9.48
43	114109.20	2,62	1447.92	11.96
44	126406.25	2.90	1537.27	14.72
45	139784.84	3.21	1623.30	17.78
46	154666.98	3.55	1699.39	21.16
47	170157.85	3.91	1769.61	24.88
48	185990.18	4.27	1832.75	28.97
49	201992,64	4.64	1894.58	33.43
50	218522.96	5.02	1956.10	38.26
51	237214.05	5.45	2024.29	43.49
52	255380.19	5.86	2075.63	49.14
53	268998.35	6.18	2125.30	55.16
54	282587.03	6.49	2167.18	61.50
55	296319.75	6.80	2209.05	68.14
56	310196.38	7.12	2250.89	75.10
57	324212.86	7.44	2292.64	82.38

Summary

Pond Depth = 20.25 ft

Peak Elevation = 49.73 ft
Peak Inflow = 324.39 cfs
Peak Outflow = No Discharge

Peak Storage = 36.90 Ac-ft Freeboard = 7.27 ft

Detention Pond B (Irregular Shape)

Elevation (ft)	Surface Area (sf)	Surface Area (acres)	Perimeter (ft)	Cum. Store (Ac-ft)
47	106908.62	2.45	3998.70	0.00
48	118939.02	2.73	4022.70	2.59
49	131040.75	3.01	4046.70	5.46
50	143213.79	3.29	4070.70	8.61
51	155458.15	3.57	4094.60	12.04
52	167773.82	3.85	4118.80	15.75
53	180160.81	4.14	4158.10	19.74

Summary

Pond Depth = 6 ft

 Peak Elevation =
 52.22 ft

 Peak Inflow =
 331.73 cfs

 Peak Outflow =
 42.46 cfs

Peak Storage = 16.607 Ac-ft
Culvert size = 2 X 21 in x 128 ft RCP

Culvert Slope = 0.20% Freeboard = 0.78 ft

Retention Pond C (Irregular Shape)

Elevation (ft)	Surface Area (sf)	Surface Area (acres)	Perimeter (ft)	Cum. Store (Ac-ft)
31	89848.61	2.06	2014.10	0.00
32	95917.31	2.20	2032.90	2.13
33	102041.29	2.34	2051.70	4.40
34	108220.56	2.48	2070.50	6.81
35	114455.12	2.63	2089.20	9.36
36	120744.98	2.77	2108.00	12.06
37	127090.14	2.92	2126.80	14.91
38	133490.60	3.06	2145.60	17.90
39	139946.35	3.21	2164.40	21.03
40	146457.40	3.36	2183.20	24.32
41	153023.74	3.51	2201.90	27.75
42	159645.38	3.66	2220.70	31.34
43	166322.32	3.82	2239.50	35.08
44	173054.56	3.97	2258.30	38.97
45	179842.09	4.13	2277.10	43.02
46	186684.91	4.29	2295.90	47.23
47	193583.04	4.44	2314.60	51.60
48	200536.46	4.60	2333.40	56.12

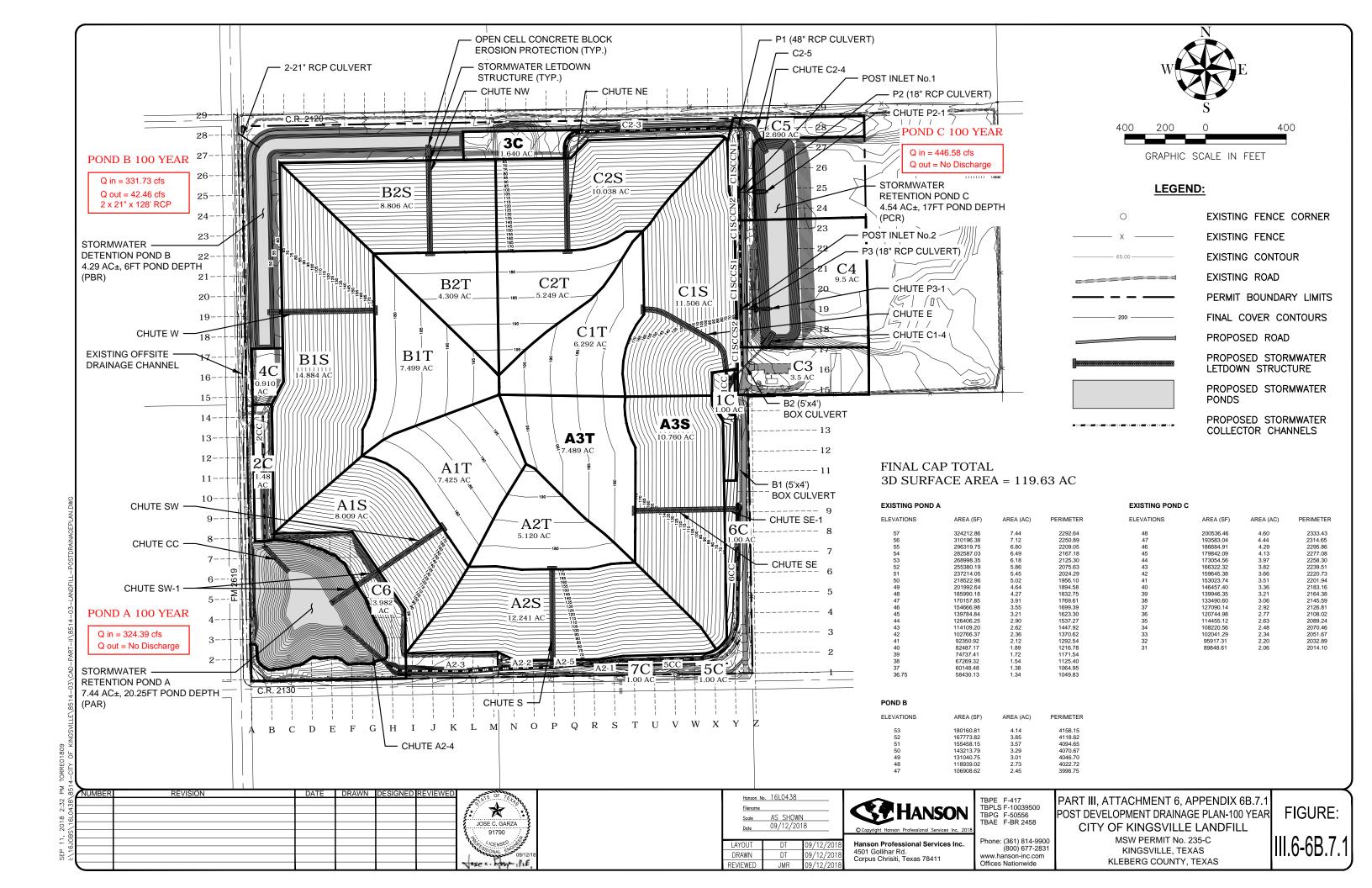
Summary

Pond Depth = 17 ft Peak Elevation = 45.81 ft

Peak Inflow = 446.58 cfs
Peak Outflow = No Discharge
Peak Storage = 46.42 Ac-ft
Freeboard = 2.19 ft

APPENDIX 6B.7.1 POST DEVELOPMENT DRAINAGE PLAN-100 YEAR





KINGSVILLE LANDFILL PERMIT AMENDMENT 235-B

PORTION OF ATTACHMENT 6 GROUNDWATER AND SURFACEWATER PROTECTION PLAN (PRE-DEVELOPMENT/POST DEVELOPMENT DRAINAGE CONDITIONS & DESIGN)

PORTION OF APPENDIX 6A-PRE-DEVELOPMENT CONDITIONS (FIGURE A-1 PRE-DEVELOPMENT DRAINAGE MAP)

PORTION OF APPENDIX 6B-FINAL DEVELOPMENT CONDITIONS (FIGURE B-1 FINAL DEVELOPMENT DRAINAGE MAP)

PORTION OF APPENDIX 6C DETENTION PONDS AND DISCHARGE CULVERTS (25-YEAR STORM STRATEGY/COMPARATIVE SUMMARY OF PEAK FLOWS)



APPENDIX 6B.8.1

PORTION OF ATTACHMENT 6 GROUNDWATER AND SURFACE WATER PROTECTION PLAN (PRE-DEVELOPMENT/POST DEVELOPMENT DRAINAGE CONDITIONS AND DESIGN [ANNOTATED]



Attachment 6

Groundwater and Surface Water Protection Plan

City of Kingsville Municipal Landfill Facility Permit Amendment Application 235-B

Prepared by: Alpha Engineering

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(75)	.0 . .0	Pre-Development Drainage Conditions Post-Development Drainage Conditions and Design	. 3
4	.0	 3.1 Stormwater Detention Ponds Analysis Erosion and Sedimentation Control Plan 4.1 Erosion and Sedimentation Assessment 4.2 Stormwater Management Structural Controls 4.3 Soil Erosion and Sediment Control Practices 4.4 Minimizing Offsite Vehicular Tracking of Sediments 4.5 Run-on and Run-off Controls for Active Disposal Areas 4.6 Maintenance and Inspection 	7 7 8 9 9 10
7	0.0	Floodplain Evaluation Maintenance and Restoration Plan	11

Appendices

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Annandiy AB	Final Development Condition	ons	
Appendix 6C	Detention Ponds and Disch	arge Cul	veris
Appendix 6D	Drainage Channel Profiles	and Cros	s-2ections
Appendix 6E	Erosion Control Plan		
Appendix 6F	Offsite Drainage System		
Appendix 6G	References	# 14 P	- Sec. 19
50 (6.5)			S. N.E.

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May 1998
Page i Revision No. 1

are as follows. From 2.0 Pre-Development Drainage Conditions

	Watershed	Drainage Area	Name	25-Year Peak F	low (cis)
9.	Α .	PA1		27.3	
		PA2		22,0	
		PA3		13.7	
	12	3.3.33		30	
	В	PB1		19.0	
	ь	PB2		4.3	
		PB3		5.4	
	C	PC1		39.6	2.70
		PC2		15.7	SV .
		PC3		3.1	

3.0 POST-DEVELOPMENT DRAINAGE CONDITIONS AND DESIGN

The post-development peak discharge analysis defines the hydrologic conditions for the final landfill development. The method for calculating the 25-year peak discharge flows also follows the TR-55 worksheets and is shown in Appendix 6B. Since the composition of the final cover material and slopes are different from the pre-existing conditions, the CN values also change to reflect an increase runoff, and are shown below.

Description	CN
Unimproved, 0 - 7% slope	60
Unimproved, greater than 7% slope	70

Appendix 6B includes final development contour maps, drainage area boundaries, slope map, and each worksheet necessary to calculate the post-development peak discharges for the strategic points. Although the landfill facility changes the storm water drainage patterns from the site pre-development conditions, the surrounding natural drainage patterns will not be adversely affected. The peak discharge flows before detention are as follows.

	Watershed	25 0	Drainage Area Name	25-Yea	r Peak Flow (cfs)
22 E	A		FA		87.3
fi (a)	В	4	FB		68.0
	С		FC		71.7

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Kingsville Landfill Permit Amendment 235-B Attachment 6

Appendix 6A Pre-Development Conditions

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5	Drainage Area PA3	8
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	Drainage Area PB2	14
	Drainage Area PB3	17
	Drainage Area PC1	21
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	The state of the s	
	Channel Segment C-D (Trial)	29
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	Channel Segment Q-R	31
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Figure A-1 Pre-Development Drainage Map
Figure A-2 Pre-Development Slope Map



APPENDIX 6B.8.2

PORTION OF APPENDIX 6A-PRE-DEVELOPMENT CONDITIONS (FIGURE A-1 PRE-DEVELOPMENT DRAINAGE MAP) [ANNOTATED]



Part III, Attachment 6, Appendix 6B.8.2, p.g.-1

Kingsville Landfill Permit Amendment 235-B Attachment 6

Appendix 6B Final Development Conditions

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FlowMaster Hydraulic Worksheets		
Channel Segment K-H		10
Channel Segment R-U		11
Channel Segment Y-Z		12
Berm B3		13
Section D6		14
Section D3	19	15
Section D2		16
Section D1		17

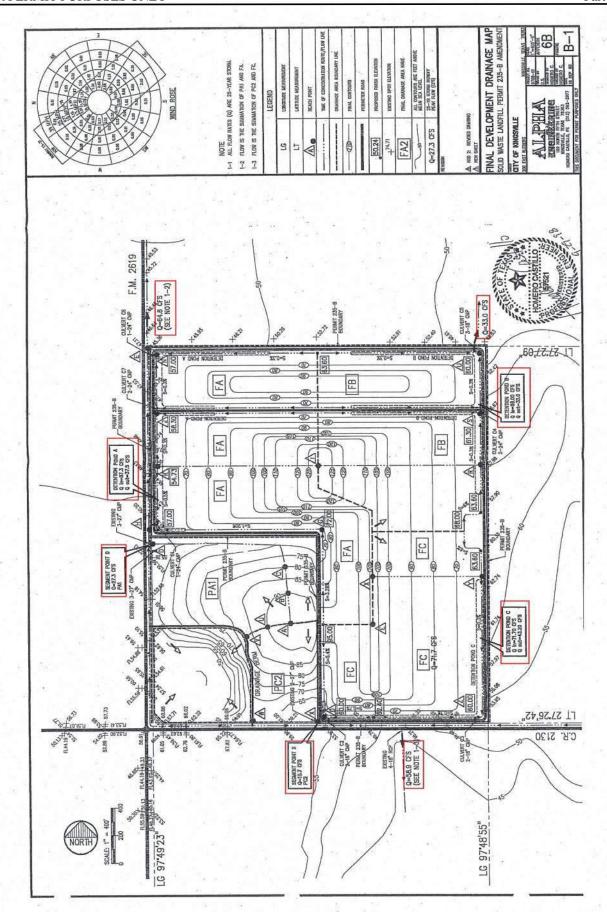
Figure B-1	Final Development Drainage Map
Figure B-2	Final Development Slope Map
Figure B-3	Final Cover Phase 1
Figure B-4	Perimeter Road and Berm Sections



APPENDIX 6B.8.3

PORTION OF APPENDIX 6B-FINAL DEVELOPMENT CONDITIONS (FIGURE B-1 FINAL DEVELOPMENT DRAINAGE MAP) [ANNOTATED]





Part III, Attachment 6, Appendix 6B.8.3, p.g.-1

Hanson Professional Services Inc. Submittal Date: September 2018 Revision: 0

APPENDIX 6B.8.4

PORTION OF APPENDIX 6C DETENTION PONDS AND DISCHARGE CULVERTS (25-YEAR STORM STRATEGY/COMPARATIVE SUMMARY OF PEAK FLOWS) [ANNOTATED]



Kingsville Landfill Permit Amendment 235-B Attachment 6

Appendix 6C Detention Ponds and Discharge Culverts

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Figure C-1 Detention Pond A Figure C-2 Detention Pond B Figure C-3 Detention Pond C



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Kingsville Landfill Permit 235-B Attachment 6

25-Year Stormwater Detention Strategy

W	1-4	~	-1	 H	Λ

 Pre-Development Conditions

 Area No.
 Peak Flow (cfs)

 PA2
 22.0

 PA3
 13.7

 Total
 35.7

	relopment Conditions fore detention)
Area No.	Peak Flow (cfs)
FA	87.3
Total	87.3

Maximum Final Development discharge for Watershed A shall not exceed 35.7 cfs

Watershed B

Pre-Development Conditions		
Area No.	Peak Flow (cfs)	
PB1	19.0	
PB2	4.3	
Total	23.3	

	relopment Conditions fore detention)
Area No.	Peak Flow (cfs)
FB	68.0
Total	68.0

Maximum Final Development discharge for Watershed B shall not exceed 23.3 cfs

Watershed C

Pre-Development Conditions	
Area No.	Peak Flow (cfs)
PC1	39.6
PC3	3.1
Total	42.7

	relopment Conditions
· (be	fore detention)
Area No.	Peak Flow (cfs)
FC	71.7

Total 71.7

Maximum Final Development discharge for Watershed B shall not exceed 42.7 cfs

Comparative Summary of Peak Flows

	Pre-Development 25-Year Peak Flow	Final Development 25-Year Peak Flow (after detention)
Watershed A	35.7 cfs	37.5 cfs
Watershed B	23.3 cfs	33.0 cfs
Watershed C	42.7 cfs	43.2 cfs

Appendix 6C May 1998 Revision 1

APPENDIX 6B.9

PERIMETER CHANNELS, COLLECTOR CHANNELS, AND CHUTES-25 YEAR SUMMARY TABLE



25 Year Perimeter Channels, Collector Channels, & Chutes Summary Table

23 Tear I	ermieter	er Channels, Collector Channels, & Chutes Summary Table																				
		· · · · · · · · · · · · · · · · · · ·	Begining			Ending				Trapezoidal, Triangular, Box, & Pipe Channels												
Channel ID	Length (FT)	Existing NG Elev	Depth (FT)	FL	Existing NG Elev	Slope (FT/FT)	FL	Depth (FT)	Base Width (Ft)	Avg Channel Depth (FT)	**Avg Channel Flow Depth (FT)	***Hydraulic Grade Elev	Freeboard (FT)	Bottom Slope (FT/FT)	Side Slope	Top Width (FT)	Manning n	Wetted Permeter (FT)	Area (SF)	Hydraulic Radius	Velocity (FPS)	Qp (CFS)
EAST																						
6CC	740.00	61.71	2.21	59.50	62.36	0.0040	56.54	5.82	2.00	4.02	0.77	60.27	1.4	0.0040	2.00	10.84	0.030	5.44	2.73	0.50	1.98	5.40
B1	464.00	62.36	4.00	56.54	65.59	0.0057	53.89	4.00	5.00	4.00	2.17	58.71	1.8	0.0057	0.00	5.00	0.013	9.34	10.85	1.16	9.57	103.85
100	222.00	65.59	11.70	53.89	61.74	0.0020	53.45	8.29	3.00	10.00	4.52	58.41	7.2	0.0020	2.00	49.80	0.030	23.21	54.42	2.34	3.90	212.35
B2	200.00	61.74	4.00	53.45	59.30	0.0183	49.80	4.00	5.00	4.00	2.44	55.85	1.6	0.0183	0.00	5.00	0.013	9.88	12.20	1.23	17.82	217.42
SOUTH																						
5CC	595.00	61.64	3.14	58.50	61.01	0.0015	57.61	3.40	2.00	3.27	0.97	59.47	2.2	0.0015	2.00	14.56	0.030	6.34	3.82	0.60	1.37	5.24
A2-1	250.50	61.01	3.40	57.61	60.16	0.0015	57.23	2.93	2.00	3.17	1.24	58.85	2.2	0.0015	2.00	15.60	0.030	7.55	5.56	0.74	1.58	8.76
A2~5	5.60	60.16	2.93	57,23	60.18	0.2482	55.84	4.34	2.00	3.64	0.30	57.53	2.6	0.2482	2.00	13.72	0.025	3.34	0.78	0.23	11.26	8 .78
A2-2	257.00	60.18	4.34	55.84	60.98	0.0020	55.33	5.65	7.00	5.00	2.54	58.37	1.8	0.0020	2.00	24.36	0.025	18.36	30.68	1.67	3.74	114.73
A2-3	582.00	60.98	5.65	55.33	60.40	0.0020	54.17	6.23	8.00	5.94	2.58	57.90	3,1	0.0020	2.00	30.60	0.030	19.54	33.95	1.74	3.20	108.82
NORTH																						
Ç2-3	882.00	57.50	4.00	53.50	57.50	0.0020	51.75	5.75	4.00	4.88	2,82	56.32	1.2	0.0020	2.00	20.00	0.030	16.61	27.18	1.64	3.07	83.52
P1	64.00	57.50	4.00	51.75	57.50	0.0100	51.11	4.00	4.00	4.00	1.97	53.72	2.0	0.0100	NA.	4.00	0.011	6.22	6.16	0.99	13.46	82.95
C2-5	106.00	53.61	2.50	51.11	50.50	0.0293	48.00	2.50	5.00	2.50	1.08	52.19	1.4	0.0293	4.00	25.00	0.025	13.91	10.07	0.72	8.23	82,84
C1SCCN1	285.00	60.00	1.50	58.50	60.00	0.0033	57.55	2.45	3.00	1.98	0.33	58.83	1.2	0.0033	2.00	9.00	0.030	4.48	1.21	0.27	1.20	1.45
C1SCCN2	287.50	60.00	1.50	58.50	60.00	0.0033	57.55	2.45	3.00	1.98	0.33	58.83	1.2	0.0033	2.00	9.00	0.030	4.48	1.21	0.27	1.19	1.44
P2	72.00	60.00	1.50	54.39	60.00	0.0150	53.31	1.50	1.50	1.50	0.44	54.83	1.1	0.0150	NΑ	1.50	0.011	1.72	0.43	0.25	6.61	2.86
C1SCCS1	280.00	60.00	1.50	58.50	60.00	0.0033	57.58	2.42	3.00	1.96	0.33	58.83	1.2	0.0033	2.00	9.00	0.030	4.48	1.21	0.27	1.19	1,44
C1SCCS2	280.00	60.00	1,50	58.50	60.00	0.0033	57.58	2.42	3.00	1.96	0.33	58.83	1.2	0.0033	2.00	9.00	0.030	4.48	1.21	0.27	1.19	1.44
P3	72.00	60.00	1.50	55.41	60.00	0.0150	54.33	1.50	1.50	1.50	0.44	55.85	1.1	0.0150	NA	1.50	0.011	1.72	0.43	0.25	6.61	2.86
WEST																						
2CC	650.00	57.70	3.20	54.50	59.94	0.0020	53.20	6.74	0.00	4.97	1.28	55.78	1.9	0.0020	3.00	19.20	0.030	8.10	4.92	0.61	1.59	7.83

	Length (FT)	Begining			Ending				Trapezoidal Channel													
*Chute ID		Existing Elev	Depth (FT)	FL	Existing Elev	Slope (FT/FT)	FL	Depth (FT)	Base Width (FT)	Avg Channel Depth	**Avg Channel Flow Depth (FT)	***Hydraulic Grade Elev	Freeboard (FT)	Bottom Slope (FT/FT)	Side Slope	Top Width (FT)	Manning n	Wetted Permeter (FT)	Area (SF)	Hydraulic Radius	Velocity (FPS)	Qp (CFS)
SE	450.00	176.00	2.00	174.00	63.54	0.2500	61.54	2.00	5.00	2.00	0.69	174.69	1.3	0.2500	4.00	21.00	0.025	10.69	5.35	0.50	18.79	100.64
SE1	62.00	63.54	2.00	61.54	58.54	0.0806	56.54	2.00	5.00	2.00	0.92	62.46	1.1	0.0806	4.00	21.00	0.025	12.59	7.99	0.63	12.49	99.77
S	451.00	176.00	2.00	174.00	61.25	0.2500	61.25	0.00	5.00	1.00	0.72	174.72	1.3	0.2500	4.00	21.00	0.025	10.94	5.67	0.52	19.24	109.15
SW	404.00	176.00	2.00	174.00	77.00	0.2500	73.00	4.00	5.00	3.00	0.67	174.67	1.3	0.2500	4.00	21.00	0.025	10.52	5.15	0.49	18.49	95.16
W	456.00	176.00	2.00	174.00	60.00	0.2500	60.00	0.00	5.00	1.00	0.78	174.78	1.2	0.2500	4.00	21.00	0.025	11.43	6.33	0.55	20.10	127.32
NW	456.00	176.00	2.00	174.00	60.00	0.2500	60.00	0.00	5.00	1.00	0.60	174.60	1.4	0.2500	4.00	21.00	0.025	9.95	4,44	0.45	17.40	77.27
NE	456.00	176.00	2.00	174.00	60.00	0.2500	60.00	0.00	5.00	1.00	0.66	174.66	1.3	0.2500	4.00	21.00	0.025	10.44	5.04	0.48	18.34	92.49
E	456.00	176.00	2.00	174.00	60.00	0.2500	60.00	0.00	5.00	1.00	0.71	174.71	1.3	0.2500	4.00	21.00	0.025	10.85	5.57	0.51	19.09	106.27
C1-4	76.00	51.80	2.00	49.80	33.00	0.2474	31.00	2.00	5.00	2.50	1.01	50.81	1.0	0.2474	4.00	21.00	0.025	13.33	9.13	0.69	23.04	210.33
C2-4	52.00	50.00	2.00	48.00	33.00	0.3269	31.00	2.00	5.00	2.00	0.58	48.58	1.4	0.3269	4.00	21.00	0.025	9.78	4.25	0.43	19.53	82.93
P2-1	60.00	56.15	1.50	53.31	32.50	0.3718	31.00	1.50	2.00	1.50	0.14	53.45	1.4	0.3718	3.00	11.00	0.025	2.89	0.34	0.12	8.71	2.95
P3-1	60.00	56.15	1.50	54.65	32.50	0.3942	31.00	1.50	2.00	1.50	0.14	54.79	1.4	0.3942	3.00	11.00	0.025	2.89	0.34	0.12	8.97	3.04
A2-4	250.00	56.17	2.00	54.17	38.75	0.0697	36.75	2.00	10.00	2.00	0.75	54.92	1.3	0.0697	4.00	26.00	0.025	16.18	9.75	0.60	11.22	109.41
SW-1	266.00	72.50	2.00	70.50	38.75	0.1269	36.75	2.00	5.00	2.00	0.80	71.30	1.2	0.1269	4.00	21.00	0.025	11.60	6.56	0.57	14.52	95.26
c c	160.00	55.20	2.00	53.20	38.75	0.1028	36.75	2.00	5.00	2.00	0.21	53.41	1.8	0.1028	4.00	21.00	0.025	6.73	1.23	0.18	6.14	7.53

^{*}Chutes-Precast Interlocking Articulating Concrete Blocks

^{**} Avg Channel Flow Depth Determined by HydroCAD

^{***} Hydraulic Grade Elevation Determined by HydroCAD

APPENDIX 6B.10

PERIMETER CHANNELS, COLLECTOR CHANNELS, AND CHUTES-100 YEAR SUMMARY TABLE



100 Year Perimeter Channels, Collector Channels, & Chutes Summary Table

			Begining			End	ing						Trapea	toidal, Triangul	lar, Box,	& Pipe Chani	nels					
Channel ID	Length (FT)	Existing NG Elev	Depth (FT)	FL	Existing NG Elev	Slope (FT/FT)	FL	Depth (FT)	Base Width (Ft)	Avg Channel Depth (FT)	**Avg Channel Flow Depth (FT)	***Hydraulic Grade Elev	Freeboard (FT)	Bottom Slope (FT/FT)	Side Slope	Top Width (FT)	Manning n	Wetted Permeter (FT)	Area (SF)	Hydraulic Radius	Velocity (FPS)	Qp (CFS)
EAST					·											***************************************						
6CC	740.00	61.71	2.21	59.50	62.36	0.0040	56.54	5.82	2.00	4.02	0.92	60.42	1.3	0.0040	2.00	10.84	0.030	6.11	3.53	0.58	2.18	7.70
B1.	464.00	62.36	4.00	56.54	65.59	0.0057	53.89	4.00	5.00	4.00	2.81	59,35	1.2	0.0057	0.00	5.00	0.013	10.62	14.05	1.32	10.44	146.66
1CC	222.00	65.59	11.70	53.89	61.74	0.0020	53.45	8.29	3.00	10.00	5.24	59.13	6.5	0.0020	2.00	49.80	0.030	26.43	70.64	2.67	4.26	300.75
82	200.00	61.74	4.00	53.45	59.30	0.0183	49.80	4.00	5.00	4.00	3.12	56.57	0.9	0.0183	0.00	5.00	0.013	11.24	15.60	1.39	19.27	300.54
SOUTH																						
5CC	595.00	61.64	3.14	58.50	61.01	0.0015	57.61	3.40	2.00	3.27	1.15	59.65	2.0	0.0015	2.00	14.56	0.030	7.14	4.95	0.69	1.50	7.43
A2-1	250.50	61.01	3.40	57.61	60.16	0.0015	57.2 3	2.93	2.00	3.17	1.48	59.09	1.9	0.0015	2.00	15.60	0.030	8.62	7.34	0.85	1.74	12.76
A2-5	5.60	60.16	2.93	57.23	60.18	0.2482	55.84	4.34	2.00	3.64	0.37	57.60	2.6	0.2482	2.00	13.72	0.025	3.65	1.01	0.28	12.63	12.80
A2-2	257.00	60.18	4.34	55.84	60.98	0.0020	55.33	5.65	7.00	5.00	3.02	58.86	1.3	0.0020	2.00	24.36	0.025	20.51	39.38	1.92	4.10	161.54
A2-3	582.00	60.98	5.65	55.33	60.40	0.0020	54.17	6.23	8.00	5.94	3.09	58.42	2.6	0.0020	2.00	30.60	0.030	21.82	43.82	2.01	3.53	154.64
NORTH																		-				L
C2-3	882.00	57.50	4.00	53.50	57.50	0.0020	51.75	5.75	4.00	4.88	3.32	56.82	0.7	0.0020	2.00	20.00	0.030	18.85	35.32	1.87	3.36	118.80
P1	64.00	57.50	4.00	51.75	57.50	0.0100	51.11	4.00	4.00	4.00	2.46	54.21	1.5	0.0100	NΑ	4.00	0.011	7.21	8.11	1.12	14.64	118.72
C2-5	106.00	53.61	2.50	51.11	50.50	0.0293	48.00	2.50	5.00	2.50	1.29	52.40	1.2	0.0293	4.00	25.00	0.025	15.64	13.11	0.84	9.08	118.94
C1SCCN1	285.00	60.00	1.50	58.50	60.00	0.0033	57.55	2.45	3.00	1.98	0.40	58.90	1.1	0.0033	2.00	9.00	0.030	4.79	1.52	0.32	1.33	2.03
C1SCCN2	287.50	60.00	1.50	58.50	60.00	0.0033	57.55	2.45	3.00	1.98	0.40	58.90	1.1	0.0033	2.00	9.00	0.030	4.79	1.52	0.32	1.33	2.02
P2	72.00	60.00	1.50	54.39	60.00	0.0150	53.31	1.50	1.50	1.50	0.53	54.92	1.0	0.0150	NA	1.50	0.011	1.91	0.56	0.29	7.31	4.08
C1SCCS1	280.00	60.00	1.50	58.50	60.00	0.0033	57.58	2.42	3.00	1.96	0.41	58.91	1.1	0.0033	2.00	9.00	0.030	4.83	1.57	0.32	1.34	2.10
C1SCCS2	280.00	60.00	1.50	58.50	60.00	0.0033	57.58	2.42	3.00	1.96	0.41	58.91	1.1	0.0033	2.00	9.00	0.030	4.83	1.57	0.32	1.34	2.10
Р3	72.00	60.00	1.50	55.41	60.00	0.0150	54.33	1.50	1.50	1.50	0.53	55.94	1.0	0.0150	NA	1.50	0.011	1.91	0.56	0.29	7.31	4.08
WEST																				<u> </u>		L
2CC	650.00	57.70	3.20	54.50	59.94	0.0020	53.20	6.74	0.00	4.97	1.46	55.96	1.7	0.0020	3.00	19.20	0.030	9.23	6.39	0.69	1.74	11.12

												Trapezoi	idal Char	inel								
*Chute 1D	Length (FT)	Existing Elev	Depth (FT)	FL	Existing Elev	Slope (FT/FT)	FL	Depth (FT)	Base Width (FT)	Avg Channel Depth	**Avg Channel Flow Depth (FT)	***Hydraulic Grade Elev	Freeboard (FT)	Bottom Slope (FT/FT)	Side Slope	Top Width (FT)	Manning n	Wetted Permeter (FT)	Area (SF)	Hydraulic Radius	Velocity (FPS)	Qp (CFS)
SE	450.00	176.00	2.00	174.00	63.54	0.2500	61.54	2.00	5.00	2.00	0.83	174.83	1.2	0.2500	4.00	21.00	0.025	11.84	6.91	0.58	20.80	143.62
SE1	62.00	63.54	2.00	61.54	58.54	0.0806	56.54	2.00	5.00	2.00	1.10	62.64	0.9	0.0806	4.00	21.00	0.025	14.07	10.34	0.73	13.78	142.47
5	451.00	176.00	2.00	174.00	61.25	0.2500	61.25	0.00	5.00	1.00	0.86	174.86	1.1	0.2500	4.00	21.00	0.025	12.09	7.26	0.60	21.21	153.92
SW	404.00	17 6 .00	2.00	174.00	77.00	0.2500	73.00	4.00	5.00	3.00	0.81	174.81	1.2	0.2500	4.00	21.00	0.025	11.68	6.67	0.57	20.52	136.97
W	456.00	176.00	2.00	174.00	60.00	0.2500	60.00	0.00	5.00	1.00	0.93	174.93	1.1	0.2500	4.00	21.00	0.025	12.67	8.11	0.64	22.13	179.50
NW	456.00	176.00	2.00	174.00	60.00	0.2500	60.00	0.00	5.00	1.00	0.72	174.72	1.3	0.2500	4.00	21.00	0.025	10.94	5.67	0.52	19.24	109.15
NE	456.00	17 6 .00	2.00	174.00	60.00	0.2500	60,00	0.00	5.00	1.00	0.79	174.79	1.2	0.2500	4.00	21.00	0.025	11.51	6.45	0.56	20.24	130.49
E	456.00	176.00	2.00	174.00	60.00	0.2500	60.00	0.00	5.00	1.00	0.85	174.85	1.2	0.2500	4.00	21.00	0.025	12.01	7.14	0.59	21.07	1 50.44
C1-4	76.00	51.80	2.00	49.80	33.00	0.2474	31.00	2.00	5.00	2.50	1.21	51.01	8.0	0.2474	4.00	21.00	0.025	14.98	11.91	0.79	25.44	302.89
C2-4	52.00	50.00	2.00	48.00	33.00	0.3269	31.00	2.00	5.00	2.00	0.70	48.70	1.3	0.3269	4.00	21.00	0.025	10.77	5.46	0.51	21.65	118.28
P2-1	60.00	56.15	1.50	53.31	32.50	0.3718	31.00	1.50	2.00	1.50	0.17	53.48	1.3	0.3718	3.00	11.00	0.025	3.08	0.43	0.14	9.74	4.16
P3-1	60.00	56.15	1.50	54.65	32.50	0.3942	31.00	1.50	2.00	1.50	0.17	54.82	1.3	0.3942	3.00	11.00	0.025	3.08	0.43	0.14	10.03	4.28
A2-4	250.00	56.17	2.00	54.17	38.75	0.0697	36.75	2.00	10.00	2.00	0.91	55.08	1.1	0.0697	4.00	26.00	0.025	17.50	12.41	0.71	12.51	155.29
5W-1	266.00	72.50	2.00	70.50	38.75	0.1269	36.75	2.00	5.00	2.00	0.96	71.46	1.0	0.1269	4.00	21.00	0.025	12,92	8.49	0.66	16.05	136.17
cc	160.00	55.20	2.00	53.20	38.75	0.1028	36.75	2.00	5.00	2.00	0.26	54.46	1.7	0.1028	4.00	21.00	0.025	7.14	1.57	0.22	6.96	10.93

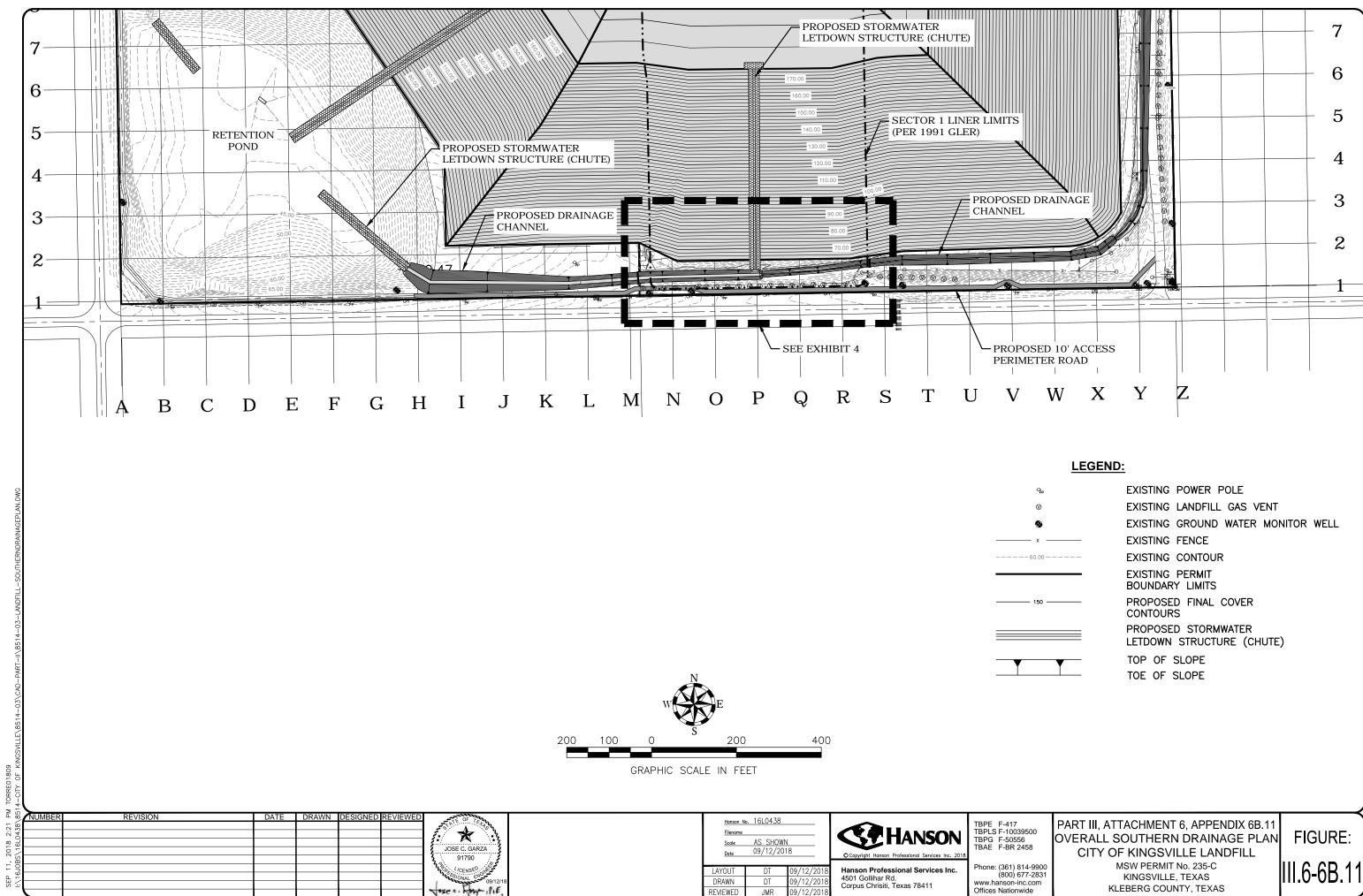
^{*}Chutes-Precast Interlocking Articulating Concrete Blocks

^{**} Avg Channel Flow Depth Determined by HydroCAD

^{***} Hydraulic Grade Elevation Determined by HydroCAD

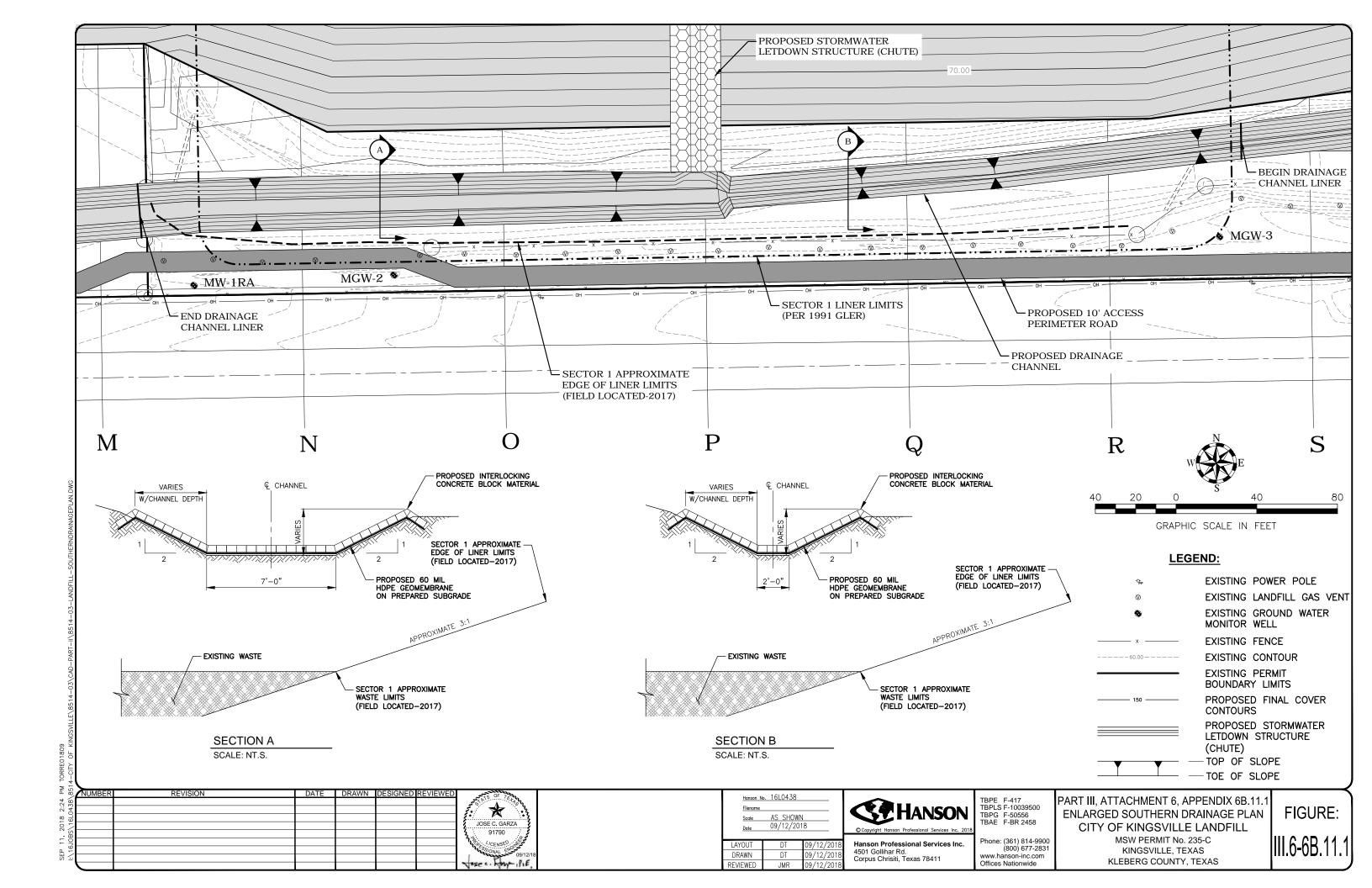
APPENDIX 6B.11 FIGURE 1 OVERALL SOUTHERN DRAINAGE PLAN





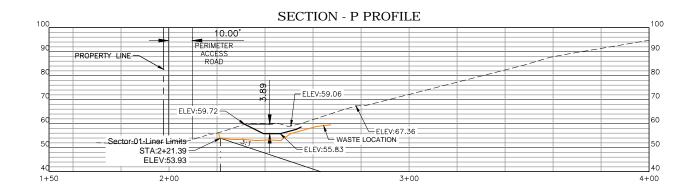
APPENDIX 6B.11.1 FIGURE 2 ENLARGED SOUTHERN DRAINAGE PLAN

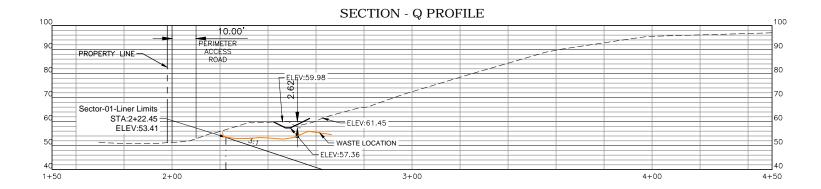


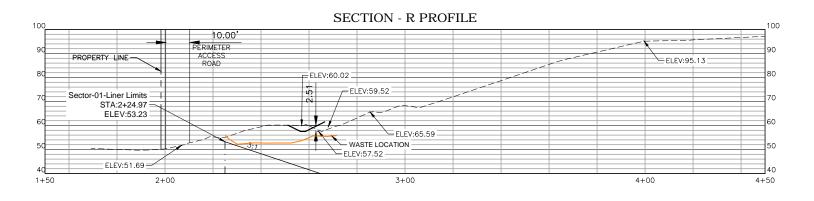


APPENDIX 6B.11.2 FIGURE 3 CROSS SECTIONS











NUMBER	REVISION	DATE	DRAWN	DESIGNED	REVIEWED	OF CALL
						F
						<i>f.</i> 🖈
						<i>3*</i>
						JOSE C. GARZ
						91790
						CENSED
						SSIONAL ENG
						Mary Mary
						MARC C. HAWA

١	Hanson No.	16L0438
- 1	Filename	
- 1	Scale	AS SHOWN
١	Date	09/12/2018
- 1		

DT

09/12/20

DRAWN

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PART III, ATTACHMENT 6, APPENDIX 6B.11.2 CROSS SECTIONS CITY OF KINGSVILLE LANDFILL MSW PERMIT No. 235-C

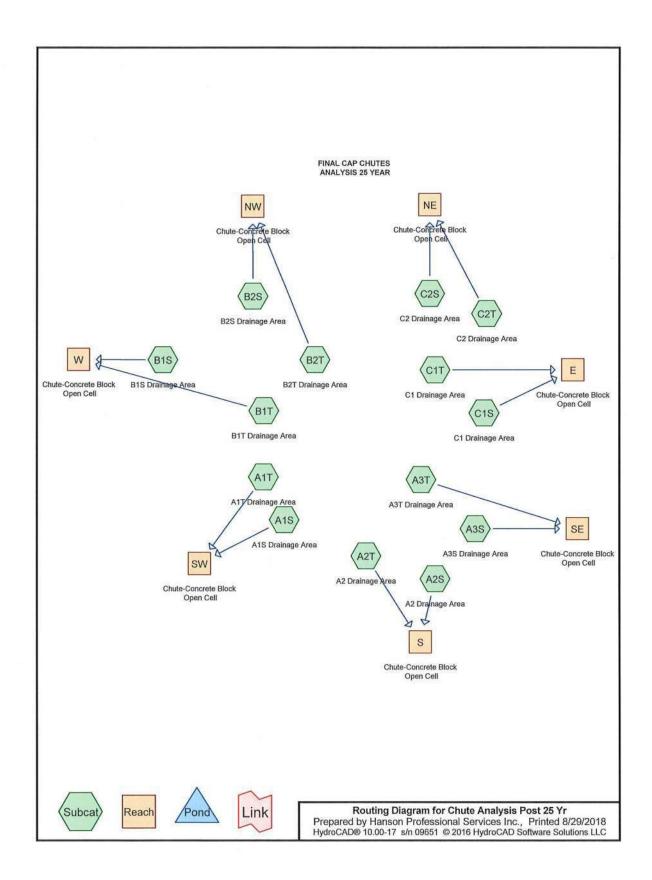
KINGSVILLE, TEXAS

KLEBERG COUNTY, TEXAS

FIGURE:

APPENDIX 6B.12 HYDROCAD MODEL 25 YEAR POST DEVELOPMENT CHUTES





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Area Listing (all nodes)

	Area (acres)	CN	Description (subcatchment-numbers)
38-	119.627	79	50-75% Grass cover, Fair, HSG C (A1S, A1T, A2S, A2T, A3S, A3T, B1S, B1T,
			B2S, B2T, C1S, C1T, C2S, C2T)
	119.627	79	TOTAL AREA

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Soil Listing (all nodes)

	Area (acres)	Soil Group	Subcatchment Numbers
2.5	0.000	HSG A	
	0.000	HSG B	
	119.627	HSG C	A1S, A1T, A2S, A2T, A3S, A3T, B1S, B1T, B2S, B2T, C1S, C1T, C2S, C2T
	0.000	HSG D	
	0.000	Other	
	119.627		TOTAL AREA

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Ground Covers (all nodes)

	HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
8	0.000	0.000	119.627	0.000	0.000	119.627	50-75% Grass cover, Fair	A1S,
								A1T,
								A2S,
								A2T,
								A3S,
								A3T,
								B1S,
								B1T,
								B2S,
								B2T,
								C1S,
								C1T,
								C2S,
								C2T
	0.000	0.000	119.627	0.000	0.000	119.627	TOTAL AREA	

Type III 24-hr 25-Year Rainfall=8.70"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Reach routing by Stor-Ind+Trans method - Folid routing by Stor-Ind method
Subcatchment A1S: A1S Drainage Area Runoff Area=8.009 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=49.80 cfs 4.113 af
Subcatchment A1T: A1T Drainage Area Runoff Area=7.425 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=46.16 cfs 3.813 af
Subcatchment A2S: A2 Drainage Area Runoff Area=12.241 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=76.11 cfs 6.287 af
Subcatchment A2T: A2 Drainage Area Runoff Area=5.120 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=31.83 cfs 2.629 af
Subcatchment A3S: A3S Drainage Area Runoff Area=10.760 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=66.90 cfs 5.526 af
Subcatchment A3T: A3T Drainage Area Runoff Area=7.489 ac 0.00% Impervious Runoff Depth=6.16" Flow Length=1,050' Tc=16.7 min CN=79 Runoff=38.81 cfs 3.846 af
Subcatchment B1S: B1S Drainage Area Runoff Area=14.884 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=92.54 cfs 7.644 af
Subcatchment B1T: B1T Drainage Area Runoff Area=7.499 ac 0.00% Impervious Runoff Depth=6.16" Flow Length=950' Tc=16.0 min CN=79 Runoff=39.52 cfs 3.851 af
Subcatchment B2S: B2S Drainage Area Runoff Area=8.806 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=54.75 cfs 4.522 af
Subcatchment B2T: B2T Drainage Area Runoff Area=4.309 ac 0.00% Impervious Runoff Depth=6.16" Flow Length=850' Tc=13.7 min CN=79 Runoff=24.07 cfs 2.213 af
Subcatchment C1S: C1 Drainage Area Runoff Area=11.506 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=71.54 cfs 5.909 af
Subcatchment C1T: C1 Drainage Area Runoff Area=6.292 ac 0.00% Impervious Runoff Depth=6.16" Flow Length=800' Tc=12.5 min CN=79 Runoff=36.29 cfs 3.231 af
Subcatchment C2S: C2 Drainage Area Runoff Area=10.038 ac 0.00% Impervious Runoff Depth=6.16" Tc=10.0 min CN=79 Runoff=62.41 cfs 5.155 af
Subcatchment C2T: C2 Drainage Area Runoff Area=5.249 ac 0.00% Impervious Runoff Depth=6.16" Flow Length=800' Tc=12.5 min CN=79 Runoff=30.27 cfs 2.696 af
Reach E: Chute-Concrete Block n=0.025
Reach NE: Chute-Concrete Block n=0.025

Type III 24-hr 25-Year Rainfall=8.70"

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Reach NW: Chute-Concrete Block Avg. Flow Depth=0.60' Max Vel=17.38 fps Inflow=77.52 cfs 6.735 af n=0.025 L=456.0' S=0.2500'/' Capacity=877.30 cfs Outflow=77.39 cfs 6.735 af

Avg. Flow Depth=0.72' Max Vel=19.13 fps Inflow=107.94 cfs 8.916 af Reach S: Chute-Concrete Block n=0.025 L=451.0' S=0.2500 '/' Capacity=877.30 cfs Outflow=107.71 cfs 8.916 af

Avg. Flow Depth=0.69' Max Vel=18.76 fps Inflow=100.71 cfs 9.372 af Reach SE: Chute-Concrete Block n=0.025 L=441.7' S=0.2500 '/' Capacity=877.36 cfs Outflow=100.58 cfs 9.372 af

Avg. Flow Depth=0.67' Max Vel=18.50 fps Inflow=95.96 cfs 7.926 af Reach SW: Chute-Concrete Block n=0.025 L=406.0' S=0.2500 '/' Capacity=877.30 cfs Outflow=95.76 cfs 7.926 af

Avg. Flow Depth=0.78' Max Vel=20.06 fps Inflow=127.46 cfs 11.495 af Reach W: Chute-Concrete Block n=0.025 L=456.0' S=0.2500 '/' Capacity=877.30 cfs Outflow=127.28 cfs 11.495 af

> Total Runoff Area = 119.627 ac Runoff Volume = 61.436 af Average Runoff Depth = 6.16" 100.00% Pervious = 119.627 ac 0.00% Impervious = 0.000 ac

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment A1S: A1S Drainage Area

Use Conservative Value of Tc=10 min.

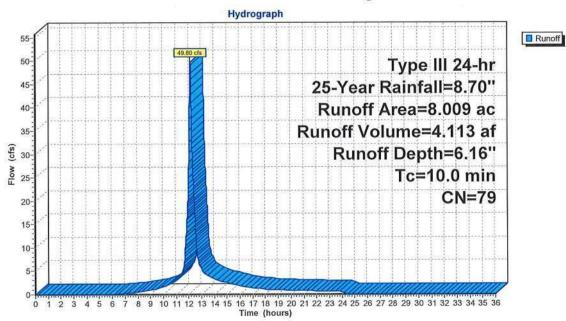
Runoff = 49.80 cfs @ 12.14 hrs, Volume=

4.113 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac) C	N Des	cription		
8.	009	79 50-7	5% Grass	cover, Fair	, HSG C
8.	009	100.	00% Pervi	ous Area	
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	W - W				Direct Entry, A1S-Chute Flow Evaluation

Subcatchment A1S: A1S Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment A1T: A1T Drainage Area

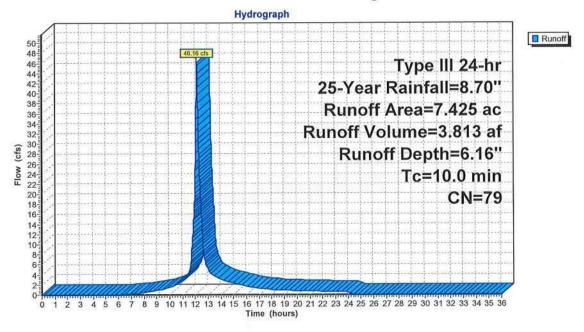
Runoff = 46.16 cfs @ 12.14 hrs, Volume=

3.813 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	cription		
7.	425	79	50-7	5% Grass	cover, Fair	r, HSG C
7.	425		100.	00% Pervi	ous Area	
Tc (min)	Leng (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0				No.		Direct Entry, A1T-Chute Flow Evaluation

Subcatchment A1T: A1T Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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76.11 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment A2S: A2 Drainage Area

Use Conservative Value of Tc=10 min.

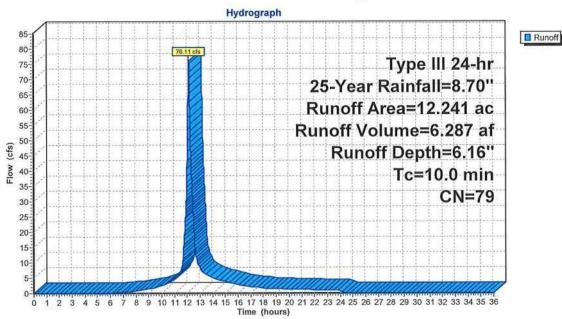
Runoff

6.287 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	cription			
12.	241	79	50-7	5% Grass	cover, Fair,	, HSG C	
12.	241		100.	00% Pervi	ous Area		
Tc (min)	Leng (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
10.0						Direct Entry A2 Drainage Area	

Subcatchment A2S: A2 Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment A2T: A2 Drainage Area

Runoff

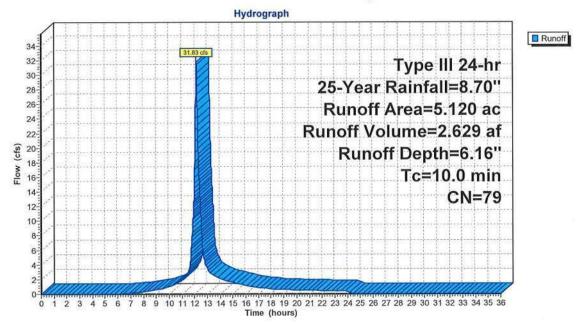
31.83 cfs @ 12.14 hrs, Volume=

2.629 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Desc	cription								
5	.120	79	9 50-75% Grass cover, Fair, HSG C									
5	.120		100.	00% Pervi	ous Area							
Tc (min)	Lengt (fee	1	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description						
10.0						Direct Entry, A2 Drainage Area						

Subcatchment A2T: A2 Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment A3S: A3S Drainage Area

Use Conservative Value of Tc=10 min.

Runoff

10.0

66.90 cfs @ 12.14 hrs, Volume=

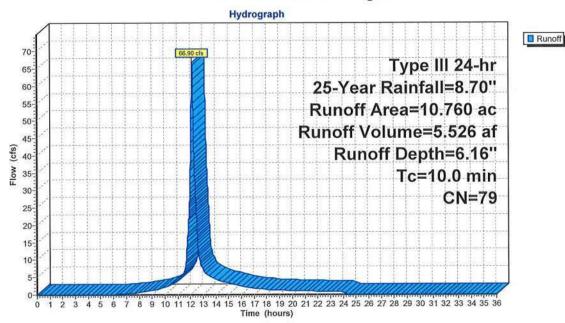
5.526 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

77-	Area	(ac)	CN	Desc	cription			
02.0	10.	760	79	50-7	5% Grass	cover, Fair	r, HSG C	
	10.	760		100.	00% Pervi	ous Area		
	Tc (min)	Leng (fee		Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	

Direct Entry, A3S-Chute Flow Evaluation

Subcatchment A3S: A3S Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment A3T: A3T Drainage Area

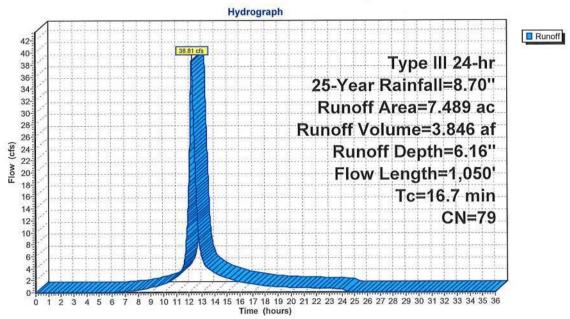
Runoff = 38.81 cfs @ 12.23 hrs, Volume=

3.846 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac) C	N Des	cription		
7.	489 7	9 50-7	5% Grass	cover, Fair	r, HSG C
7.	489	100.	00% Pervi	ous Area	
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	750		1.30		Direct Entry, A3T-Chute Flow Evaluation
7.1	300		0.70		Direct Entry,
16.7	1.050	Total			

Subcatchment A3T: A3T Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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92.54 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment B1S: B1S Drainage Area

Use Conservative Value of Tc=10 min.

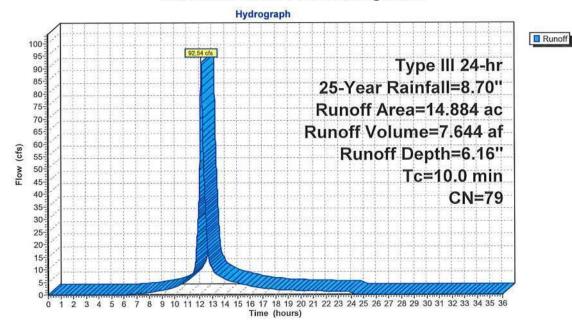
Runoff

7.644 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN	Des	cription		
14.	884	79	50-7	5% Grass	cover, Fair,	HSG C
14.	884		100.	00% Pervi	ous Area	
Tc	0				THE RESERVE THE PROPERTY OF THE PERSON OF TH	Description
(min)	(fee	et)	(ft/ft)	(ft/sec)	(cfs)	
10.0						Direct Entry, B1S-Chute Flow Evaluation

Subcatchment B1S: B1S Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment B1T: B1T Drainage Area

Runoff

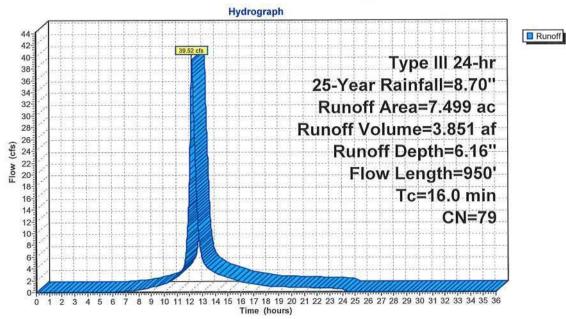
39.52 cfs @ 12.21 hrs, Volume=

3.851 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac) C	N Des	cription		
7.499		9 50-7	5% Grass	cover, Fair	HSG C
7.	499	100.	00% Pervi	ous Area	
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	600		1.30		Direct Entry, B1T-Chute Flow Evaluation
8.3	350		0.70		Direct Entry,
16.0	950	Total		•	

Subcatchment B1T: B1T Drainage Area



Runoff

Chute Analysis Post 25 Yr

Type III 24-hr 25-Year Rainfall=8.70"

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54.75 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment B2S: B2S Drainage Area

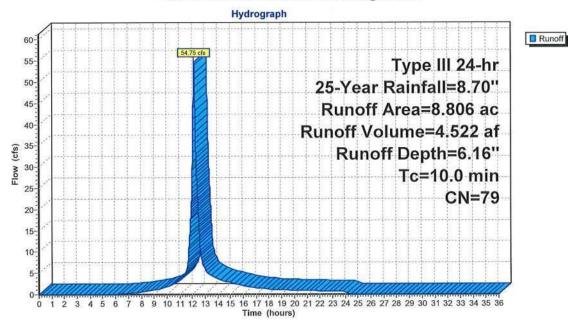
Use Conservative Value of Tc=10 min.

4.522 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN D	escription		
8.	.806	79 5	0-75% Grass	cover, Fair	, HSG C
8	.806	1	00.00% Perv	ious Area	
Tc (min)	Length (feet)		기계의 기가 있었다면 보고 하다.	Capacity (cfs)	Description
10.0					Direct Entry, B2S-Chute Flow Evaluation

Subcatchment B2S: B2S Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment B2T: B2T Drainage Area

Runoff =

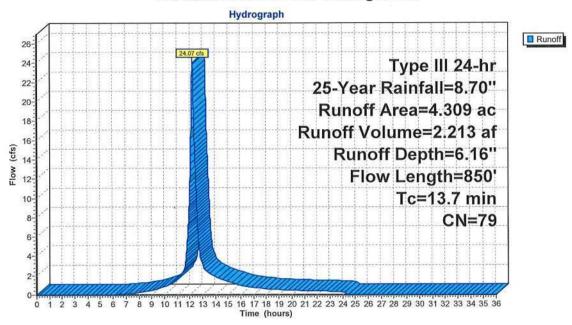
24.07 cfs @ 12.19 hrs, Volume=

2.213 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac) C	N Des	cription		
4.	.309	79 50-7	5% Grass	cover, Fair	, HSG C
4.	.309	100.	00% Pervi	ous Area	
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7 6.0	600 250		1.30 0.70		Direct Entry, B2T-Chute Flow Evaluation Direct Entry,
13.7	850	Total			

Subcatchment B2T: B2T Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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71.54 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment C1S: C1 Drainage Area

Use Conservative Value of Tc=10 min.

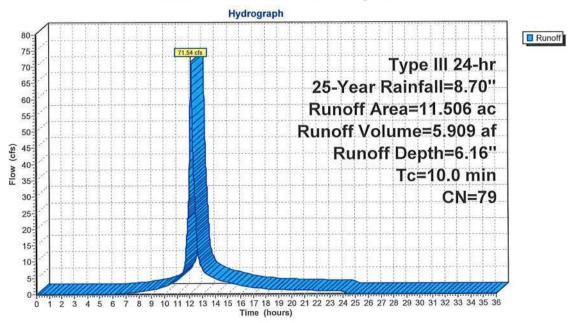
Runoff

5.909 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac)	CN De	escription			
11	.506	79 50	-75% Grass	cover, Fair	r, HSG C	
11	.506	10	0.00% Perv	ious Area		
Tc (min)	Length (feet			Capacity (cfs)	Description	
10.0	1.55				Direct Entry, C1 Drainage Area	

Subcatchment C1S: C1 Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment C1T: C1 Drainage Area

Runoff = 36.29 cfs

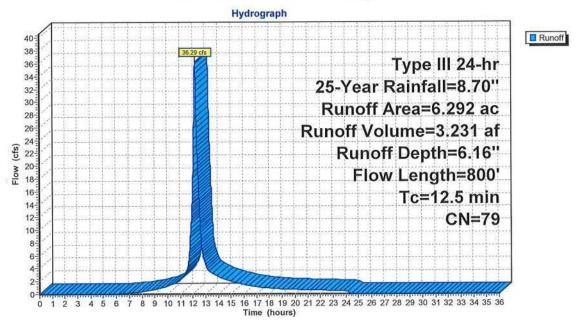
36.29 cfs @ 12.17 hrs, Volume=

3.231 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac) C	N Des	cription					
6.	292 7	9 50-7	50-75% Grass cover, Fair, HSG C					
6.	292	100.	00% Pervi	ous Area				
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description			
7.7	600		1.30		Direct Entry, C1 Drainage Area			
4.8	200		0.70		Direct Entry,			
12.5	800	Total						

Subcatchment C1T: C1 Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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62.41 cfs @ 12.14 hrs, Volume=

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Summary for Subcatchment C2S: C2 Drainage Area

Use Conservative Value of Tc=10 min.

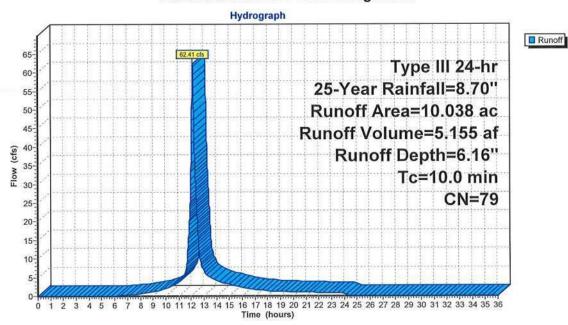
Runoff

5.155 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac) C	N Des	cription			
10	.038 7	9 50-7	5% Grass	cover, Fair	, HSG C	
10	.038	100.	00% Pervi	ious Area		
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
10.0				The second second	Direct Entry, C2 Drainage Area	

Subcatchment C2S: C2 Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Subcatchment C2T: C2 Drainage Area

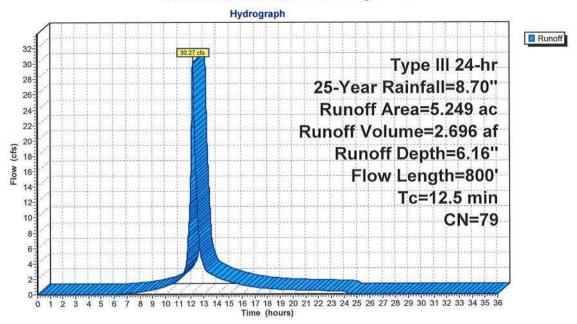
Runoff = 30.27 cfs @ 12.17 hrs, Volume=

2.696 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=8.70"

Area	(ac) C	N Des	cription			
5.	249 7	9 50-75% Grass cover, F			, HSG C	
5.	.249	100.	00% Pervi	ous Area		
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
7.7	600		1.30		Direct Entry, C2 Drainage Area	
4.8	200		0.70		Direct Entry,	
12.5	800	Total				

Subcatchment C2T: C2 Drainage Area



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach E: Chute-Concrete Block Open Cell

Inflow Area = 17.798 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 106.93 cfs @ 12.15 hrs, Volume= 9.140 af

Outflow = 106.72 cfs @ 12.16 hrs, Volume= 9.140 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

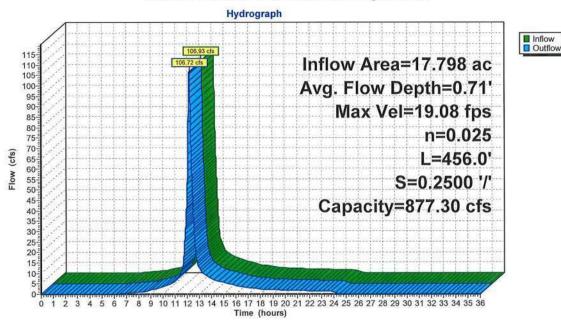
Max. Velocity= 19.08 fps, Min. Travel Time= 0.4 min Avg. Velocity = 5.95 fps, Avg. Travel Time= 1.3 min

Peak Storage= 2,552 cf @ 12.15 hrs Average Depth at Peak Storage= 0.71' Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.30 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented Side Slope Z-value= 4.0 '/' Top Width= 21.00' Length= 456.0' Slope= 0.2500 '/' Inlet Invert= 172.00', Outlet Invert= 58.00'



Reach E: Chute-Concrete Block Open Cell



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach NE: Chute-Concrete Block Open Cell

Inflow Area = 15.287 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 91.93 cfs @ 12.15 hrs, Volume= 7.851 af

Outflow = 91.74 cfs @ 12.16 hrs, Volume= 7.851 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 18.27 fps, Min. Travel Time= 0.4 min Avg. Velocity = 5.65 fps, Avg. Travel Time= 1.3 min

Peak Storage= 2,292 cf @ 12.15 hrs Average Depth at Peak Storage= 0.66' Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.30 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

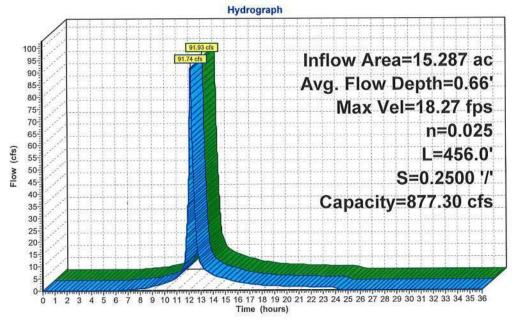
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 456.0' Slope= 0.2500 '/'

Inlet Invert= 172.00', Outlet Invert= 58.00'



Reach NE: Chute-Concrete Block Open Cell



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach NW: Chute-Concrete Block Open Cell

Inflow Area = 13.115 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 77.52 cfs @ 12.15 hrs, Volume= 6.735 af

Outflow = 77.39 cfs @ 12.16 hrs, Volume= 6.735 af, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 17.38 fps, Min. Travel Time= 0.4 min Avg. Velocity = 5.36 fps, Avg. Travel Time= 1.4 min

Peak Storage= 2,032 cf @ 12.15 hrs Average Depth at Peak Storage= 0.60' Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.30 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

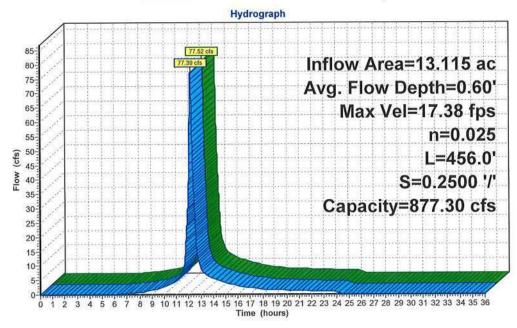
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 456.0' Slope= 0.2500 '/'

Inlet Invert= 172.00', Outlet Invert= 58.00'



Reach NW: Chute-Concrete Block Open Cell



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach S: Chute-Concrete Block Open Cell

Inflow Area = 17.361 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 107.94 cfs @ 12.14 hrs, Volume= 8.916 af

Outflow = 107.71 cfs @ 12.15 hrs, Volume= 8.916 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 19.13 fps, Min. Travel Time= 0.4 min Avg. Velocity = 5.91 fps, Avg. Travel Time= 1.3 min

Peak Storage= 2,541 cf @ 12.14 hrs Average Depth at Peak Storage= 0.72' Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.30 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

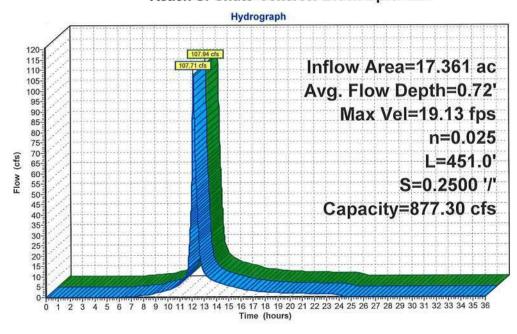
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 451.0' Slope= 0.2500 '/'

Inlet Invert= 172.00', Outlet Invert= 59.25'



Reach S: Chute-Concrete Block Open Cell



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach SE: Chute-Concrete Block Open Cell

Inflow Area = 18.249 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 100.71 cfs @ 12.16 hrs, Volume= 9.372 af

Outflow = 100.58 cfs @ 12.17 hrs, Volume= 9.372 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 18.76 fps, Min. Travel Time= 0.4 min Avg. Velocity = 5.97 fps, Avg. Travel Time= 1.2 min

Peak Storage= 2,370 cf @ 12.16 hrs Average Depth at Peak Storage= 0.69' Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.36 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

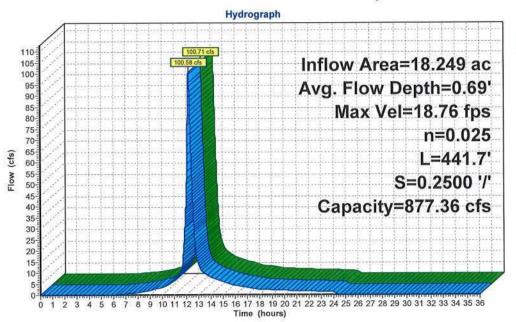
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 441.7' Slope= 0.2500 '/'

Inlet Invert= 172.00', Outlet Invert= 61.56'



Reach SE: Chute-Concrete Block Open Cell



Inflow
Outflow

Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach SW: Chute-Concrete Block Open Cell

Inflow Area = 15.434 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 95.96 cfs @ 12.14 hrs, Volume= 7.926 af

Outflow = 95.76 cfs @ 12.15 hrs, Volume= 7.926 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 18.50 fps, Min. Travel Time= 0.4 min Avg. Velocity = 5.68 fps, Avg. Travel Time= 1.2 min

Peak Storage= 2,104 cf @ 12.14 hrs Average Depth at Peak Storage= 0.67'

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.30 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

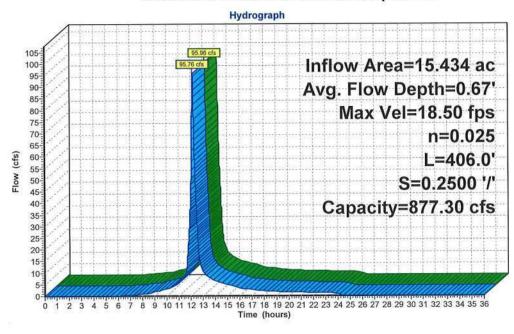
Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 406.0' Slope= 0.2500 '/'

Inlet Invert= 172.00', Outlet Invert= 70.50'



Reach SW: Chute-Concrete Block Open Cell



Type III 24-hr 25-Year Rainfall=8.70"

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Summary for Reach W: Chute-Concrete Block Open Cell

Inflow Area = 22.383 ac, 0.00% Impervious, Inflow Depth = 6.16" for 25-Year event

Inflow = 127.46 cfs @ 12.15 hrs, Volume= 11.495 af

Outflow = 127.28 cfs @ 12.16 hrs, Volume= 11.495 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 20.06 fps, Min. Travel Time= 0.4 min Avg. Velocity = 6.41 fps, Avg. Travel Time= 1.2 min

Peak Storage= 2,895 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.78'

Peak Full Depth = 2.00', Flow Area = 26.0 sf. Cana

Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 877.30 cfs

5.00' x 2.00' deep channel, n= 0.025 Rubble masonry, cemented

Side Slope Z-value= 4.0 '/' Top Width= 21.00'

Length= 456.0' Slope= 0.2500 '/'

Inlet Invert= 172.00', Outlet Invert= 58.00'



Reach W: Chute-Concrete Block Open Cell

