

Annexe A - HELP Simul A-1 Ce10UV16%(drain at field cap).txt

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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\DATA4.D4
TEMPERATURE DATA FILE: C:\HELP3\DATA7.D7
SOLAR RADIATION DATA FILE: C:\HELP3\DATA13.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\DATA11.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\DATA10.D10
OUTPUT DATA FILE: C:\HELP3\RCRA.OUT

TIME: 11:11 DATE: 1/14/2003

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

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 43
THICKNESS = 15.00 CM
POROSITY = 0.4370 VOL/VOL
FIELD CAPACITY = 0.0620 VOL/VOL
WILTING POINT = 0.0240 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0620 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.700000022000E-02 CM/SEC

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER

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MATERIAL TEXTURE NUMBER 0
THICKNESS = 3700.00 CM
POROSITY = 0.6000 VOL/VOL
FIELD CAPACITY = 0.2600 VOL/VOL
WILTING POINT = 0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.1600 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 1
THICKNESS = 50.00 CM
POROSITY = 0.4170 VOL/VOL
FIELD CAPACITY = 0.0450 VOL/VOL
WILTING POINT = 0.0180 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0450 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.999999978000E-02 CM/SEC
SLOPE = 2.00 PERCENT
DRAINAGE LENGTH = 75.0 METERS

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER

MATERIAL TEXTURE NUMBER 35
THICKNESS = 0.20 CM
POROSITY = 0.0000 VOL/VOL
FIELD CAPACITY = 0.0000 VOL/VOL
WILTING POINT = 0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY = 0.00 HOLES/HECTARE
FML INSTALLATION DEFECTS = 0.00 HOLES/HECTARE
FML PLACEMENT QUALITY = 2 - EXCELLENT

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 0 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 3.% AND A SLOPE LENGTH OF 100. METERS.

SCS RUNOFF CURVE NUMBER = 0.00
FRACTION OF AREA ALLOWING RUNOFF = 0.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE = 1.0000 HECTARES
EVAPORATIVE ZONE DEPTH = 14.0 CM
INITIAL WATER IN EVAPORATIVE ZONE = 0.868 CM
UPPER LIMIT OF EVAPORATIVE STORAGE = 6.118 CM
LOWER LIMIT OF EVAPORATIVE STORAGE = 0.336 CM
INITIAL SNOW WATER = 0.000 CM

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 INITIAL WATER IN LAYER MATERIALS = 595.180 CM
 TOTAL INITIAL WATER = 595.180 CM
 TOTAL SUBSURFACE INFLOW = 0.00 MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
 BERTHIERVILLE QUEBEC

STATION LATITUDE = 46.00 DEGREES
 MAXIMUM LEAF AREA INDEX = 1.00
 START OF GROWING SEASON (JULIAN DATE) = 120
 END OF GROWING SEASON (JULIAN DATE) = 300
 EVAPORATIVE ZONE DEPTH = 14.0 CM
 AVERAGE ANNUAL WIND SPEED = 15.00 KPH
 AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 70.00 %
 AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 66.00 %
 AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
 AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 75.00 %

NOTE: PRECIPITATION DATA FOR BERTHIERVILLE QUEBEC
 WAS ENTERED BY THE USER.

NOTE: TEMPERATURE DATA FOR BERTHIERVILLE QUEBEC
 WAS ENTERED BY THE USER.

NOTE: SOLAR RADIATION DATA FOR BERTHIERVILLE QUEBEC
 WAS ENTERED BY THE USER.

ANNUAL TOTALS FOR YEAR 1

	MM	CU. METERS	PERCENT
PRECIPITATION	959.00	9590.000	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	264.201	2642.013	27.55
DRAINAGE COLLECTED FROM LAYER 3	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0000		
CHANGE IN WATER STORAGE	694.799	6947.992	72.45
SOIL WATER AT START OF YEAR	5960.584	59605.836	

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 SOIL WATER AT END OF YEAR 6538.360 65383.598

SNOW WATER AT START OF YEAR 0.000 0.000 0.00
 SNOW WATER AT END OF YEAR 117.023 1170.232 12.20
 ANNUAL WATER BUDGET BALANCE -0.0005 -0.005 0.00

ANNUAL TOTALS FOR YEAR 2

	MM	CU. METERS	PERCENT
PRECIPITATION	959.50	9594.998	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	433.868	4338.683	45.22
DRAINAGE COLLECTED FROM LAYER 3	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0000		
CHANGE IN WATER STORAGE	525.632	5256.316	54.78
SOIL WATER AT START OF YEAR	6538.360	65383.598	
SOIL WATER AT END OF YEAR	7068.581	70685.805	
SNOW WATER AT START OF YEAR	117.023	1170.232	12.20
SNOW WATER AT END OF YEAR	112.434	1124.337	11.72
ANNUAL WATER BUDGET BALANCE	-0.0001	-0.001	0.00

AVERAGE MONTHLY VALUES (MM) FOR YEARS 1 THROUGH 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	71.90 88.20	44.70 83.65	65.20 85.45	61.85 61.40	72.00 138.85	85.40 100.65
STD. DEVIATIONS	4.38	29.13	47.52	25.81	22.49	12.73

RUNOFF

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

EVAPOTRANSPIRATION

TOTALS	9.336 47.307	6.497 59.407	16.540 36.722	17.898 23.487	60.084 17.127	46.476 8.154
STD. DEVIATIONS	1.977 60.217	1.231 22.461	2.602 9.307	6.645 4.693	20.831 1.494	4.047 2.243

LATERAL DRAINAGE COLLECTED FROM LAYER 3

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

PERCOLATION/LEAKAGE THROUGH LAYER 4

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

 AVERAGES OF MONTHLY AVERAGED DAILY HEADS (CM)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

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

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 2

	MM		CU. METERS	PERCENT
PRECIPITATION	959.25	(0.000)	9592.5	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	349.035	(119.9727)	3490.35	36.386

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LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.00000 (0.00000)	0.000	0.00000
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00000 (0.00000)	0.000	0.00000
AVERAGE HEAD ON TOP OF LAYER 4	0.000 (0.000)		
CHANGE IN WATER STORAGE	610.215 (4.7094)	6102.15	63.614

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PEAK DAILY VALUES FOR YEARS	1 THROUGH	2
	(MM)	(CU. METERS)
PRECIPITATION	37.90	379.000
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.00000	0.00000
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000000	0.00000
AVERAGE HEAD ON TOP OF LAYER 4	0.000	
MAXIMUM HEAD ON TOP OF LAYER 4	0.000	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 METERS	
SNOW WATER	205.93	2059.2656
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.4370
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.0240

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

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

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FINAL WATER STORAGE AT END OF YEAR 2

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LAYER	(CM)	(VOL/VOL)
1	1.8592	0.1239
2	701.8705	0.1897
3	2.2500	0.0450
4	0.0000	0.0000
SNOW WATER	11.243	

