

Appendix C
Sump Design Calculations



Type II Waste Rock Storage Area

Storage Pad & Sump Size Determination

- Purpose:
- 1) Evaluate the ability of storage pad to handle a 100 year storm without overlapping perimeter berm.
 - 2) Determine the required size of sump to store peak monthly average leachate generation with 6 pumping cycles per day.

Data:

- Area of Type II Storage Pad = 285,500 ft² — CAAD Source
 - 100 year storm = 5 inches — Figure 1
 - Peak monthly Average Leachate generation = 1.4208" — HELP
 - porosity of waste rock = 0.4
- Results**
(Attachment C1)

Calculations:

1) The storage volume available (see Fig. A) = 48,200 cy (CAAD)

Available Storage Volume = 48,200 cy

$$= 48,200 \text{ cy} \times \frac{27 \text{ ft}^3}{\text{cy}} \times \frac{7.48 \text{ gal}}{\text{ft}^3} \times 0.4$$

$$= \underline{\underline{3,894,000 \text{ gal}}}$$

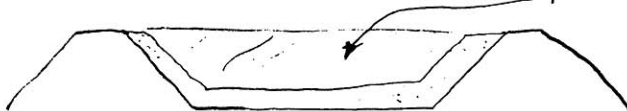


Figure A

$$\text{required storage volume} = 285,500 \text{ ft}^2 \times \frac{5 \text{ in}}{12 \frac{\text{in}}{\text{ft}}} \times \frac{7.48 \text{ gal}}{\text{ft}^3}$$

$$= \underline{\underline{889,800 \text{ gal}}}$$

∴ 3,894,000 gal > 889,800 gal, storage capacity is adequate



2) Sump Sizing

$$\text{Volume / sump / day} = 285,500 \text{ ft}^2 \left(\frac{1.4208 \text{ in}^3}{12 \text{ in/ft}} \right) \left(\frac{12 \text{ mon}}{\text{yr}} \right) \left(\frac{1 \text{ yr}}{365 \text{ day}} \right)$$

$$= \underline{\underline{1111.3 \frac{\text{ft}^3}{\text{day}}}}$$

with 6 pumping cycles per day, size of sump required = $\frac{1111.3 \frac{\text{ft}^3}{\text{day}}}{6n}$ where $n = \text{porosity of stone in sump} = 0.3$

$$= \frac{1111.3}{6 \times 0.3} = 617.4 \text{ ft}^3$$

Assume the shape of the sump to be a truncated square pyramid.

using 2.5' lowering of leachate per cycle, i.e. difference in elevation between on and off elevations, required area at on elevation is:

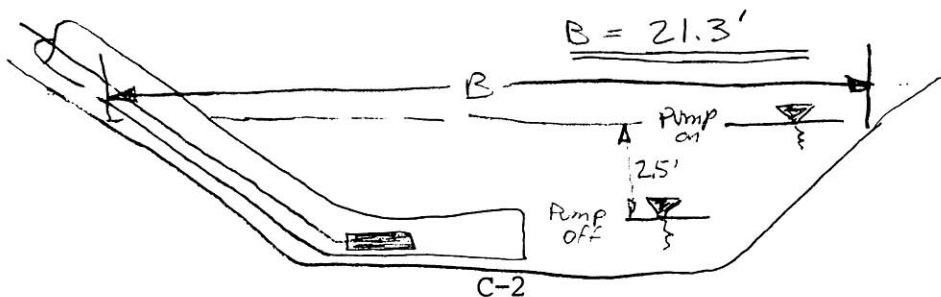
$$\left[B^2 + (B-15)^2 \right] \frac{2.5}{2} = 617.4 \text{ ft}^2$$

$$\left[2B^2 - 30B + 225 \right] = 493.9$$

$$B^2 - 15B + 112.5 = 246.96$$

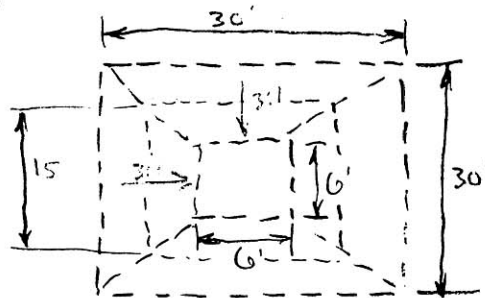
$$B^2 - 15B - 134.5 = 0$$

$$\Rightarrow B = +15 \pm \frac{\sqrt{225 + 537.8}}{2}$$





Therefore, the minimum size sump required is 21.3' x 21.3'. This would be too small at the bottom if it is 4' deep with 3:1 side slopes. Therefore, increase to 30' x 30'. The capacity is as follows:



$$V = \frac{1}{3} h (B_1 + B_2 + \sqrt{B_1 B_2}) \quad \text{where } B_1 = \text{Area of top elev.}$$

$$B_2 = \text{Area of bot elev.}$$

$$V = \frac{1}{3} (2.5') (15^2 + 30^2 + \sqrt{15^2 \cdot 30^2}) = 1312.5 \text{ ft}^3$$

$$V = 1312.5 \text{ ft}^3 \times \text{porosity of stone} = 1312.5 \text{ ft}^3 \times 0.3 = 393.8 \text{ ft}^3$$

$$\text{capacity} = 393.8 \text{ ft}^3 \times 7.48 \text{ gal/ft}^3$$

$$V = \underline{\underline{2,945 \text{ gallons}}}$$

Size pump to evacuate sump in 2 hours

$$\text{pumping rate} = \frac{2945 \text{ gal}}{2 \text{ hr}} \frac{1 \text{ hr}}{60 \text{ min}} = 24.5 \text{ gal/min}$$

select a 25 gpm (min) pump

The pump system curve is presented on the following page.

A typical pump curve is provided on page 5.

Foth & Van Dyke	Client: NMC	Scope I.D.: 99C018
	Project: Addendum 6	Page: 4 of 5
	Prepared By: MRS	Date: 11/8/99
	Checked By: HJA	Date: 11/24/99

LEACHATE PUMP SYSTEM CURVE

Instructions: input number of each fitting into Table A

Table A - Fittings

Fitting	Ke	No.	subtotal	Fitting	Ke	No.	subtotal
Entrance	0.5	1	0.5	Gate Valve	0.19		0.0
Exit	1.0	1	1.0	Standard elbow	0.90	3	2.7
Globe Valve (open)	10.0	0	0.0	Elbow (45)	0.45		0.0
Ball Valve	0.3	0	0.0	Tee (through)	0.60	0	0.0
Check Valve	2.3	0	0.0	Tee (out)	1.8	0	0.0
Total Ke =							4.2

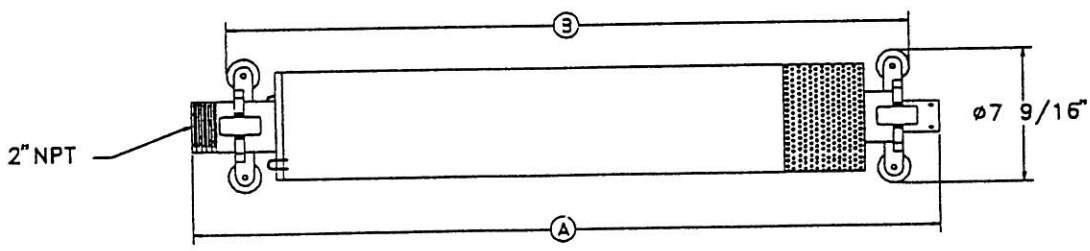
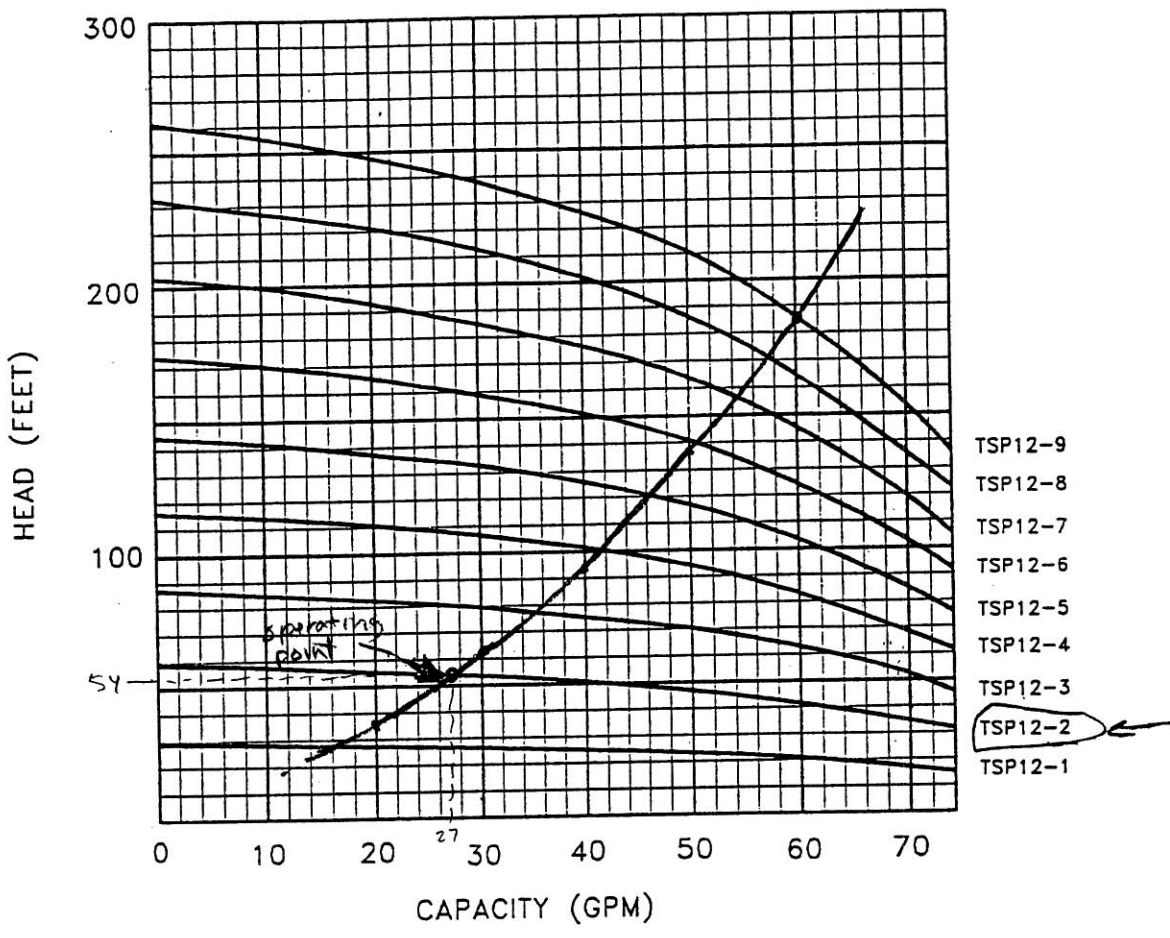
Input C value = 150

Flow (gpm)	Dia. (in)	Velocity (ft/sec)	Ke (table A)	Hm (ft)	L (ft)	S, slope of energy grade line (ft/ft)	Hf (ft)	Static Head (ft)	TDH (ft)
15	1.943	1.62	4.2	0.17	2231	0.0059	13.1	14.0	27.3
20	1.943	2.16	4.2	0.31	2231	0.0100	22.3	14.0	36.6
25	1.943	2.71	4.2	0.48	2231	0.0151	33.7	14.0	48.2
30	1.943	3.25	4.2	0.69	2231	0.0212	47.3	14.0	62.0
35	1.943	3.79	4.2	0.94	2231	0.0282	62.9	14.0	77.8
40	1.943	4.33	4.2	1.22	2231	0.0361	80.5	14.0	95.7
45	1.943	4.87	4.2	1.55	2231	0.0449	100.1	14.0	115.7
50	1.943	5.41	4.2	1.91	2231	0.0545	121.7	14.0	137.6
55	1.943	5.95	4.2	2.31	2231	0.0650	145.1	14.0	161.4
60	1.943	6.49	4.2	2.75	2231	0.0764	170.5	14.0	187.2



TSP12 SurePump™ SIDE SLOPE RISER

892



PUMP MODEL	SINGLE PHASE			THREE PHASE			SHIPPING WEIGHT (LBS)	
	MOTOR HP	A (in)	B (in)	MOTOR HP	A (in)	B (in)	1 ϕ	3 ϕ
TSP12-1	1.0	35.75	33.75	1.0	35.75	33.75	56.7	56.7
TSP12-2	1.0	37.75	35.75	1.0	37.75	35.75	59.2	59.2
TSP12-3	1.5	42.00	40.00	1.5	41.00	39.00	69.0	64.4
TSP12-4	2.0	46.25	44.25	2.0	44.50	42.50	75.7	70.9
TSP12-5	3.0	57.00	55.00	3.0	54.25	52.25	103.5	93.0
TSP12-6	3.0	59.50	57.50	3.0	56.75	54.75	106.3	95.8
TSP12-7	5.0	68.25	66.25	5.0	62.25	60.25	129.4	110.2
TSP12-8	5.0	70.75	68.75	5.0	64.75	62.75	132.7	113.5
TSP12-9	5.0	73.25	71.25	5.0	67.25	65.25	136.1	116.9

SEE 0576-2 FOR HIGH HEAD MODELS.

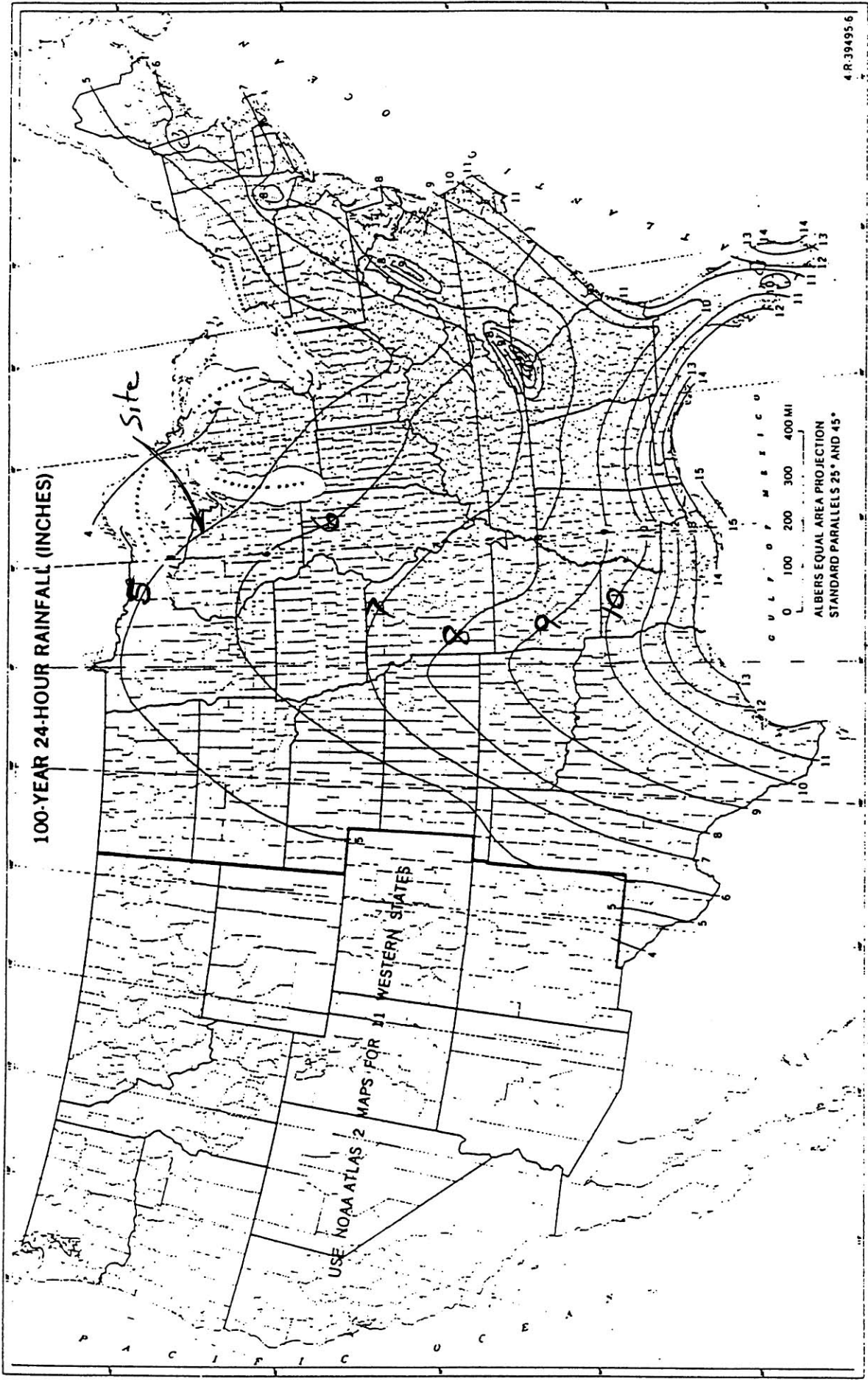


Figure B-8.—One hundred-year, 24-hour rainfall.

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**      HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
**      HELP MODEL VERSION 3.04a (10 JULY 1995)
**      DEVELOPED BY ENVIRONMENTAL LABORATORY
**      USAE WATERWAYS EXPERIMENT STATION
**      FOR USEPA RISK REDUCTION ENGINEERING LABORATORY
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PRECIPITATION DATA FILE:  j:\scopes\93c049\mrs_help\1_PREC.D4
TEMPERATURE DATA FILE:   j:\scopes\93c049\mrs_help\1_PREC.D7
SOLAR RADIATION DATA FILE: j:\scopes\93c049\mrs_help\1_PREC.D13
EVAPOTRANSPIRATION DATA:  j:\scopes\93c049\mrs_help\1_PREC.D11
SOIL AND DESIGN DATA FILE: j:\scopes\93c049\mrs_help\9_21_99\RUN_2B.D10
OUTPUT DATA FILE:         j:\scopes\93c049\mrs_help\9_21_99\RUN_2b.OUT

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TIME: 11: 8 DATE: 10/19/1999

TITLE: Run #2-Type II storage area

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

LAYER 1

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TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0
THICKNESS = 480.00 INCHES
POROSITY = 0.3970 VOL/VOL
FIELD CAPACITY = 0.0320 VOL/VOL
WILTING POINT = 0.0130 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0320 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 1.00000000000 CM/SEC

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LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 10

THICKNESS	=	24.00	INCHES
POROSITY	=	0.3980	VOL/VOL
FIELD CAPACITY	=	0.2440	VOL/VOL
WILTING POINT	=	0.1360	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2440	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.119999997000E-03	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 34

THICKNESS	=	0.24	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	33.0000000000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	180.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER

MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	2	- EXCELLENT

LAYER 5

TYPE 3 - BARRIER SOIL LINER

MATERIAL TEXTURE NUMBER 0

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.	=	0.879999970000E-05	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.5010	VOL/VOL
FIELD CAPACITY	=	0.2840	VOL/VOL
WILTING POINT	=	0.1350	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.5010	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999995000E-04	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	0.00	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	0.640	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	7.940	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.260	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	27.405	INCHES
TOTAL INITIAL WATER	=	27.405	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
GREEN BAY WISCONSIN

STATION LATITUDE	=	45.29	DEGREES
MAXIMUM LEAF AREA INDEX	=	3.00	
START OF GROWING SEASON (JULIAN DATE)	=	130	
END OF GROWING SEASON (JULIAN DATE)	=	275	
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.10	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	73.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING

COEFFICIENTS FOR GREEN BAY WISCONSIN

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.08	0.82	1.62	2.35	3.18	3.58
3.73	4.14	3.99	2.46	1.96	1.45

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR GREEN BAY WISCONSIN

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
10.20	14.20	26.00	40.40	53.20	61.50
66.10	63.30	54.90	44.70	30.50	15.50

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR GREEN BAY WISCONSIN AND STATION LATITUDE = 45.29 DEGREES

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	26.82	97356.602	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	17.524	63613.055	65.34
DRAINAGE COLLECTED FROM LAYER 3	0.0364	132.276	0.14
PERC./LEAKAGE THROUGH LAYER 5	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0000		
PERC./LEAKAGE THROUGH LAYER 6	2.723969	9888.006	10.16
CHANGE IN WATER STORAGE	6.535	23723.273	24.37
SOIL WATER AT START OF YEAR	27.405	99480.672	
SOIL WATER AT END OF YEAR	33.511	121645.562	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.429	1558.387	1.60

ANNUAL WATER BUDGET BALANCE 0.0000 -0.012 0.00

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.59	121931.703	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	19.559	70999.539	58.23
DRAINAGE COLLECTED FROM LAYER 3	9.7909	35541.148	29.15
PERC./LEAKAGE THROUGH LAYER 5	0.000005	0.020	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0013		
PERC./LEAKAGE THROUGH LAYER 6	0.190793	692.579	0.57
CHANGE IN WATER STORAGE	4.049	14698.474	12.05
SOIL WATER AT START OF YEAR	33.511	121645.562	
SOIL WATER AT END OF YEAR	36.677	133136.984	
SNOW WATER AT START OF YEAR	0.429	1558.387	1.28
SNOW WATER AT END OF YEAR	1.313	4765.428	3.91
ANNUAL WATER BUDGET BALANCE	0.0000	-0.037	0.00

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.29	128102.703	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	19.717	71573.367	55.87
DRAINAGE COLLECTED FROM LAYER 3	14.9546	54285.258	42.38
PERC./LEAKAGE THROUGH LAYER 5	0.000007	0.027	0.00

AVG. HEAD ON TOP OF LAYER 4	0.0020		
PERC./LEAKAGE THROUGH LAYER 6	0.109855	398.773	0.31
CHANGE IN WATER STORAGE	0.476	1727.052	1.35
SOIL WATER AT START OF YEAR	36.677	133136.984	
SOIL WATER AT END OF YEAR	38.024	138027.625	
SNOW WATER AT START OF YEAR	1.313	4765.428	3.72
SNOW WATER AT END OF YEAR	0.441	1601.845	1.25
ANNUAL WATER BUDGET BALANCE	0.0326	118.256	0.09

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	28.80	104544.016	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	17.987	65292.012	62.45
DRAINAGE COLLECTED FROM LAYER 3	11.8570	43040.973	41.17
PERC./LEAKAGE THROUGH LAYER 5	0.000006	0.023	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0016		
PERC./LEAKAGE THROUGH LAYER 6	0.073610	267.204	0.26
CHANGE IN WATER STORAGE	-1.122	-4071.576	-3.89
SOIL WATER AT START OF YEAR	38.024	138027.625	
SOIL WATER AT END OF YEAR	37.289	135357.422	
SNOW WATER AT START OF YEAR	0.441	1601.845	1.53
SNOW WATER AT END OF YEAR	0.055	200.467	0.19
ANNUAL WATER BUDGET BALANCE	0.0042	15.405	0.01

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.38	121169.414	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	15.441	56050.566	46.26
DRAINAGE COLLECTED FROM LAYER 3	15.2233	55260.469	45.61
PERC./LEAKAGE THROUGH LAYER 5	0.000007	0.027	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		
PERC./LEAKAGE THROUGH LAYER 6	0.055080	199.939	0.17
CHANGE IN WATER STORAGE	2.661	9658.410	7.97
SOIL WATER AT START OF YEAR	37.289	135357.422	
SOIL WATER AT END OF YEAR	39.268	142542.109	
SNOW WATER AT START OF YEAR	0.055	200.467	0.17
SNOW WATER AT END OF YEAR	0.737	2674.194	2.21
ANNUAL WATER BUDGET BALANCE	0.0000	0.033	0.00

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.16	116740.797	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	19.451	70607.148	60.48
DRAINAGE COLLECTED FROM LAYER 3	14.2282	51648.395	44.24
PERC./LEAKAGE THROUGH LAYER 5	0.000007	0.025	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0019		
PERC./LEAKAGE THROUGH LAYER 6	0.043918	159.421	0.14
CHANGE IN WATER STORAGE	-1.571	-5702.326	-4.88
SOIL WATER AT START OF YEAR	39.268	142542.109	
SOIL WATER AT END OF YEAR	38.291	138995.828	

SNOW WATER AT START OF YEAR	0.737	2674.194	2.29
SNOW WATER AT END OF YEAR	0.143	518.147	0.44
ANNUAL WATER BUDGET BALANCE	0.0078	28.159	0.02

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	29.68	107738.391	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	13.515	49059.750	45.54
DRAINAGE COLLECTED FROM LAYER 3	12.0676	43805.305	40.66
PERC./LEAKAGE THROUGH LAYER 5	0.000006	0.023	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0016		
PERC./LEAKAGE THROUGH LAYER 6	0.035958	130.528	0.12
CHANGE IN WATER STORAGE	4.053	14712.730	13.66
SOIL WATER AT START OF YEAR	38.291	138995.828	
SOIL WATER AT END OF YEAR	40.276	146202.266	
SNOW WATER AT START OF YEAR	0.143	518.147	0.48
SNOW WATER AT END OF YEAR	2.211	8024.439	7.45
ANNUAL WATER BUDGET BALANCE	0.0083	30.073	0.03

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.30	117249.023	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	15.494	56243.602	47.97

DRAINAGE COLLECTED FROM LAYER 3	19.6785	71432.781	60.92
PERC./LEAKAGE THROUGH LAYER 5	0.000009	0.032	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0026		
PERC./LEAKAGE THROUGH LAYER 6	0.030950	112.348	0.10
CHANGE IN WATER STORAGE	-2.903	-10539.688	-8.99
SOIL WATER AT START OF YEAR	40.276	146202.266	
SOIL WATER AT END OF YEAR	37.557	136330.453	
SNOW WATER AT START OF YEAR	2.211	8024.439	6.84
SNOW WATER AT END OF YEAR	2.027	7356.569	6.27
ANNUAL WATER BUDGET BALANCE	0.0000	-0.016	0.00

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
	-----	-----	-----
PRECIPITATION	34.30	124509.023	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	20.117	73026.484	58.65
DRAINAGE COLLECTED FROM LAYER 3	15.9824	58016.027	46.60
PERC./LEAKAGE THROUGH LAYER 5	0.000007	0.024	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
PERC./LEAKAGE THROUGH LAYER 6	0.026666	96.799	0.08
CHANGE IN WATER STORAGE	-1.827	-6632.565	-5.33
SOIL WATER AT START OF YEAR	37.557	136330.453	
SOIL WATER AT END OF YEAR	37.164	134906.828	
SNOW WATER AT START OF YEAR	2.027	7356.569	5.91
SNOW WATER AT END OF YEAR	0.592	2147.636	1.72
ANNUAL WATER BUDGET BALANCE	0.0006	2.277	0.00

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	28.35	102910.516	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	18.584	67458.766	65.55
DRAINAGE COLLECTED FROM LAYER 3	9.8996	35935.391	34.92
PERC./LEAKAGE THROUGH LAYER 5	0.000006	0.020	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0013		
PERC./LEAKAGE THROUGH LAYER 6	0.023801	86.397	0.08
CHANGE IN WATER STORAGE	-0.162	-587.250	-0.57
SOIL WATER AT START OF YEAR	37.164	134906.828	
SOIL WATER AT END OF YEAR	36.744	133381.141	
SNOW WATER AT START OF YEAR	0.592	2147.636	2.09
SNOW WATER AT END OF YEAR	0.850	3086.060	3.00
ANNUAL WATER BUDGET BALANCE	0.0047	17.207	0.02

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	0.87 4.92	0.81 4.17	1.63 3.66	2.46 2.22	3.45 1.83	4.10 1.35
STD. DEVIATIONS	0.60 2.05	0.50 1.59	0.87 1.40	0.91 1.15	1.87 0.65	1.75 0.78
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000

0.000 0.000 0.000 0.000 0.000 0.000

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

EVAPOTRANSPIRATION

TOTALS 0.446 0.402 0.411 0.695 2.293 3.187
3.326 2.550 2.274 1.203 0.601 0.351

STD. DEVIATIONS 0.071 0.104 0.093 0.453 1.119 1.377
0.861 0.721 0.571 0.420 0.191 0.046

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS 0.8745 0.6220 0.5629 0.4569 1.3879 1.3136
1.2254 1.4208 1.1443 1.2145 1.1002 1.0487

STD. DEVIATIONS 0.4719 0.3186 0.2802 0.2099 1.2759 0.7458
0.5727 0.8222 0.7218 0.6447 0.4879 0.4715

PERCOLATION/LEAKAGE THROUGH LAYER 5

TOTALS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

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

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS 0.2023 0.0277 0.0197 0.0145 0.0122 0.0102
0.0097 0.0069 0.0080 0.0077 0.0068 0.0059

STD. DEVIATIONS 0.6217 0.0681 0.0420 0.0273 0.0211 0.0161
0.0138 0.0065 0.0101 0.0094 0.0073 0.0049

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES 0.0013 0.0011 0.0009 0.0007 0.0022 0.0021
0.0019 0.0022 0.0018 0.0019 0.0018 0.0016

STD. DEVIATIONS 0.0007 0.0005 0.0004 0.0003 0.0020 0.0012
0.0009 0.0013 0.0012 0.0010 0.0008 0.0007

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

INCHES CU. FEET PERCENT

PRECIPITATION	31.47	(2.860)	114225.2	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	17.739	(2.2310)	64392.43	56.373
LATERAL DRAINAGE COLLECTED FROM LAYER 3	12.37185	(5.27007)	44909.805	39.31689
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00001	(0.00000)	0.022	0.00002
AVERAGE HEAD ON TOP OF LAYER 4	0.002	(0.001)		
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.33146	(0.84220)	1203.199	1.05336
CHANGE IN WATER STORAGE	1.019	(3.1266)	3698.65	3.238

PEAK DAILY VALUES FOR YEARS 1 THROUGH 10

	(INCHES)	(CU. FT.)
PRECIPITATION	4.05	14701.501
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.23058	836.99933
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000000	0.00030
AVERAGE HEAD ON TOP OF LAYER 4	0.011	
MAXIMUM HEAD ON TOP OF LAYER 4	0.022	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	2.5 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.682713	2478.24951
SNOW WATER	4.24	15373.6377
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.3970
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.0130

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

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

FINAL WATER STORAGE AT END OF YEAR 10

LAYER	(INCHES)	(VOL/VOL)
1	27.1891	0.0566
2	6.6770	0.2782
3	0.0033	0.0139
4	0.0000	0.0000
5	0.1772	0.7500
6	2.6975	0.2248
SNOW WATER	0.850	

