URS

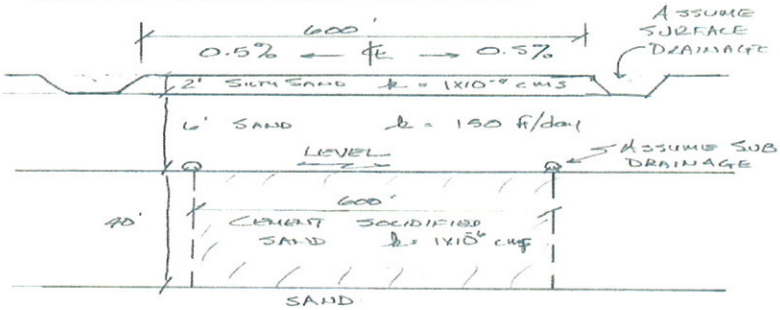
Job:	National Grid Hempstead NY	Project No.:	1175056			
Decription:	Groundwater Mounding	Computed by:	DWA	Date:	4/2/09	Rev. 4/21/09
	HELP analysis	Checked by:		Date:		

Problem: Estimate depth of groundwater mounding on solidified sand unit.

Analysis: Use Hydrologic Evaluation of Landfill Performance (HELP) computer model to determine head on solidified layer over time. Program used is Visual HELP version 2.2, Waterloo Hydrogeologics Inc.

Revision: 1. Replaced 6" gravel/24" silty Sand with just 24" gravel for bare soil case.

Given: Sketch below showing assumed configuration and soil properties of site.
Surface cover is either gravel parking lot or grass landscaping.



PROFILE INPUT SKETCH
NOT TO SCALE

HELP Input:

Soil Data

Layer Data					Soil Properties			
Grass Cover Layer #	Bare soil Layer #	Layer	Layer Type	HELP Soil texture #	porosity	field capacity, vol/vol	wilting point, vol/vol	permeability, k
	1	24" Gravel	Vert. Perc.	5	0.3	0.1	0.05	1 cms
1	-	24" Silty Sand	Vert. Perc.	5	0.457	0.131	0.058	86 cm/day
2	2	6' Sand	Drainage Layer	1	0.417	0.045	0.018	$6x10^{-2}$ cms
3	3	Cement Solidified Sand	Barrier Layer	29	0.451	0.419	0.332	$1X10^{-6}$ cms

= HELP default soil property
= modified soil property

Surface Conditions: Bare Soil & Good Grass

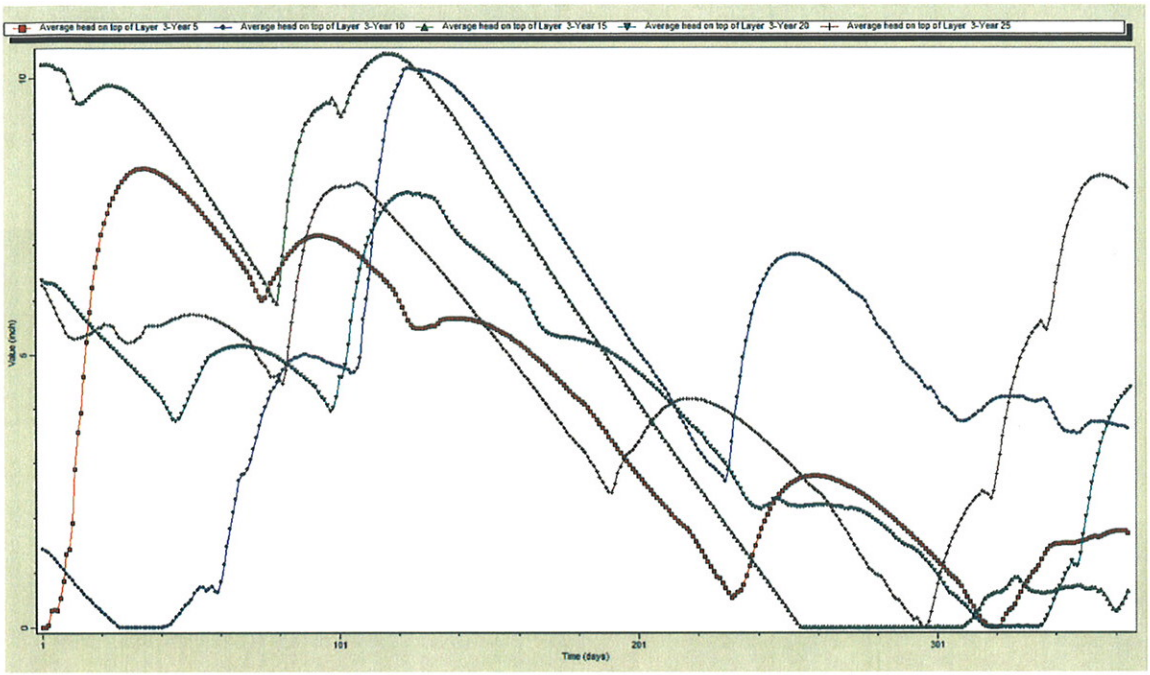
Climate Simulation: Weather data from nearest city (New York, NY), 25 year simulation

Results:

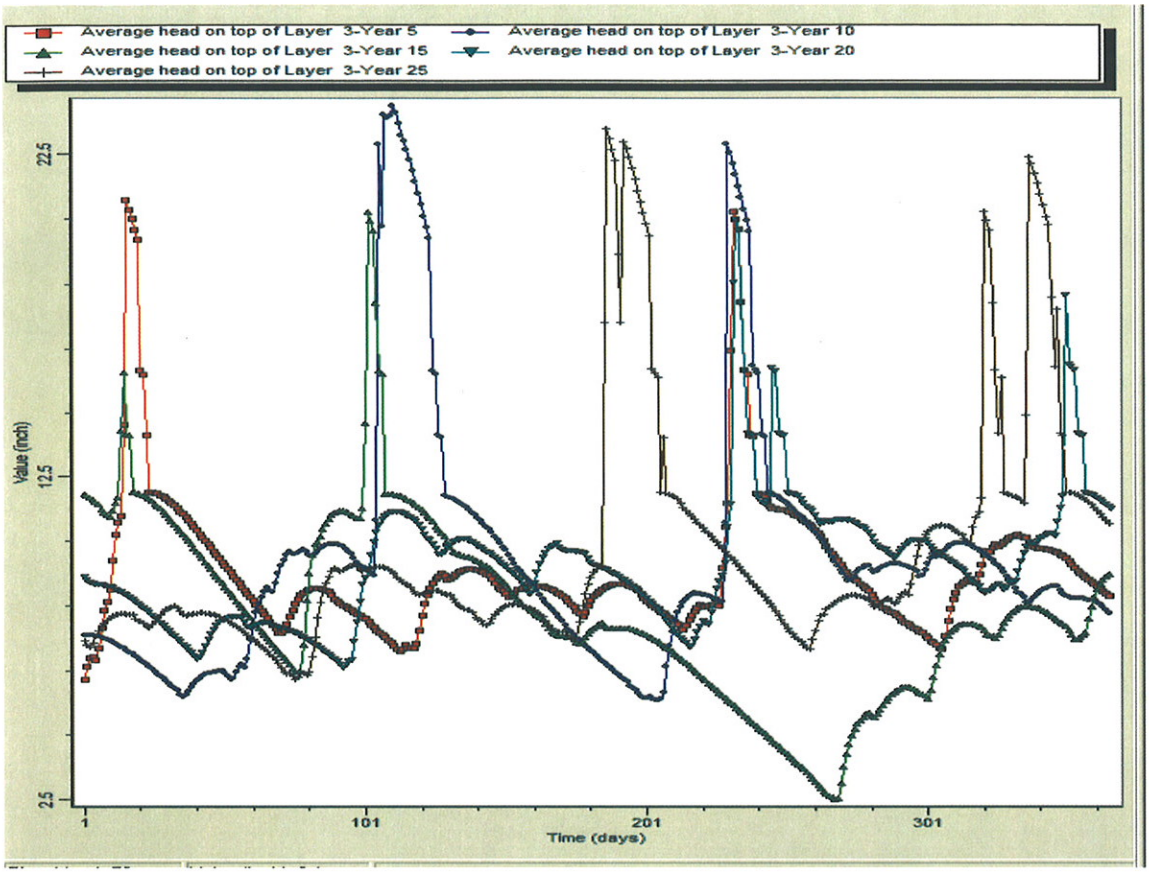
Print outs of HELP input for both Bare Soil and Grass Cover cases are attached along with annual average values for a HELP output for simulation year 5, 10, 15, 20 and 25 and annual average values of the entire 25 year simulation.

Plots of daily average head on the solidified soil layer for simulation year 5, 10, 15, 20 and 25 for both Grass Covered (Plot 1) and Bare Soil (Plot 2) are attached. The annual ave. heads on Layer 3/4 for selected years and the entire simulation period are :

	Annual Ave. Head, in.	
Year	Grass Covered	Bare Soil
5	3.9	9.6
10	4.8	10.0
15	5.0	8.3
20	4.0	9.8
25	4.7	10.2
1 to 25	4.5	9.4



PLOT 1 GRASS COVERED – AVE. DAILY HEAD ON SOLIDIFIED SOIL
YEARS 5, 10, 15, 20, 25



PLOT 2 BARE SOIL – AVE. DAILY HEAD ON SOLIDIFIED SOIL
YEARS 5, 10, 15, 20, 25

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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:\WHI\VHELP22\data\P588.VHP_weather1.dat

TEMPERATURE DATA FILE: C:\WHI\VHELP22\data\P588.VHP_weather2.dat

SOLAR RADIATION DATA FILE: C:\WHI\VHELP22\data\P588.VHP_weather3.dat

EVAPOTRANSPIRATION DATA: C:\WHI\VHELP22\data\P588.VHP_weather4.dat

SOIL AND DESIGN DATA FILE: C:\WHI\VHELP22\data\P588.VHP\I_385991.inp

OUTPUT DATA FILE: C:\WHI\VHELP22\data\P588.VHP\O_385991.prt

TIME: 9:44 DATE: 4/ 2/2009

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TITLE: Hempstead Grass Cover

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

Hempstead Grass Cover

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	60.96	CM
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1963	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000224000E-02	CM/SEC

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 4.90
FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 1

THICKNESS	=	182.88	CM
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1433	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.600000000000E-01	CM/SEC
SLOPE	=	0.00	PERCENT
DRAINAGE LENGTH	=	91.4	METERS

LAYER 3

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 29

THICKNESS	=	1219.20	CM
POROSITY	=	0.4510	VOL/VOL
FIELD CAPACITY	=	0.4190	VOL/VOL
WILTING POINT	=	0.3320	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4510	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000000000E-05	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
SOIL DATA BASE USING SOIL TEXTURE # 5 WITH A
GOOD STAND OF GRASS, A SURFACE SLOPE OF 0.%
AND A SLOPE LENGTH OF 91. METERS.

SCS RUNOFF CURVE NUMBER	=	52.56	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	0.4047	HECTARES
EVAPORATIVE ZONE DEPTH	=	20.3	CM
INITIAL WATER IN EVAPORATIVE ZONE	=	2.812	CM

Hempstead Grass Cover

UPPER LIMIT OF EVAPORATIVE STORAGE	=	9.286	CM
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.179	CM
INITIAL SNOW WATER	=	0.000	CM
INITIAL WATER IN LAYER MATERIALS	=	588.027	CM
TOTAL INITIAL WATER	=	588.027	CM
TOTAL SUBSURFACE INFLOW	=	0.00	MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
New York NY

STATION LATITUDE	=	40.67	DEGREES
MAXIMUM LEAF AREA INDEX	=	4.00	
START OF GROWING SEASON (JULIAN DATE)	=	108	
END OF GROWING SEASON (JULIAN DATE)	=	302	
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	12.20	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR New York NY

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.11	3.08	4.10	3.76	3.46	3.15
3.67	4.32	3.48	3.24	3.77	3.68

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR New York NY

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.80	33.30	41.00	51.90	61.70	71.00
76.40	75.30	68.20	57.50	47.10	36.20

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR New York NY
AND STATION LATITUDE = 40.70 DEGREES

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.37	161059.589	100.00
RUNOFF	5.259	19090.811	11.85
EVAPOTRANSPIRATION	25.314	91886.426	57.05
DRAINAGE COLLECTED FROM LAYER 2	2.0200	7332.589	4.55
PERC./LEAKAGE THROUGH LAYER 3	12.321350	44725.526	27.77
AVG. HEAD ON TOP OF LAYER 3	3.9405		
CHANGE IN WATER STORAGE	-0.544	-1975.760	-1.23
SOIL WATER AT START OF YEAR	228.884	830831.708	
SOIL WATER AT END OF YEAR	229.070	831506.101	
SNOW WATER AT START OF YEAR	0.730	2650.153	1.65
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.51	157937.858	100.00
RUNOFF	1.324	4805.288	3.04
EVAPOTRANSPIRATION	24.966	90626.099	57.38
DRAINAGE COLLECTED FROM LAYER 2	2.7954	10147.251	6.42
PERC./LEAKAGE THROUGH LAYER 3	12.173103	44187.399	27.98
AVG. HEAD ON TOP OF LAYER 3	4.7505		

CHANGE IN WATER STORAGE	2.251	8171.823	5.17
SOIL WATER AT START OF YEAR	227.715	826586.060	
SOIL WATER AT END OF YEAR	229.130	831724.222	
SNOW WATER AT START OF YEAR	0.458	1662.721	1.05
SNOW WATER AT END OF YEAR	1.294	4696.382	2.97
ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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ANNUAL TOTALS FOR YEAR 15

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.24	124288.491	100.00
RUNOFF	2.189	7946.115	6.39
EVAPOTRANSPIRATION	20.459	74264.060	59.75
DRAINAGE COLLECTED FROM LAYER 2	3.7638	13662.323	10.99
PERC./LEAKAGE THROUGH LAYER 3	10.982603	39865.982	32.08
AVG. HEAD ON TOP OF LAYER 3	4.9998		
CHANGE IN WATER STORAGE	-3.154	-11449.987	-9.21
SOIL WATER AT START OF YEAR	231.147	839043.967	
SOIL WATER AT END OF YEAR	227.992	827593.979	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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Hempstead Grass Cover
MONTHLY TOTALS (IN INCHES) FOR YEAR 20

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.73	3.44	3.48	4.10	1.96	4.21
	1.43	7.35	2.52	2.85	4.09	2.55
RUNOFF	4.185	0.972	2.075	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.427	1.275	0.784	2.467	1.762	3.300
	1.234	5.504	2.571	1.628	1.467	1.471
LATERAL DRAINAGE COLLECTED FROM LAYER 2	0.2506	0.1436	0.1935	0.2860	0.4340	0.2558
	0.1771	0.0740	0.0376	0.0189	0.0004	0.0564
PERCOLATION/LEAKAGE THROUGH LAYER 3	1.0668	0.9955	1.0654	1.0331	1.0708	1.0327
	1.0649	1.0611	1.0252	1.0577	0.5442	1.0593

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ANNUAL TOTALS FOR YEAR 20

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.71	158663.842	100.00
RUNOFF	7.232	26253.072	16.55
EVAPOTRANSPIRATION	23.889	86715.722	54.65
DRAINAGE COLLECTED FROM LAYER 2	1.9280	6998.561	4.41
PERC./LEAKAGE THROUGH LAYER 3	12.076794	43837.807	27.63
AVG. HEAD ON TOP OF LAYER 3	3.9956		
CHANGE IN WATER STORAGE	-1.416	-5141.318	-3.24
SOIL WATER AT START OF YEAR	229.780	834083.163	
SOIL WATER AT END OF YEAR	228.828	830628.672	
SNOW WATER AT START OF YEAR	0.465	1686.826	1.06
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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Hempstead Grass Cover
ANNUAL TOTALS FOR YEAR 25

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.69	151331.402	100.00
RUNOFF	0.098	355.927	0.24
EVAPOTRANSPIRATION	26.276	95380.218	63.03
DRAINAGE COLLECTED FROM LAYER 2	2.4281	8813.838	5.82
PERC./LEAKAGE THROUGH LAYER 3	12.510994	45413.918	30.01
AVG. HEAD ON TOP OF LAYER 3	4.6794		
CHANGE IN WATER STORAGE	0.377	1367.504	0.90
SOIL WATER AT START OF YEAR	230.416	836390.773	
SOIL WATER AT END OF YEAR	230.792	837758.277	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 25

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.78	3.28	3.65	4.35	3.08	3.08
	3.63	4.73	3.08	3.12	4.18	3.59
STD. DEVIATIONS	1.07	1.84	1.69	1.68	1.56	1.10
	2.00	2.66	1.59	1.25	2.09	1.85
RUNOFF						
TOTALS	0.600	1.316	0.935	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.034
STD. DEVIATIONS	1.178	1.482	1.223	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.134
EVAPOTRANSPIRATION						
TOTALS	1.009	0.799	1.973	2.897	2.811	2.815
	2.803	3.415	2.311	1.502	1.520	1.154

Hempstead Grass Cover

STD. DEVIATIONS	0.344	0.403	0.507	0.616	0.913	0.882
	1.282	1.573	0.679	0.462	0.164	0.167

LATERAL DRAINAGE COLLECTED FROM LAYER 2

TOTALS	0.5746	0.3225	0.2473	0.4140	0.4191	0.2932
	0.1723	0.0921	0.1071	0.0942	0.1072	0.4062
STD. DEVIATIONS	0.7602	0.3047	0.2298	0.4347	0.3705	0.2712
	0.1858	0.1182	0.1586	0.1324	0.1521	0.6368

PERCOLATION/LEAKAGE THROUGH LAYER 3

TOTALS	1.0534	0.9527	0.9895	1.0059	1.0266	0.9592
	0.9005	0.8522	0.8561	0.8891	0.9186	1.0318
STD. DEVIATIONS	0.0578	0.0741	0.1930	0.1048	0.1107	0.1924
	0.3009	0.3484	0.3071	0.3049	0.1816	0.1289

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	6.8366	5.6448	4.7083	6.1976	6.2522	5.2234
	3.7265	2.5915	2.7105	2.4290	2.7328	5.4140
STD. DEVIATIONS	4.9634	3.6746	3.0192	3.7601	3.7702	3.3749
	2.8438	2.2155	2.5807	2.4309	2.5037	4.2780

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 25

	INCHES		CU. FEET	PERCENT
PRECIPITATION	42.55	(5.171)	154458.9	100.00
RUNOFF	2.885	(2.6153)	10473.78	6.781
EVAPOTRANSPIRATION	25.009	(2.6217)	90781.78	58.774
LATERAL DRAINAGE COLLECTED FROM LAYER 2	3.24981	(2.35507)	11796.544	7.63733
PERCOLATION/LEAKAGE THROUGH LAYER 3	11.43567	(1.51814)	41510.561	26.87482
AVERAGE HEAD ON TOP OF LAYER 3	4.539	(2.352)		
CHANGE IN WATER STORAGE	-0.029	(2.9703)	-103.72	-0.067

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 25 and their dates (DDDYYYY)

	(INCHES)	(CU. FT.)	
PRECIPITATION	3.96	14374.48669	2270010
RUNOFF	3.210	11650.79132	430009
DRAINAGE COLLECTED FROM LAYER 2	0.15894	576.94389	3470016
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.035790	129.91638	3470016
AVERAGE HEAD ON TOP OF LAYER 3	25.051		
MAXIMUM HEAD ON TOP OF LAYER 3	31.771		
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	300.0 FEET		
SNOW WATER	5.09	18486.9827	520013

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4199
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0580

*** 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 25

LAYER	(INCHES)	(VOL/VOL)
1	5.2308	0.2180
2	9.0816	0.1261
3	216.4800	0.4510
SNOW WATER	0.000	

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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:\WHI\VHELP22\data\P588.VHP_weather1.dat

TEMPERATURE DATA FILE: C:\WHI\VHELP22\data\P588.VHP_weather2.dat

SOLAR RADIATION DATA FILE: C:\WHI\VHELP22\data\P588.VHP_weather3.dat

EVAPOTRANSPIRATION DATA: C:\WHI\VHELP22\data\P588.VHP_weather4.dat

SOIL AND DESIGN DATA FILE: C:\WHI\VHELP22\data\P588.VHP\I_385648.inp

OUTPUT DATA FILE: C:\WHI\VHELP22\data\P588.VHP\O_385648.prt

TIME: 9:43 DATE: 4/21/2009

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TITLE: Hempstead Bare Soil

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

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5
THICKNESS = 60.96 CM
POROSITY = 0.3000 VOL/VOL
FIELD CAPACITY = 0.1000 VOL/VOL
WILTING POINT = 0.0500 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0833 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 1.00000000000 CM/SEC
NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 4.90 FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 1
THICKNESS = 182.88 CM
POROSITY = 0.4170 VOL/VOL
FIELD CAPACITY = 0.0450 VOL/VOL
WILTING POINT = 0.0180 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.1496 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.600000000000E-01 CM/SEC
SLOPE = 0.00 PERCENT
DRAINAGE LENGTH = 91.4 METERS

LAYER 3

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 29
THICKNESS = 1219.20 CM
POROSITY = 0.4510 VOL/VOL
FIELD CAPACITY = 0.4190 VOL/VOL
WILTING POINT = 0.3320 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.4510 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000000000E-05 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 5 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 0.% AND A SLOPE LENGTH OF 0. METERS.

SCS RUNOFF CURVE NUMBER = 1.00
FRACTION OF AREA ALLOWING RUNOFF = 100.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE = 0.4047 HECTARES
EVAPORATIVE ZONE DEPTH = 20.3 CM
INITIAL WATER IN EVAPORATIVE ZONE = 1.016 CM
UPPER LIMIT OF EVAPORATIVE STORAGE = 6.096 CM
LOWER LIMIT OF EVAPORATIVE STORAGE = 1.016 CM
INITIAL SNOW WATER = 0.000 CM
INITIAL WATER IN LAYER MATERIALS = 582.290 CM
TOTAL INITIAL WATER = 582.290 CM
TOTAL SUBSURFACE INFLOW = 0.00 MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
New York NY

STATION LATITUDE = 40.67 DEGREES
MAXIMUM LEAF AREA INDEX = 4.00
START OF GROWING SEASON (JULIAN DATE) = 108
END OF GROWING SEASON (JULIAN DATE) = 302
EVAPORATIVE ZONE DEPTH = 8.0 INCHES
AVERAGE ANNUAL WIND SPEED = 12.20 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 72.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR New York NY

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.11	3.08	4.10	3.76	3.46	3.15
3.67	4.32	3.48	3.24	3.77	3.68

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR New York NY

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.80	33.30	41.00	51.90	61.70	71.00
76.40	75.30	68.20	57.50	47.10	36.20

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.37	161059.589	100.00
RUNOFF	5.129	18616.783	11.56
EVAPOTRANSPIRATION	17.577	63802.187	39.61
DRAINAGE COLLECTED FROM LAYER 2	9.0396	32813.039	20.37
PERC./LEAKAGE THROUGH LAYER 3	12.664089	45969.641	28.54
AVG. HEAD ON TOP OF LAYER 3	9.6102		
CHANGE IN WATER STORAGE	-0.039	-142.058	-0.09
SOIL WATER AT START OF YEAR	228.165	828222.669	
SOIL WATER AT END OF YEAR	228.856	830730.765	
SNOW WATER AT START OF YEAR	0.730	2650.153	1.65
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.51	157937.858	100.00
RUNOFF	1.381	5012.655	3.17
EVAPOTRANSPIRATION	17.776	64527.127	40.86
DRAINAGE COLLECTED FROM LAYER 2	10.6885	38798.590	24.57
PERC./LEAKAGE THROUGH LAYER 3	12.673765	46004.765	29.13
AVG. HEAD ON TOP OF LAYER 3	9.9681		
CHANGE IN WATER STORAGE	0.990	3594.723	2.28
SOIL WATER AT START OF YEAR	227.909	827291.940	
SOIL WATER AT END OF YEAR	228.064	827853.002	
SNOW WATER AT START OF YEAR	0.458	1662.721	1.05
SNOW WATER AT END OF YEAR	1.294	4696.382	2.97
ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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ANNUAL TOTALS FOR YEAR 15

	INCHES	CU. FEET	PERCENT

PRECIPITATION	34.24	124288.491	100.00
RUNOFF	2.194	7964.444	6.41
EVAPOTRANSPIRATION	13.048	47363.682	38.11
DRAINAGE COLLECTED FROM LAYER 2	7.1016	25778.205	20.74
PERC./LEAKAGE THROUGH LAYER 3	12.629766	45845.053	36.89
AVG. HEAD ON TOP OF LAYER 3	8.2906		
CHANGE IN WATER STORAGE	-0.734	-2662.891	-2.14
SOIL WATER AT START OF YEAR	228.957	831095.806	
SOIL WATER AT END OF YEAR	228.223	828432.914	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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ANNUAL TOTALS FOR YEAR 20

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.71	158663.842	100.00
RUNOFF	7.266	26373.792	16.62
EVAPOTRANSPIRATION	14.786	53672.555	33.83
DRAINAGE COLLECTED FROM LAYER 2	9.3593	33973.396	21.41
PERC./LEAKAGE THROUGH LAYER 3	12.703936	46114.283	29.06
AVG. HEAD ON TOP OF LAYER 3	9.8005		
CHANGE IN WATER STORAGE	-0.405	-1470.180	-0.93
SOIL WATER AT START OF YEAR	228.531	829550.244	
SOIL WATER AT END OF YEAR	228.591	829766.890	
SNOW WATER AT START OF YEAR	0.465	1686.826	1.06
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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ANNUAL TOTALS FOR YEAR 25

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.69	151331.402	100.00
RUNOFF	0.058	211.605	0.14
EVAPOTRANSPIRATION	17.460	63376.754	41.88
DRAINAGE COLLECTED FROM LAYER 2	10.8944	39545.809	26.13

AVG. HEAD ON TOP OF LAYER 3	10.1507		
CHANGE IN WATER STORAGE	0.599	2174.600	1.44
SOIL WATER AT START OF YEAR	228.425	829166.362	
SOIL WATER AT END OF YEAR	229.025	831340.962	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 25

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.78	3.28	3.65	4.35	3.08	3.08
	3.63	4.73	3.08	3.12	4.18	3.59
STD. DEVIATIONS	1.07	1.84	1.69	1.68	1.56	1.10
	2.00	2.66	1.59	1.25	2.09	1.85
RUNOFF						
TOTALS	0.621	1.412	0.968	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.031
STD. DEVIATIONS	1.211	1.557	1.263	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.135
EVAPOTRANSPIRATION						
TOTALS	0.833	0.670	1.285	1.942	1.544	1.784
	1.884	2.223	1.479	1.137	1.111	0.949
STD. DEVIATIONS	0.221	0.262	0.420	0.450	0.615	0.660
	0.796	0.928	0.507	0.372	0.310	0.275
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	1.0544	0.5100	0.4616	0.9705	0.8885	0.6797
	0.6381	0.8185	0.8708	0.7430	0.8991	1.4830
STD. DEVIATIONS	0.7601	0.2793	0.3089	0.8075	0.6820	0.5603
	0.5173	0.7085	0.6845	0.5757	0.6354	1.2363
PERCOLATION/LEAKAGE THROUGH LAYER 3						
TOTALS	1.0781	0.9768	1.0703	1.0416	1.0760	1.0391
	1.0726	1.0744	1.0411	1.0745	1.0417	1.0819
STD. DEVIATIONS	0.0077	0.0150	0.0050	0.0095	0.0081	0.0071
	0.0072	0.0088	0.0084	0.0067	0.0074	0.0112

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3						
AVERAGES	10.7674	8.1250	7.2096	9.9380	9.8067	8.7517
	8.2710	9.0718	9.7149	9.1272	10.0115	12.4708
STD. DEVIATIONS	3.4960	2.1393	2.2921	4.4775	3.6913	3.3172

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 25

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.55 (5.171)	154458.9	100.00
RUNOFF	3.033 (2.6760)	11010.62	7.129
EVAPOTRANSPIRATION	16.842 (1.9794)	61134.46	39.580
LATERAL DRAINAGE COLLECTED FROM LAYER 2	10.01721 (3.75276)	36361.698	23.54134
PERCOLATION/LEAKAGE THROUGH LAYER 3	12.66821 (0.05404)	45984.616	29.77142
AVERAGE HEAD ON TOP OF LAYER 3	9.439 (2.060)		
CHANGE IN WATER STORAGE	-0.009 (1.9111)	-32.45	-0.021

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 25 and their dates (DDDYYYY)

	(INCHES)	(CU. FT.)	
PRECIPITATION	3.96	14374.48669	2270010
RUNOFF	3.268	11863.57462	430009
DRAINAGE COLLECTED FROM LAYER 2	0.23025	835.77949	3450016
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.036152	131.22830	3450016
AVERAGE HEAD ON TOP OF LAYER 3	30.151		
MAXIMUM HEAD ON TOP OF LAYER 3	38.239		
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	300.0 FEET		
SNOW WATER	5.09	18486.9827	520013
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.2870		
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0500		

*** 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 25

LAYER	(INCHES)	(VOL/VOL)

1	2.8452	0.1186
2	9.6993	0.1347
3	216.4800	0.4510

SNOW WATER 0.000

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