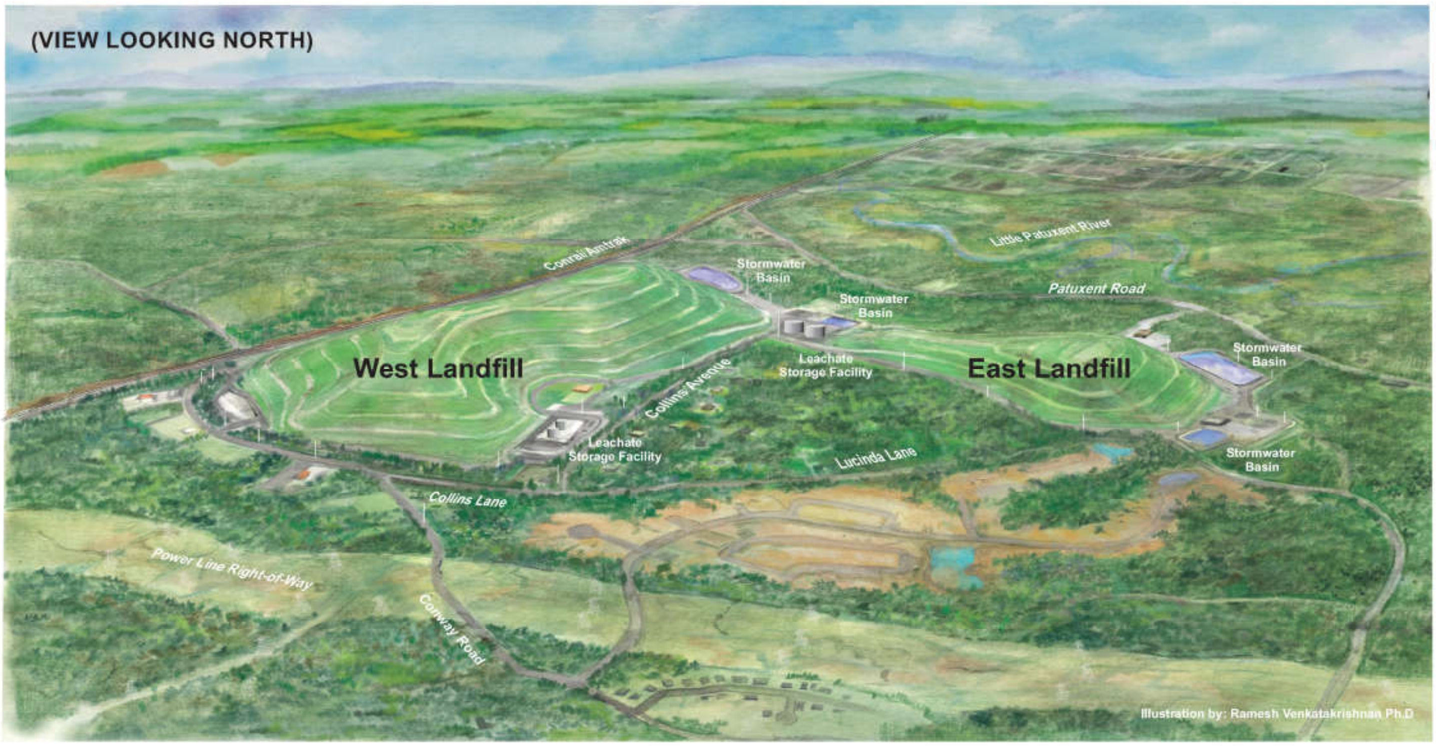
R E V I S E D
PHASE III PERMIT APPLICATION
FOR
CHESAPEAKE TERRACE RUBBLE LANDFILL
ANNE ARUNDEL COUNTY, MARYLAND

VOLUME 2 OF 3



PREPARED FOR:

National Waste Managers, Inc.
2900 Linden Lane
Silver Spring, Maryland 20910

PREPARED BY:

ADVANCED GeoServices
a Montrose Environmental Group company

1055 Andrew Drive, Suite A
West Chester, Pennsylvania 19380

JULY, 2020

PROJECT NO. 2018-3854 **REVISED JANUARY 14, 2022**

PROFESSIONAL ENGINEER'S CERTIFICATION

I hereby certify that these documents entitled *"Revised Phase III Permit Application for Chesapeake Terrace Rubble Landfill, Anne Arundel County, Maryland"* Revised January 14, 2022, were prepared by me, or under my direct supervision, and that I am a duly licensed professional engineer under the laws of the State of Maryland, License No. 21681, Expiration Date: August 11, 2023.

1/14/22

Paul G. Stratman, P.E.
January 14, 2022

PHASE III PERMIT APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
ANNE ARUNDEL COUNTY, MARYLAND

TABLE OF CONTENTS

VOLUME 1 OF 3

VOLUME 2 OF 3

VOLUME 3 OF 3

ADVANCED GeoServices
a Montrose Environmental Group company

SECTION 10
(continued)

LEACHATE MANAGEMENT SYSTEM

ATTACHMENT 10A (continued)

Leachate Generation Rates (per acre)

HELP MODEL PRINTOUTS

FULL -HEIGHT – THIRTEEN (13) LIFTS

Floor slope 2%

```
****************************************************************************
****************************************************************************
**                                                                        **
**                                                                        **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF13S2.OUT


TIME:  15:23     DATE:   6/24/2020


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

     TITLE:  FULL FILL @13 LIFTS; S = 2%

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


     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   6
           THICKNESS                 =     12.00   INCHES
           POROSITY                  =      0.4530 VOL/VOL
           FIELD CAPACITY            =      0.1900 VOL/VOL
           WILTING POINT             =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT  =    0.2160 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

```
                     LAYER  2
                     --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    624.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0755 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                     LAYER  3
                     --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2131 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                     LAYER  4
                     --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    528.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0762 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                     LAYER  5
                     --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2898 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```



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

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =     96.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0757 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                     LAYER  7
                     --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     48.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2885 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                     LAYER  8
                     --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                  =     24.00   INCHES
POROSITY                   =      0.4570 VOL/VOL
FIELD CAPACITY             =      0.1310 VOL/VOL
WILTING POINT              =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2230 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                     LAYER  9
                     --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                  =      0.15   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0157 VOL/VOL
```

```
EFFECTIVE SAT. HYD. COND.   =   4.42000008000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET


                        LAYER 10
                        --------

            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         =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  1 - PERFECT


         GENERAL DESIGN AND EVAPORATIVE ZONE DATA
         ----------------------------------------

NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     86.00
FRACTION OF AREA ALLOWING RUNOFF   =     75.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      1.944  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.077  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      0.765  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    122.442  INCHES
TOTAL INITIAL WATER                =    122.442  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


          EVAPOTRANSPIRATION AND WEATHER DATA
          -----------------------------------

NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
         BALTIMORE             MARYLAND

     STATION LATITUDE                        =  39.18 DEGREES
     MAXIMUM LEAF AREA INDEX                 =   0.00
     START OF GROWING SEASON (JULIAN DATE)   =    102
     END OF GROWING SEASON (JULIAN DATE)     =    300
     EVAPORATIVE ZONE DEPTH                  =   9.0  INCHES
     AVERAGE ANNUAL WIND SPEED               =   9.30 MPH
```



```
AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  68.00 %


NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    BALTIMORE           MARYLAND

         NORMAL MEAN MONTHLY PRECIPITATION (INCHES)
```

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

```
NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    BALTIMORE           MARYLAND

     NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)
```

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

```
NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    BALTIMORE           MARYLAND
           AND STATION LATITUDE  =  39.18 DEGREES


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

                  MONTHLY TOTALS (IN INCHES) FOR YEAR    1
-------------------------------------------------------------------------------
```

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	4.2406	2.7871	1.0568	0.5803	0.6351	0.3957

FROM LAYER 9	0.3135	0.2777	0.3231	0.2750	1.4684	1.3930
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 10	0.068	0.050	0.017	0.010	0.010	0.007
	0.005	0.004	0.005	0.004	0.024	0.022
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 10	0.041	0.023	0.005	0.001	0.001	0.001
	0.000	0.001	0.002	0.002	0.023	0.007

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.077	11168.417	6.99
EVAPOTRANSPIRATION	28.424	103179.672	64.59
DRAINAGE COLLECTED FROM LAYER 9	13.7463	49899.180	31.23
PERC./LEAKAGE THROUGH LAYER 10	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0190		
CHANGE IN WATER STORAGE	-1.237	-4491.000	-2.81
SOIL WATER AT START OF YEAR	122.444	444472.719	
SOIL WATER AT END OF YEAR	121.207	439981.719	
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	0.017	0.00

****

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
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	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.2406	2.7871	1.0568	0.5803	0.6351	0.3957
	0.3135	0.2777	0.3231	0.2750	1.4684	1.3930
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0683	0.0497	0.0170	0.0097	0.0102	0.0066
	0.0050	0.0045	0.0054	0.0044	0.0244	0.0224

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

****

****

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.077	(0.0000)	11168.42	6.991
EVAPOTRANSPIRATION	28.424	(0.0000)	103179.67	64.586
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.74633	(0.00000)	49899.180	31.23456
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.019	(0.000)		
CHANGE IN WATER STORAGE	-1.237	(0.0000)	-4491.00	-2.811

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.600	9439.0186
DRAINAGE COLLECTED FROM LAYER 9	0.29146	1058.01111
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00006
AVERAGE HEAD ON TOP OF LAYER 10	0.145	
MAXIMUM HEAD ON TOP OF LAYER 10	0.285	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	5.2 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

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

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

****

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5515	0.2126
2	47.4658	0.0761
3	3.4622	0.2885
4	39.9106	0.0756
5	3.4034	0.2836
6	7.0505	0.0734
7	11.9465	0.2489
8	5.4053	0.2252
9	0.0088	0.0588
10	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

FULL -HEIGHT – THIRTEEN (13) LIFTS

Floor slope 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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF13S3.OUT


TIME:  15:26     DATE:   6/24/2020


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

     TITLE:  FULL FILL @13 LIFTS; S = 3%

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


     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   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
           FIELD CAPACITY             =      0.1900 VOL/VOL
           WILTING POINT              =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2160 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```



```
                                   LAYER  2
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER  19
           THICKNESS                  =    624.00   INCHES
           POROSITY                   =      0.1680 VOL/VOL
           FIELD CAPACITY             =      0.0730 VOL/VOL
           WILTING POINT              =      0.0190 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0755 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  3
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
           FIELD CAPACITY             =      0.1900 VOL/VOL
           WILTING POINT              =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2131 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                                   LAYER  4
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER  19
           THICKNESS                  =    528.00   INCHES
           POROSITY                   =      0.1680 VOL/VOL
           FIELD CAPACITY             =      0.0730 VOL/VOL
           WILTING POINT              =      0.0190 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0762 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  5
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
           FIELD CAPACITY             =      0.1900 VOL/VOL
           WILTING POINT              =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2898 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```

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

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER  19
     THICKNESS                   =     96.00   INCHES
     POROSITY                    =      0.1680 VOL/VOL
     FIELD CAPACITY              =      0.0730 VOL/VOL
     WILTING POINT               =      0.0190 VOL/VOL
     INITIAL SOIL WATER CONTENT  =      0.0757 VOL/VOL
     EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                       LAYER  7
                       --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   6
     THICKNESS                   =     48.00   INCHES
     POROSITY                    =      0.4530 VOL/VOL
     FIELD CAPACITY              =      0.1900 VOL/VOL
     WILTING POINT               =      0.0850 VOL/VOL
     INITIAL SOIL WATER CONTENT  =      0.2885 VOL/VOL
     EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                       LAYER  8
                       --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   5
     THICKNESS                   =     24.00   INCHES
     POROSITY                    =      0.4570 VOL/VOL
     FIELD CAPACITY              =      0.1310 VOL/VOL
     WILTING POINT               =      0.0580 VOL/VOL
     INITIAL SOIL WATER CONTENT  =      0.2230 VOL/VOL
     EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                       LAYER  9
                       --------

                TYPE 2 - LATERAL DRAINAGE LAYER
                 MATERIAL TEXTURE NUMBER   0
     THICKNESS                   =      0.15   INCHES
     POROSITY                    =      0.8500 VOL/VOL
     FIELD CAPACITY              =      0.0100 VOL/VOL
     WILTING POINT               =      0.0050 VOL/VOL
     INITIAL SOIL WATER CONTENT  =      0.0101 VOL/VOL
```



```
     EFFECTIVE SAT. HYD. COND.   =   4.42000008000      CM/SEC
     SLOPE                       =      3.00   PERCENT
     DRAINAGE LENGTH             =    250.0    FEET


                       LAYER 10
                       --------

               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         =      0.00   HOLES/ACRE
     FML INSTALLATION DEFECTS    =      0.00   HOLES/ACRE
     FML PLACEMENT QUALITY       =  1 - PERFECT


           GENERAL DESIGN AND EVAPORATIVE ZONE DATA
           ----------------------------------------

  NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

  SCS RUNOFF CURVE NUMBER            =     86.00
  FRACTION OF AREA ALLOWING RUNOFF   =     75.0    PERCENT
  AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
  EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
  INITIAL WATER IN EVAPORATIVE ZONE  =      1.944  INCHES
  UPPER LIMIT OF EVAPORATIVE STORAGE =      4.077  INCHES
  LOWER LIMIT OF EVAPORATIVE STORAGE =      0.765  INCHES
  INITIAL SNOW WATER                 =      0.000  INCHES
  INITIAL WATER IN LAYER MATERIALS   =    122.441  INCHES
  TOTAL INITIAL WATER                =    122.441  INCHES
  TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


            EVAPOTRANSPIRATION AND WEATHER DATA
            -----------------------------------

  NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
         BALTIMORE             MARYLAND

      STATION LATITUDE                        =  39.18 DEGREES
      MAXIMUM LEAF AREA INDEX                 =   0.00
      START OF GROWING SEASON (JULIAN DATE)   =    102
      END OF GROWING SEASON (JULIAN DATE)     =    300
      EVAPORATIVE ZONE DEPTH                  =   9.0  INCHES
      AVERAGE ANNUAL WIND SPEED               =   9.30 MPH
```

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	4.2719	2.7625	1.0528	0.5792	0.6351	0.3947

FROM LAYER 9	0.3133	0.2778	0.3226	0.2753	1.4773	1.3848
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.046	0.033	0.011	0.006	0.007	0.004
TOP OF LAYER 10	0.003	0.003	0.004	0.003	0.016	0.015
STD. DEVIATION OF DAILY	0.028	0.015	0.003	0.001	0.001	0.001
HEAD ON TOP OF LAYER 10	0.000	0.000	0.001	0.001	0.015	0.005

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.077	11168.417	6.99
EVAPOTRANSPIRATION	28.424	103179.672	64.59
DRAINAGE COLLECTED FROM LAYER 9	13.7473	49902.805	31.24
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0126		
CHANGE IN WATER STORAGE	-1.238	-4494.628	-2.81
SOIL WATER AT START OF YEAR	122.443	444466.625	
SOIL WATER AT END OF YEAR	121.204	439972.000	
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	0.020	0.00

****

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
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	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.2719	2.7625	1.0528	0.5792	0.6351	0.3947
	0.3133	0.2778	0.3226	0.2753	1.4773	1.3848
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0459	0.0328	0.0113	0.0064	0.0068	0.0044
	0.0034	0.0030	0.0036	0.0030	0.0164	0.0149

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

****

****

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.077	(0.0000)	11168.42	6.991
EVAPOTRANSPIRATION	28.424	(0.0000)	103179.67	64.586
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.74733	(0.00000)	49902.805	31.23683
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.013	(0.000)		
CHANGE IN WATER STORAGE	-1.238	(0.0000)	-4494.63	-2.813

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.600	9439.0186
DRAINAGE COLLECTED FROM LAYER 9	0.29260	1062.12488
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 10	0.097	
MAXIMUM HEAD ON TOP OF LAYER 10	0.192	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	2.9 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

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

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

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5515	0.2126
2	47.4658	0.0761
3	3.4622	0.2885
4	39.9106	0.0756
5	3.4034	0.2836
6	7.0505	0.0734
7	11.9465	0.2489
8	5.4053	0.2252
9	0.0070	0.0465
10	0.0000	0.0000
SNOW WATER	0.000	

a Montrose Environmental Group company

HELP MODEL PRINTOUTS

FULL -HEIGHT – THIRTEEN (13) LIFTS

Floor slope 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:\DATA4.D4
TEMPERATURE DATA FILE:       C:\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\DATA10.D10
OUTPUT DATA FILE:            C:\FF13S4.OUT


TIME:  15:30     DATE:   6/24/2020


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

     TITLE:  FULL FILL @13 LIFTS; S = 4%

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


     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   6
           THICKNESS                    =     12.00   INCHES
           POROSITY                     =      0.4530 VOL/VOL
           FIELD CAPACITY               =      0.1900 VOL/VOL
           WILTING POINT                =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

```
                        LAYER  2
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    624.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0755 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                        LAYER  3
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2171 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                        LAYER  4
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    528.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0759 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                        LAYER  5
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2898 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```



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

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =     96.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0778 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     48.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2884 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                  =     24.00   INCHES
POROSITY                   =      0.4570 VOL/VOL
FIELD CAPACITY             =      0.1310 VOL/VOL
WILTING POINT              =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2201 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                        LAYER  9
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                  =      0.15   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0289 VOL/VOL
```

```
EFFECTIVE SAT. HYD. COND.   =   4.42000008000     CM/SEC
SLOPE                       =      4.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET


                        LAYER 10
                        --------

            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         =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  1 - PERFECT


        GENERAL DESIGN AND EVAPORATIVE ZONE DATA
        ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     86.00
FRACTION OF AREA ALLOWING RUNOFF   =     75.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      1.944  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.077  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      0.765  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    122.461  INCHES
TOTAL INITIAL WATER                =    122.461  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


          EVAPOTRANSPIRATION AND WEATHER DATA
          -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
          BALTIMORE             MARYLAND

     STATION LATITUDE                        =  39.18 DEGREES
     MAXIMUM LEAF AREA INDEX                 =   0.00
     START OF GROWING SEASON (JULIAN DATE)   =    102
     END OF GROWING SEASON (JULIAN DATE)     =    300
     EVAPORATIVE ZONE DEPTH                  =   9.0  INCHES
     AVERAGE ANNUAL WIND SPEED               =   9.30 MPH
```



```
     AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  62.00 %
     AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  65.00 %
     AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  71.00 %
     AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  68.00 %


 NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
          COEFFICIENTS FOR    BALTIMORE           MARYLAND

          NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
  3.47        3.02        3.93        3.00        3.89        3.43
  3.85        3.74        3.98        3.16        3.12        3.35


 NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
          COEFFICIENTS FOR    BALTIMORE           MARYLAND

     NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
 32.40       35.50       43.70       53.20       62.80       71.70
 76.50       74.50       67.40       55.30       45.50       36.60


 NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
          COEFFICIENTS FOR    BALTIMORE           MARYLAND
            AND STATION LATITUDE  =  39.18 DEGREES


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

                  MONTHLY TOTALS (IN INCHES) FOR YEAR    1
-------------------------------------------------------------------------------

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

PRECIPITATION                 2.00    1.42    3.53    1.61    2.69    4.35
                              2.02    3.97    7.14    4.15    3.78    7.35

RUNOFF                        0.000   0.000   0.000   0.000   0.000   0.016
                              0.000   0.064   2.589   0.068   0.001   0.353

EVAPOTRANSPIRATION            1.805   1.880   2.771   2.254   1.951   4.909
                              1.762   3.476   1.136   3.011   2.304   1.282

LATERAL DRAINAGE COLLECTED    4.2472  2.7901  1.0628  0.5821  0.6278  0.3999
```

FROM LAYER 9	0.3174	0.2996	0.2908	0.2664	1.2843	1.4432
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.034	0.025	0.009	0.005	0.005	0.003
TOP OF LAYER 10	0.003	0.002	0.002	0.002	0.011	0.012
STD. DEVIATION OF DAILY	0.022	0.012	0.002	0.001	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.001	0.011	0.004

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.091	11220.854	7.02
EVAPOTRANSPIRATION	28.542	103606.211	64.85
DRAINAGE COLLECTED FROM LAYER 9	13.6116	49410.078	30.93
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0094		
CHANGE IN WATER STORAGE	-1.234	-4480.892	-2.80
SOIL WATER AT START OF YEAR	122.465	444548.031	
SOIL WATER AT END OF YEAR	121.231	440067.125	
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	0.029	0.00

****

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
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	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.2472	2.7901	1.0628	0.5821	0.6278	0.3999
	0.3174	0.2996	0.2908	0.2664	1.2843	1.4432
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0342	0.0249	0.0086	0.0048	0.0051	0.0033
	0.0026	0.0024	0.0024	0.0021	0.0107	0.0116

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

****

****

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

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01 (0.000)	159756.3	100.00
RUNOFF	3.091 (0.0000)	11220.85	7.024
EVAPOTRANSPIRATION	28.542 (0.0000)	103606.21	64.853
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.61159 (0.00000)	49410.078	30.92841
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000 (0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.009 (0.000)		
CHANGE IN WATER STORAGE	-1.234 (0.0000)	-4480.89	-2.805

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.589	9398.5059
DRAINAGE COLLECTED FROM LAYER 9	0.30676	1113.52625
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 10	0.077	
MAXIMUM HEAD ON TOP OF LAYER 10	0.152	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	1.3 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

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

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

****

****

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6121	0.2177
2	47.3083	0.0758
3	3.4348	0.2862
4	40.2308	0.0762
5	3.4091	0.2841
6	7.0173	0.0731
7	11.7788	0.2454
8	5.4300	0.2263
9	0.0051	0.0343
10	0.0000	0.0000
SNOW WATER	0.000	

****
****

a Montrose Environmental Group company

HELP MODEL PRINTOUTS

FULL -HEIGHT – THIRTEEN (13) LIFTS

Floor slope 5%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF13S5.OUT


TIME:  15:33     DATE:   6/24/2020


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

     TITLE:  FULL FILL @13 LIFTS; S = 5%

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


     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   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
           FIELD CAPACITY             =      0.1900 VOL/VOL
           WILTING POINT              =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2160 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```



```
                                   LAYER  2
                                   --------

                   TYPE 1 - VERTICAL PERCOLATION LAYER
                       MATERIAL TEXTURE NUMBER  19
           THICKNESS                  =    624.00   INCHES
           POROSITY                   =      0.1680 VOL/VOL
           FIELD CAPACITY             =      0.0730 VOL/VOL
           WILTING POINT              =      0.0190 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0755 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  3
                                   --------

                   TYPE 1 - VERTICAL PERCOLATION LAYER
                       MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
           FIELD CAPACITY             =      0.1900 VOL/VOL
           WILTING POINT              =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2171 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                                   LAYER  4
                                   --------

                   TYPE 1 - VERTICAL PERCOLATION LAYER
                       MATERIAL TEXTURE NUMBER  19
           THICKNESS                  =    528.00   INCHES
           POROSITY                   =      0.1680 VOL/VOL
           FIELD CAPACITY             =      0.0730 VOL/VOL
           WILTING POINT              =      0.0190 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0759 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  5
                                   --------

                   TYPE 1 - VERTICAL PERCOLATION LAYER
                       MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
           FIELD CAPACITY             =      0.1900 VOL/VOL
           WILTING POINT              =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2898 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```

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

              TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0778 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  7
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2884 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  8
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2201 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  9
                        --------

               TYPE 2 - LATERAL DRAINAGE LAYER
                MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.15   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0261 VOL/VOL
```


```
EFFECTIVE SAT. HYD. COND.   =  4.42000008000     CM/SEC
SLOPE                       =      5.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET


                        LAYER 10
                        --------

               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         =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  1 - PERFECT


           GENERAL DESIGN AND EVAPORATIVE ZONE DATA
           ----------------------------------------

  NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

 SCS RUNOFF CURVE NUMBER            =     86.00
 FRACTION OF AREA ALLOWING RUNOFF   =     75.0    PERCENT
 AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
 EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
 INITIAL WATER IN EVAPORATIVE ZONE  =      1.944  INCHES
 UPPER LIMIT OF EVAPORATIVE STORAGE =      4.077  INCHES
 LOWER LIMIT OF EVAPORATIVE STORAGE =      0.765  INCHES
 INITIAL SNOW WATER                 =      0.000  INCHES
 INITIAL WATER IN LAYER MATERIALS   =    122.460  INCHES
 TOTAL INITIAL WATER                =    122.460  INCHES
 TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


            EVAPOTRANSPIRATION AND WEATHER DATA
            -----------------------------------

  NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
           BALTIMORE             MARYLAND

      STATION LATITUDE                     =  39.18 DEGREES
      MAXIMUM LEAF AREA INDEX              =   0.00
      START OF GROWING SEASON (JULIAN DATE) =   102
      END OF GROWING SEASON (JULIAN DATE)   =   300
      EVAPORATIVE ZONE DEPTH               =   9.0  INCHES
      AVERAGE ANNUAL WIND SPEED            =   9.30 MPH
```

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
EVAPOTRANSPIRATION	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	4.2562	2.7829	1.0614	0.5821	0.6278	0.3996
FROM LAYER 9	0.3173	0.2996	0.2907	0.2664	1.2872	1.4406
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.027	0.020	0.007	0.004	0.004	0.003
TOP OF LAYER 10	0.002	0.002	0.002	0.002	0.009	0.009
STD. DEVIATION OF DAILY	0.017	0.009	0.002	0.001	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.001	0.009	0.003

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.091	11220.854	7.02
EVAPOTRANSPIRATION	28.542	103606.211	64.85
DRAINAGE COLLECTED FROM LAYER 9	13.6118	49410.684	30.93
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0075		
CHANGE IN WATER STORAGE	-1.235	-4481.474	-2.81
SOIL WATER AT START OF YEAR	122.464	444544.969	
SOIL WATER AT END OF YEAR	121.230	440063.500	
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	0.008	0.00

****

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
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	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.2562	2.7829	1.0614	0.5821	0.6278	0.3996
	0.3173	0.2996	0.2907	0.2664	1.2872	1.4406
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0275	0.0199	0.0068	0.0039	0.0041	0.0027
	0.0020	0.0019	0.0019	0.0017	0.0086	0.0093
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

****

****

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.091	(0.0000)	11220.85	7.024
EVAPOTRANSPIRATION	28.542	(0.0000)	103606.21	64.853
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.61176	(0.00000)	49410.684	30.92879
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.008	(0.000)		
CHANGE IN WATER STORAGE	-1.235	(0.0000)	-4481.47	-2.805

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.589	9398.5059
DRAINAGE COLLECTED FROM LAYER 9	0.30584	1110.21704
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 10	0.061	
MAXIMUM HEAD ON TOP OF LAYER 10	0.122	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	0.4 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

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

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

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6121	0.2177
2	47.3083	0.0758
3	3.4348	0.2862
4	40.2308	0.0762
5	3.4091	0.2841
6	7.0173	0.0731
7	11.7788	0.2454
8	5.4300	0.2263
9	0.0046	0.0304
10	0.0000	0.0000
SNOW WATER	0.000	

a Montrose Environmental Group company

HELP MODEL PRINTOUTS

FULL -HEIGHT – THIRTEEN (13) LIFTS

Floor slope 6%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:       C:\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\DATA10.D10
OUTPUT DATA FILE:            C:\FF13S6.OUT


TIME:  15:36     DATE:   6/24/2020


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

     TITLE:  FULL FILL @13 LIFTS; S = 6%

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


     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   6
           THICKNESS                    =     12.00   INCHES
           POROSITY                     =      0.4530 VOL/VOL
           FIELD CAPACITY               =      0.1900 VOL/VOL
           WILTING POINT                =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

```
                    LAYER  2
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    624.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0755 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                    LAYER  3
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2187 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                    LAYER  4
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    528.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0767 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                    LAYER  5
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2855 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```



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

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0751 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                    LAYER  7
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2848 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                    LAYER  8
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2221 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                    LAYER  9
                    --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.15   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.   =   4.42000008000     CM/SEC
SLOPE                       =      6.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET


                        LAYER 10
                        --------

            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         =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  1 - PERFECT


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     86.00
FRACTION OF AREA ALLOWING RUNOFF   =     75.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      1.944  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      4.077  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE  =      0.765  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    122.464  INCHES
TOTAL INITIAL WATER                =    122.464  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


           EVAPOTRANSPIRATION AND WEATHER DATA
           -----------------------------------

NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
         BALTIMORE             MARYLAND

    STATION LATITUDE                         =  39.18 DEGREES
    MAXIMUM LEAF AREA INDEX                  =   0.00
    START OF GROWING SEASON (JULIAN DATE)    =    102
    END OF GROWING SEASON (JULIAN DATE)      =    300
    EVAPORATIVE ZONE DEPTH                   =   9.0  INCHES
    AVERAGE ANNUAL WIND SPEED                =   9.30 MPH
```



```
    AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  62.00 %
    AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  65.00 %
    AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  71.00 %
    AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  68.00 %


NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    BALTIMORE           MARYLAND

          NORMAL MEAN MONTHLY PRECIPITATION (INCHES)
```

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

```
NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    BALTIMORE           MARYLAND

      NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)
```

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

```
NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    BALTIMORE           MARYLAND
           AND STATION LATITUDE  =  39.18 DEGREES


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

                  MONTHLY TOTALS (IN INCHES) FOR YEAR    1
-------------------------------------------------------------------------------
```

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.001	0.000	0.000	0.000	0.000	0.016
	0.000	0.070	2.562	0.069	0.001	0.385
EVAPOTRANSPIRATION	1.804	1.891	2.770	2.244	1.962	4.893
	1.762	3.479	1.128	3.025	2.302	1.281
LATERAL DRAINAGE COLLECTED	3.9390	3.0638	1.0835	0.5920	0.6298	0.4013

FROM LAYER 9	0.3174	0.2893	0.2988	0.2633	1.2797	1.4717
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.021	0.018	0.006	0.003	0.003	0.002
TOP OF LAYER 10	0.002	0.002	0.002	0.001	0.007	0.008
STD. DEVIATION OF DAILY	0.014	0.009	0.002	0.001	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.001	0.008	0.003

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.103	11263.241	7.05
EVAPOTRANSPIRATION	28.542	103605.773	64.85
DRAINAGE COLLECTED FROM LAYER 9	13.6296	49475.574	30.97
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0063		
CHANGE IN WATER STORAGE	-1.264	-4588.320	-2.87
SOIL WATER AT START OF YEAR	122.465	444549.250	
SOIL WATER AT END OF YEAR	121.201	439960.906	
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	0.012	0.00

****

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.001	0.000	0.000	0.000	0.000	0.016
	0.000	0.070	2.562	0.069	0.001	0.385
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	1.804	1.891	2.770	2.244	1.962	4.893
	1.762	3.479	1.128	3.025	2.302	1.281
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	3.9390	3.0638	1.0835	0.5920	0.6298	0.4013
	0.3174	0.2893	0.2988	0.2633	1.2797	1.4717
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0212	0.0183	0.0058	0.0033	0.0034	0.0022
	0.0017	0.0016	0.0017	0.0014	0.0071	0.0079

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

****

****

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.103	(0.0000)	11263.24	7.050
EVAPOTRANSPIRATION	28.542	(0.0000)	103605.77	64.852
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.62963	(0.00000)	49475.574	30.96941
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.006	(0.000)		
CHANGE IN WATER STORAGE	-1.264	(0.0000)	-4588.32	-2.872

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.562	9301.0596
DRAINAGE COLLECTED FROM LAYER 9	0.25693	932.63879
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 10	0.043	
MAXIMUM HEAD ON TOP OF LAYER 10	0.086	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4501	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

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

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

****

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6247	0.2187
2	47.6658	0.0764
3	3.3994	0.2833
4	39.8127	0.0754
5	3.4003	0.2834
6	7.0080	0.0730
7	11.8486	0.2468
8	5.4385	0.2266
9	0.0018	0.0121
10	0.0000	0.0000
SNOW WATER	0.000	

ADVANCED GeoServices
a Montrose Environmental Group company

HELP MODEL PRINTOUTS

FULL -HEIGHT – THIRTEEN (13) LIFTS

Floor slope 33%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF13S33.OUT


TIME:  12:42     DATE:   6/26/2020


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

     TITLE:  FULL FILL @13 LIFTS, S = 33%

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


     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   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
           FIELD CAPACITY             =      0.1900 VOL/VOL
           WILTING POINT              =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2160 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```



```
                                   LAYER  2
                                   --------

                 TYPE 1 - VERTICAL PERCOLATION LAYER
                     MATERIAL TEXTURE NUMBER  19
           THICKNESS                  =    624.00   INCHES
           POROSITY                   =      0.1680 VOL/VOL
           FIELD CAPACITY             =      0.0730 VOL/VOL
           WILTING POINT              =      0.0190 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0755 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  3
                                   --------

                 TYPE 1 - VERTICAL PERCOLATION LAYER
                     MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
           FIELD CAPACITY             =      0.1900 VOL/VOL
           WILTING POINT              =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2862 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                                   LAYER  4
                                   --------

                 TYPE 1 - VERTICAL PERCOLATION LAYER
                     MATERIAL TEXTURE NUMBER  19
           THICKNESS                  =    528.00   INCHES
           POROSITY                   =      0.1680 VOL/VOL
           FIELD CAPACITY             =      0.0730 VOL/VOL
           WILTING POINT              =      0.0190 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0762 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  5
                                   --------

                 TYPE 1 - VERTICAL PERCOLATION LAYER
                     MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
           FIELD CAPACITY             =      0.1900 VOL/VOL
           WILTING POINT              =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2841 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```

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

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0731 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                    LAYER  7
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2454 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                    LAYER  8
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2263 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                    LAYER  9
                    --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.15   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0304 VOL/VOL
```



```
EFFECTIVE SAT. HYD. COND.   =  4.42000008000     CM/SEC
SLOPE                       =     33.00   PERCENT
DRAINAGE LENGTH             =     75.0    FEET


                    LAYER 10
                    --------

          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         =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  1 - PERFECT


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

  NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     86.00
FRACTION OF AREA ALLOWING RUNOFF   =     75.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      1.944  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.077  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      0.765  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    121.014  INCHES
TOTAL INITIAL WATER                =    121.014  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


           EVAPOTRANSPIRATION AND WEATHER DATA
           -----------------------------------

  NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
           BALTIMORE             MARYLAND

     STATION LATITUDE                        =  39.18 DEGREES
     MAXIMUM LEAF AREA INDEX                 =   0.00
     START OF GROWING SEASON (JULIAN DATE)   =    102
     END OF GROWING SEASON (JULIAN DATE)     =    300
     EVAPORATIVE ZONE DEPTH                  =   9.0  INCHES
     AVERAGE ANNUAL WIND SPEED               =   9.30 MPH
```

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.001	0.000	0.000	0.000	0.000	0.017
	0.000	0.083	2.478	0.070	0.003	0.497
EVAPOTRANSPIRATION	1.826	1.852	2.705	2.062	1.728	4.375
	1.390	3.389	0.869	3.032	2.314	1.288
LATERAL DRAINAGE COLLECTED	1.5979	3.8179	1.1801	0.6472	0.5369	0.3999

FROM LAYER 9	0.2972	0.4609	0.2281	0.4172	2.8133	1.5718
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.001	0.001
STD. DEVIATION OF DAILY	0.001	0.001	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.001	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.148	11428.088	7.15
EVAPOTRANSPIRATION	26.832	97400.617	60.97
DRAINAGE COLLECTED FROM LAYER 9	13.9684	50705.457	31.74
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0004		
CHANGE IN WATER STORAGE	0.061	222.139	0.14
SOIL WATER AT START OF YEAR	121.018	439296.344	
SOIL WATER AT END OF YEAR	121.079	439518.469	
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	-0.020	0.00

****

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.001	0.000	0.000	0.000	0.000	0.017
	0.000	0.083	2.478	0.070	0.003	0.497
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	1.826	1.852	2.705	2.062	1.728	4.375
	1.390	3.389	0.869	3.032	2.314	1.288
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	1.5979	3.8179	1.1801	0.6472	0.5369	0.3999
	0.2972	0.4609	0.2281	0.4172	2.8133	1.5718
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0005	0.0014	0.0004	0.0002	0.0002	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0009	0.0005
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

****

****

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.148	(0.0000)	11428.09	7.153
EVAPOTRANSPIRATION	26.832	(0.0000)	97400.62	60.968
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.96845	(0.00000)	50705.457	31.73926
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.000	(0.000)		
CHANGE IN WATER STORAGE	0.061	(0.0000)	222.14	0.139

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.478	8995.4043
DRAINAGE COLLECTED FROM LAYER 9	0.28205	1023.83862
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 10	0.003	
MAXIMUM HEAD ON TOP OF LAYER 10	0.007	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3698	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

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

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

****

****

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6619	0.2218
2	47.7646	0.0765
3	3.3418	0.2785
4	39.7701	0.0753
5	3.2540	0.2712
6	7.0080	0.0730
7	11.8216	0.2463
8	5.4512	0.2271
9	0.0017	0.0112
10	0.0000	0.0000
SNOW WATER	0.000	

****
****

HELP MODEL PRINTOUTS

FULL -HEIGHT – SEVENTEEN (17) LIFTS

Floor slope 2%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF17S2.OUT


TIME:  15:47     DATE:   6/24/2020


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

     TITLE:  FULL FILL @17 LIFTS; S = 2%

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


     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   6
           THICKNESS                    =     12.00   INCHES
           POROSITY                     =      0.4530 VOL/VOL
           FIELD CAPACITY               =      0.1900 VOL/VOL
           WILTING POINT                =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	816.00 INCHES
POROSITY	=	0.1680 VOL/VOL
FIELD CAPACITY	=	0.0730 VOL/VOL
WILTING POINT	=	0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4530 VOL/VOL
FIELD CAPACITY	=	0.1900 VOL/VOL
WILTING POINT	=	0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2131 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03 CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	720.00 INCHES
POROSITY	=	0.1680 VOL/VOL
FIELD CAPACITY	=	0.0730 VOL/VOL
WILTING POINT	=	0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0758 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4530 VOL/VOL
FIELD CAPACITY	=	0.1900 VOL/VOL
WILTING POINT	=	0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2876 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03 CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00 INCHES
POROSITY	=	0.1680 VOL/VOL
FIELD CAPACITY	=	0.0730 VOL/VOL
WILTING POINT	=	0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0753 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00 INCHES
POROSITY	=	0.4530 VOL/VOL
FIELD CAPACITY	=	0.1900 VOL/VOL
WILTING POINT	=	0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2841 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03 CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2229 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0230 VOL/VOL

```
    EFFECTIVE SAT. HYD. COND.   =   4.42000008000     CM/SEC
    SLOPE                       =      2.00   PERCENT
    DRAINAGE LENGTH             =    250.0    FEET


                        LAYER 10
                        --------

                  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         =      0.00   HOLES/ACRE
    FML INSTALLATION DEFECTS    =      0.00   HOLES/ACRE
    FML PLACEMENT QUALITY       =  1 - PERFECT


            GENERAL DESIGN AND EVAPORATIVE ZONE DATA
            ----------------------------------------

  NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

 SCS RUNOFF CURVE NUMBER            =     86.00
 FRACTION OF AREA ALLOWING RUNOFF   =     75.0    PERCENT
 AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
 EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
 INITIAL WATER IN EVAPORATIVE ZONE  =      1.944  INCHES
 UPPER LIMIT OF EVAPORATIVE STORAGE =      4.077  INCHES
 LOWER LIMIT OF EVAPORATIVE STORAGE =      0.765  INCHES
 INITIAL SNOW WATER                 =      0.000  INCHES
 INITIAL WATER IN LAYER MATERIALS   =    151.003  INCHES
 TOTAL INITIAL WATER                =    151.003  INCHES
 TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


             EVAPOTRANSPIRATION AND WEATHER DATA
             -----------------------------------

  NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
           BALTIMORE              MARYLAND

      STATION LATITUDE                        =  39.18 DEGREES
      MAXIMUM LEAF AREA INDEX                 =   0.00
      START OF GROWING SEASON (JULIAN DATE)   =    102
      END OF GROWING SEASON (JULIAN DATE)     =    300
      EVAPORATIVE ZONE DEPTH                  =   9.0  INCHES
      AVERAGE ANNUAL WIND SPEED               =   9.30 MPH
```



```
      AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  62.00 %
      AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  65.00 %
      AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  71.00 %
      AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  68.00 %


  NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
           COEFFICIENTS FOR    BALTIMORE           MARYLAND

               NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

 JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
 -------     -------     -------     -------     -------     -------
   3.47        3.02        3.93        3.00        3.89        3.43
   3.85        3.74        3.98        3.16        3.12        3.35


  NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
           COEFFICIENTS FOR    BALTIMORE           MARYLAND

      NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

 JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
 -------     -------     -------     -------     -------     -------
  32.40       35.50       43.70       53.20       62.80       71.70
  76.50       74.50       67.40       55.30       45.50       36.60


  NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
           COEFFICIENTS FOR    BALTIMORE           MARYLAND
             AND STATION LATITUDE  =  39.18 DEGREES



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

                  MONTHLY TOTALS (IN INCHES) FOR YEAR    1
-------------------------------------------------------------------------------

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

PRECIPITATION                  2.00    1.42    3.53    1.61    2.69    4.35
                               2.02    3.97    7.14    4.15    3.78    7.35

RUNOFF                         0.000   0.000   0.000   0.000   0.000   0.015
                               0.000   0.060   2.600   0.069   0.001   0.332

EVAPOTRANSPIRATION             1.811   1.893   2.700   2.247   1.953   4.919
                               1.729   3.442   1.131   3.011   2.305   1.282

LATERAL DRAINAGE COLLECTED     3.6322  3.7138  1.1496  0.6613  0.6626  0.3985
```

FROM LAYER 9	0.3165	0.2801	0.3237	0.2737	1.3412	1.4883
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 10	0.058	0.066	0.019	0.011	0.011	0.007
	0.005	0.005	0.005	0.004	0.022	0.024
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 10	0.040	0.031	0.005	0.002	0.001	0.001
	0.000	0.001	0.002	0.002	0.024	0.008

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.077	11168.417	6.99
EVAPOTRANSPIRATION	28.424	103179.672	64.59
DRAINAGE COLLECTED FROM LAYER 9	14.2417	51697.254	32.36
PERC./LEAKAGE THROUGH LAYER 10	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0198		
CHANGE IN WATER STORAGE	-1.733	-6289.024	-3.94
SOIL WATER AT START OF YEAR	151.006	548153.437	
SOIL WATER AT END OF YEAR	149.274	541864.375	
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	-0.035	0.00

****

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
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	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	3.6322	3.7138	1.1496	0.6613	0.6626	0.3985
	0.3165	0.2801	0.3237	0.2737	1.3412	1.4883
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0585	0.0662	0.0185	0.0110	0.0107	0.0066
	0.0051	0.0045	0.0054	0.0044	0.0223	0.0240

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

****

****

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.077	(0.0000)	11168.42	6.991
EVAPOTRANSPIRATION	28.424	(0.0000)	103179.67	64.586
LATERAL DRAINAGE COLLECTED FROM LAYER 9	14.24167	(0.00000)	51697.254	32.36007
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.020	(0.000)		
CHANGE IN WATER STORAGE	-1.733	(0.0000)	-6289.02	-3.937

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.600	9439.0186
DRAINAGE COLLECTED FROM LAYER 9	0.27871	1011.71722
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00006
AVERAGE HEAD ON TOP OF LAYER 10	0.139	
MAXIMUM HEAD ON TOP OF LAYER 10	0.272	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	5.0 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

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

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

****

****

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5515	0.2126
2	61.7159	0.0756
3	3.4370	0.2864
4	53.8051	0.0747
5	3.3627	0.2802
6	7.0274	0.0732
7	11.9370	0.2487
8	5.4241	0.2260
9	0.0097	0.0645
10	0.0000	0.0000
SNOW WATER	0.000	

****
****

ADVANCED GeoServices
a Montrose Environmental Group company

HELP MODEL PRINTOUTS

FULL -HEIGHT – SEVENTEEN (17) LIFTS

Floor slope 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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF17S3.OUT


TIME:  15:50     DATE:   6/24/2020


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

     TITLE:  FULL FILL @17 LIFTS; S = 3%

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


     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   6
           THICKNESS                  =    12.00   INCHES
           POROSITY                   =     0.4530 VOL/VOL
           FIELD CAPACITY             =     0.1900 VOL/VOL
           WILTING POINT              =     0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =     0.2160 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```



```
                                   LAYER  2
                                   --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER  19
           THICKNESS                  =   816.00   INCHES
           POROSITY                   =     0.1680 VOL/VOL
           FIELD CAPACITY             =     0.0730 VOL/VOL
           WILTING POINT              =     0.0190 VOL/VOL
           INITIAL SOIL WATER CONTENT =     0.0755 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  3
                                   --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =    12.00   INCHES
           POROSITY                   =     0.4530 VOL/VOL
           FIELD CAPACITY             =     0.1900 VOL/VOL
           WILTING POINT              =     0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =     0.2131 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                                   LAYER  4
                                   --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER  19
           THICKNESS                  =   720.00   INCHES
           POROSITY                   =     0.1680 VOL/VOL
           FIELD CAPACITY             =     0.0730 VOL/VOL
           WILTING POINT              =     0.0190 VOL/VOL
           INITIAL SOIL WATER CONTENT =     0.0758 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  5
                                   --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =    12.00   INCHES
           POROSITY                   =     0.4530 VOL/VOL
           FIELD CAPACITY             =     0.1900 VOL/VOL
           WILTING POINT              =     0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =     0.2876 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```

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

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0753 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                    LAYER  7
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2841 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                    LAYER  8
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2229 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                    LAYER  9
                    --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.15   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0230 VOL/VOL
```



```
EFFECTIVE SAT. HYD. COND.   =   4.42000008000     CM/SEC
SLOPE                       =      3.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET


                    LAYER 10
                    --------

            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         =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  1 - PERFECT


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

  NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     86.00
FRACTION OF AREA ALLOWING RUNOFF   =     75.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      1.944  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.077  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      0.765  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    151.003  INCHES
TOTAL INITIAL WATER                =    151.003  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


          EVAPOTRANSPIRATION AND WEATHER DATA
          -----------------------------------

  NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
           BALTIMORE             MARYLAND

    STATION LATITUDE                        =  39.18 DEGREES
    MAXIMUM LEAF AREA INDEX                 =   0.00
    START OF GROWING SEASON (JULIAN DATE)   =    102
    END OF GROWING SEASON (JULIAN DATE)     =    300
    EVAPORATIVE ZONE DEPTH                  =   9.0  INCHES
    AVERAGE ANNUAL WIND SPEED               =   9.30 MPH
```

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	3.6496	3.7049	1.1453	0.6600	0.6623	0.3975

FROM LAYER 9	0.3162	0.2803	0.3232	0.2741	1.3511	1.4794
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.039	0.044	0.012	0.007	0.007	0.004
TOP OF LAYER 10	0.003	0.003	0.004	0.003	0.015	0.016
STD. DEVIATION OF DAILY	0.027	0.021	0.003	0.001	0.001	0.001
HEAD ON TOP OF LAYER 10	0.000	0.000	0.001	0.001	0.016	0.005

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.077	11168.417	6.99
EVAPOTRANSPIRATION	28.424	103179.672	64.59
DRAINAGE COLLECTED FROM LAYER 9	14.2438	51704.973	32.36
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0132		
CHANGE IN WATER STORAGE	-1.735	-6296.778	-3.94
SOIL WATER AT START OF YEAR	151.006	548153.437	
SOIL WATER AT END OF YEAR	149.272	541856.625	
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	0.000	0.00

****

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
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	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	3.6496	3.7049	1.1453	0.6600	0.6623	0.3975
	0.3162	0.2803	0.3232	0.2741	1.3511	1.4794
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0392	0.0440	0.0123	0.0073	0.0071	0.0044
	0.0034	0.0030	0.0036	0.0029	0.0150	0.0159
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

****

****

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.077	(0.0000)	11168.42	6.991
EVAPOTRANSPIRATION	28.424	(0.0000)	103179.67	64.586
LATERAL DRAINAGE COLLECTED FROM LAYER 9	14.24379	(0.00000)	51704.973	32.36491
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.013	(0.000)		
CHANGE IN WATER STORAGE	-1.735	(0.0000)	-6296.78	-3.941

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.600	9439.0186
DRAINAGE COLLECTED FROM LAYER 9	0.28167	1022.45868
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 10	0.094	
MAXIMUM HEAD ON TOP OF LAYER 10	0.186	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	2.2 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

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

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

****

****

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5515	0.2126
2	61.7159	0.0756
3	3.4370	0.2864
4	53.8051	0.0747
5	3.3627	0.2802
6	7.0274	0.0732
7	11.9370	0.2487
8	5.4241	0.2260
9	0.0075	0.0502
10	0.0000	0.0000
SNOW WATER	0.000	

****
****

HELP MODEL PRINTOUTS

FULL -HEIGHT – SEVENTEEN (17) LIFTS

Floor slope 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:\DATA4.D4
TEMPERATURE DATA FILE:       C:\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\DATA10.D10
OUTPUT DATA FILE:            C:\FF17S4.OUT


TIME:  15:53     DATE:   6/24/2020


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

     TITLE:  FULL FILL @17 LIFTS; S = 4%

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


     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   6
           THICKNESS                    =     12.00   INCHES
           POROSITY                     =      0.4530 VOL/VOL
           FIELD CAPACITY               =      0.1900 VOL/VOL
           WILTING POINT                =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

```
                    LAYER  2
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    816.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0755 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                    LAYER  3
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2171 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                    LAYER  4
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    720.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0756 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                    LAYER  5
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2879 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```



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

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =     96.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0773 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                    LAYER  7
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     48.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2837 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                    LAYER  8
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                  =     24.00   INCHES
POROSITY                   =      0.4570 VOL/VOL
FIELD CAPACITY             =      0.1310 VOL/VOL
WILTING POINT              =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2206 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                    LAYER  9
                    --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                  =      0.15   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0144 VOL/VOL
```

```
EFFECTIVE SAT. HYD. COND.   =   4.42000008000     CM/SEC
SLOPE                       =      4.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET
```

LAYER 10

```
            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         =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  1 - PERFECT
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

```
SCS RUNOFF CURVE NUMBER             =     86.00
FRACTION OF AREA ALLOWING RUNOFF    =     75.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH              =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      1.944  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      4.077  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE  =      0.765  INCHES
INITIAL SNOW WATER                  =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =    151.027  INCHES
TOTAL INITIAL WATER                 =    151.027  INCHES
TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE   MARYLAND

```
STATION LATITUDE                         =  39.18 DEGREES
MAXIMUM LEAF AREA INDEX                  =   0.00
START OF GROWING SEASON (JULIAN DATE)    =    102
END OF GROWING SEASON (JULIAN DATE)      =    300
EVAPORATIVE ZONE DEPTH                   =   9.0  INCHES
AVERAGE ANNUAL WIND SPEED                =   9.30 MPH
```



```
AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  68.00 %
```

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR   BALTIMORE   MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR   BALTIMORE   MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR   BALTIMORE   MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR   1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
EVAPOTRANSPIRATION	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	3.6789	3.6791	1.1574	0.6654	0.6536	0.4036

FROM LAYER 9	0.3201	0.3017	0.2911	0.2672	1.1527	1.5393
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 10	0.030	0.033	0.009	0.006	0.005	0.003
	0.003	0.002	0.002	0.002	0.010	0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 10	0.021	0.016	0.003	0.001	0.000	0.000
	0.000	0.000	0.000	0.001	0.011	0.004

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.091	11220.854	7.02
EVAPOTRANSPIRATION	28.542	103606.211	64.85
DRAINAGE COLLECTED FROM LAYER 9	14.1101	51219.730	32.06
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0098		
CHANGE IN WATER STORAGE	-1.733	-6290.519	-3.94
SOIL WATER AT START OF YEAR	151.029	548235.625	
SOIL WATER AT END OF YEAR	149.296	541945.125	
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	0.005	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
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	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	3.6789	3.6791	1.1574	0.6654	0.6536	0.4036
	0.3201	0.3017	0.2911	0.2672	1.1527	1.5393
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0296	0.0328	0.0093	0.0055	0.0053	0.0034
	0.0026	0.0024	0.0024	0.0022	0.0096	0.0124

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

****

****

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.091	(0.0000)	11220.85	7.024
EVAPOTRANSPIRATION	28.542	(0.0000)	103606.21	64.853
LATERAL DRAINAGE COLLECTED FROM LAYER 9	14.11012	(0.00000)	51219.730	32.06116
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.010	(0.000)		
CHANGE IN WATER STORAGE	-1.733	(0.0000)	-6290.52	-3.938

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.589	9398.5059
DRAINAGE COLLECTED FROM LAYER 9	0.28375	1030.02466
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 10	0.071	
MAXIMUM HEAD ON TOP OF LAYER 10	0.140	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	2.0 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

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

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

****

****

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6121	0.2177
2	61.5611	0.0754
3	3.4102	0.2842
4	54.1334	0.0752
5	3.3466	0.2789
6	7.0080	0.0730
7	11.7641	0.2451
8	5.4530	0.2272
9	0.0054	0.0361
10	0.0000	0.0000
SNOW WATER	0.000	

****
****

ADVANCED GeoServices
a Montrose Environmental Group company

HELP MODEL PRINTOUTS

FULL -HEIGHT – SEVENTEEN (17) LIFTS

Floor slope 5%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF17S5.OUT


TIME:  15:57     DATE:   6/24/2020


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

     TITLE:  FULL FILL @17 LIFTS; S = 5%

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


     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   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
           FIELD CAPACITY             =      0.1900 VOL/VOL
           WILTING POINT              =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2160 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```



```
                                   LAYER  2
                                   --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
           THICKNESS                  =    816.00   INCHES
           POROSITY                   =      0.1680 VOL/VOL
           FIELD CAPACITY             =      0.0730 VOL/VOL
           WILTING POINT              =      0.0190 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0755 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  3
                                   --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
           FIELD CAPACITY             =      0.1900 VOL/VOL
           WILTING POINT              =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2171 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                                   LAYER  4
                                   --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
           THICKNESS                  =    720.00   INCHES
           POROSITY                   =      0.1680 VOL/VOL
           FIELD CAPACITY             =      0.0730 VOL/VOL
           WILTING POINT              =      0.0190 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0756 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  5
                                   --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
           FIELD CAPACITY             =      0.1900 VOL/VOL
           WILTING POINT              =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2879 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```

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

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                    =     96.00   INCHES
POROSITY                     =      0.1680 VOL/VOL
FIELD CAPACITY               =      0.0730 VOL/VOL
WILTING POINT                =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0773 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                     LAYER  7
                     --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                    =     48.00   INCHES
POROSITY                     =      0.4530 VOL/VOL
FIELD CAPACITY               =      0.1900 VOL/VOL
WILTING POINT                =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.2837 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                     LAYER  8
                     --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                    =     24.00   INCHES
POROSITY                     =      0.4570 VOL/VOL
FIELD CAPACITY               =      0.1310 VOL/VOL
WILTING POINT                =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.2206 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                     LAYER  9
                     --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =      0.15   INCHES
POROSITY                     =      0.8500 VOL/VOL
FIELD CAPACITY               =      0.0100 VOL/VOL
WILTING POINT                =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0119 VOL/VOL
```



```
EFFECTIVE SAT. HYD. COND.    =   4.42000008000     CM/SEC
SLOPE                        =      5.00   PERCENT
DRAINAGE LENGTH              =    250.0    FEET


                     LAYER 10
                     --------

          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          =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS     =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY        =  1 - PERFECT


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

  NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     86.00
FRACTION OF AREA ALLOWING RUNOFF   =     75.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      1.944  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.077  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      0.765  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    151.027  INCHES
TOTAL INITIAL WATER                =    151.027  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


           EVAPOTRANSPIRATION AND WEATHER DATA
           -----------------------------------

  NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
           BALTIMORE             MARYLAND

     STATION LATITUDE                        =  39.18 DEGREES
     MAXIMUM LEAF AREA INDEX                 =   0.00
     START OF GROWING SEASON (JULIAN DATE)   =    102
     END OF GROWING SEASON (JULIAN DATE)     =    300
     EVAPORATIVE ZONE DEPTH                  =   9.0  INCHES
     AVERAGE ANNUAL WIND SPEED               =   9.30 MPH
```

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
EVAPOTRANSPIRATION	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	3.6822	3.6779	1.1559	0.6653	0.6535	0.4032

FROM LAYER 9	0.3200	0.3018	0.2911	0.2672	1.1559	1.5365
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.024	0.026	0.007	0.004	0.004	0.003
TOP OF LAYER 10	0.002	0.002	0.002	0.002	0.008	0.010
STD. DEVIATION OF DAILY	0.017	0.012	0.002	0.001	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.001	0.009	0.003

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.091	11220.854	7.02
EVAPOTRANSPIRATION	28.542	103606.211	64.85
DRAINAGE COLLECTED FROM LAYER 9	14.1104	51220.727	32.06
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0078		
CHANGE IN WATER STORAGE	-1.733	-6291.461	-3.94
SOIL WATER AT START OF YEAR	151.028	548232.875	
SOIL WATER AT END OF YEAR	149.295	541941.375	
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	-0.047	0.00

****

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
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	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	3.6822	3.6779	1.1559	0.6653	0.6535	0.4032
	0.3200	0.3018	0.2911	0.2672	1.1559	1.5365
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0238	0.0263	0.0075	0.0044	0.0042	0.0027
	0.0021	0.0019	0.0019	0.0017	0.0077	0.0099

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

****

****

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

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01 (0.000)	159756.3	100.00
RUNOFF	3.091 (0.0000)	11220.85	7.024
EVAPOTRANSPIRATION	28.542 (0.0000)	103606.21	64.853
LATERAL DRAINAGE COLLECTED FROM LAYER 9	14.11039 (0.00000)	51220.727	32.06179
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000 (0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.008 (0.000)		
CHANGE IN WATER STORAGE	-1.733 (0.0000)	-6291.46	-3.938

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.589	9398.5059
DRAINAGE COLLECTED FROM LAYER 9	0.28293	1027.03223
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 10	0.057	
MAXIMUM HEAD ON TOP OF LAYER 10	0.113	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

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

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

****

****

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6121	0.2177
2	61.5611	0.0754
3	3.4102	0.2842
4	54.1334	0.0752
5	3.3466	0.2789
6	7.0080	0.0730
7	11.7641	0.2451
8	5.4530	0.2272
9	0.0048	0.0318
10	0.0000	0.0000
SNOW WATER	0.000	

****
****

HELP MODEL PRINTOUTS

FULL -HEIGHT – SEVENTEEN (17) LIFTS

Floor slope 6%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF17S6.OUT


TIME:  16: 1     DATE:   6/24/2020


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

     TITLE:  FULL FILL @17 LIFTS; S = 6%

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


     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   6
           THICKNESS                   =     12.00   INCHES
           POROSITY                    =      0.4530 VOL/VOL
           FIELD CAPACITY              =      0.1900 VOL/VOL
           WILTING POINT               =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.2160 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

```
                   LAYER  2
                   --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =   816.00   INCHES
POROSITY                    =     0.1680 VOL/VOL
FIELD CAPACITY              =     0.0730 VOL/VOL
WILTING POINT               =     0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.0755 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                   LAYER  3
                   --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =    12.00   INCHES
POROSITY                    =     0.4530 VOL/VOL
FIELD CAPACITY              =     0.1900 VOL/VOL
WILTING POINT               =     0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.2187 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                   LAYER  4
                   --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =   720.00   INCHES
POROSITY                    =     0.1680 VOL/VOL
FIELD CAPACITY              =     0.0730 VOL/VOL
WILTING POINT               =     0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.0762 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                   LAYER  5
                   --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =    12.00   INCHES
POROSITY                    =     0.4530 VOL/VOL
FIELD CAPACITY              =     0.1900 VOL/VOL
WILTING POINT               =     0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.2819 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```



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

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    96.00   INCHES
POROSITY                    =     0.1680 VOL/VOL
FIELD CAPACITY              =     0.0730 VOL/VOL
WILTING POINT               =     0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.0747 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                   LAYER  7
                   --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =    48.00   INCHES
POROSITY                    =     0.4530 VOL/VOL
FIELD CAPACITY              =     0.1900 VOL/VOL
WILTING POINT               =     0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.2795 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                   LAYER  8
                   --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =    24.00   INCHES
POROSITY                    =     0.4570 VOL/VOL
FIELD CAPACITY              =     0.1310 VOL/VOL
WILTING POINT               =     0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.2228 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                   LAYER  9
                   --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =     0.15   INCHES
POROSITY                    =     0.8500 VOL/VOL
FIELD CAPACITY              =     0.0100 VOL/VOL
WILTING POINT               =     0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.0349 VOL/VOL
```

```
EFFECTIVE SAT. HYD. COND.   =   4.42000008000     CM/SEC
SLOPE                       =      6.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET
```

LAYER 10

```
            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         =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  1 - PERFECT
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

```
NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER              =     86.00
FRACTION OF AREA ALLOWING RUNOFF     =     75.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE   =      1.000  ACRES
EVAPORATIVE ZONE DEPTH               =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE    =      1.944  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE   =      4.077  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE   =      0.765  INCHES
INITIAL SNOW WATER                   =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS     =    151.011  INCHES
TOTAL INITIAL WATER                  =    151.011  INCHES
TOTAL SUBSURFACE INFLOW              =      0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

```
NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
         BALTIMORE             MARYLAND

    STATION LATITUDE                        =  39.18 DEGREES
    MAXIMUM LEAF AREA INDEX                 =   0.00
    START OF GROWING SEASON (JULIAN DATE)   =    102
    END OF GROWING SEASON (JULIAN DATE)     =    300
    EVAPORATIVE ZONE DEPTH                  =   9.0  INCHES
    AVERAGE ANNUAL WIND SPEED               =   9.30 MPH
```



```
AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  68.00 %
```

```
NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    BALTIMORE           MARYLAND
```

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

```
NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    BALTIMORE           MARYLAND
```

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

```
NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    BALTIMORE           MARYLAND
           AND STATION LATITUDE  =  39.18 DEGREES
```

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.001	0.000	0.000	0.000	0.000	0.016
	0.000	0.070	2.562	0.069	0.001	0.385
EVAPOTRANSPIRATION	1.804	1.891	2.770	2.244	1.962	4.893
	1.762	3.479	1.128	3.025	2.302	1.281
LATERAL DRAINAGE COLLECTED	3.3033	3.9749	1.1951	0.6820	0.6570	0.4052

FROM LAYER 9	0.3203	0.2918	0.2994	0.2644	1.1448	1.5714
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 10	0.018	0.024	0.006	0.004	0.004	0.002
	0.002	0.002	0.002	0.001	0.006	0.008
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 10	0.013	0.011	0.002	0.001	0.000	0.000
	0.000	0.000	0.000	0.001	0.008	0.003

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.103	11263.241	7.05
EVAPOTRANSPIRATION	28.542	103605.773	64.85
DRAINAGE COLLECTED FROM LAYER 9	14.1096	51217.770	32.06
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0066		
CHANGE IN WATER STORAGE	-1.744	-6330.399	-3.96
SOIL WATER AT START OF YEAR	151.016	548188.187	
SOIL WATER AT END OF YEAR	149.272	541857.750	
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	-0.102	0.00

****

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.001	0.000	0.000	0.000	0.000	0.016
	0.000	0.070	2.562	0.069	0.001	0.385
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	1.804	1.891	2.770	2.244	1.962	4.893
	1.762	3.479	1.128	3.025	2.302	1.281
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	3.3033	3.9749	1.1951	0.6820	0.6570	0.4052
	0.3203	0.2918	0.2994	0.2644	1.1448	1.5714
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0178	0.0237	0.0064	0.0038	0.0035	0.0023
	0.0017	0.0016	0.0017	0.0014	0.0064	0.0085

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

****

****

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.103	(0.0000)	11263.24	7.050
EVAPOTRANSPIRATION	28.542	(0.0000)	103605.77	64.852
LATERAL DRAINAGE COLLECTED FROM LAYER 9	14.10958	(0.00000)	51217.770	32.05994
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.007	(0.000)		
CHANGE IN WATER STORAGE	-1.744	(0.0000)	-6330.40	-3.963

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.562	9301.0596
DRAINAGE COLLECTED FROM LAYER 9	0.27127	984.71674
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 10	0.045	
MAXIMUM HEAD ON TOP OF LAYER 10	0.088	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	5.3 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4501
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

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

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

****

****

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6247	0.2187
2	61.9250	0.0759
3	3.3629	0.2802
4	53.6667	0.0745
5	3.3406	0.2784
6	7.0080	0.0730
7	11.8811	0.2475
8	5.4556	0.2273
9	0.0023	0.0150
10	0.0000	0.0000
SNOW WATER	0.000	

****
****

HELP MODEL PRINTOUTS

FULL -HEIGHT – SEVENTEEN (17) LIFTS

Floor slope 33%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF17S33.OUT


TIME:  13: 3     DATE:   6/26/2020


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

     TITLE:  FULL FILL @17 LIFTS, S = 33%

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


     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   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
           FIELD CAPACITY             =      0.1900 VOL/VOL
           WILTING POINT              =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2160 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```



```
                                   LAYER  2
                                   --------

                       TYPE 1 - VERTICAL PERCOLATION LAYER
                           MATERIAL TEXTURE NUMBER  19
           THICKNESS                  =    816.00   INCHES
           POROSITY                   =      0.1680 VOL/VOL
           FIELD CAPACITY             =      0.0730 VOL/VOL
           WILTING POINT              =      0.0190 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0755 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  3
                                   --------

                       TYPE 1 - VERTICAL PERCOLATION LAYER
                           MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
           FIELD CAPACITY             =      0.1900 VOL/VOL
           WILTING POINT              =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2218 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                                   LAYER  4
                                   --------

                       TYPE 1 - VERTICAL PERCOLATION LAYER
                           MATERIAL TEXTURE NUMBER  19
           THICKNESS                  =    720.00   INCHES
           POROSITY                   =      0.1680 VOL/VOL
           FIELD CAPACITY             =      0.0730 VOL/VOL
           WILTING POINT              =      0.0190 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0771 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  5
                                   --------

                       TYPE 1 - VERTICAL PERCOLATION LAYER
                           MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
           FIELD CAPACITY             =      0.1900 VOL/VOL
           WILTING POINT              =      0.0850 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2816 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

```
THICKNESS                  =     96.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0765 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC
```

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

```
THICKNESS                  =     48.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2764 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

```
THICKNESS                  =     24.00   INCHES
POROSITY                   =      0.4570 VOL/VOL
FIELD CAPACITY             =      0.1310 VOL/VOL
WILTING POINT              =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2210 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC
```

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                  =      0.15   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0125 VOL/VOL
```



```
EFFECTIVE SAT. HYD. COND.  =  4.42000008000     CM/SEC
SLOPE                      =     33.00   PERCENT
DRAINAGE LENGTH            =     75.0    FEET
```

LAYER 10

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        =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY      =  1 - PERFECT
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

```
SCS RUNOFF CURVE NUMBER            =    86.00
FRACTION OF AREA ALLOWING RUNOFF   =    75.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =     1.000  ACRES
EVAPORATIVE ZONE DEPTH             =     9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =     1.944  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =     4.077  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =     0.765  INCHES
INITIAL SNOW WATER                 =     0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =   151.670  INCHES
TOTAL INITIAL WATER                =   151.670  INCHES
TOTAL SUBSURFACE INFLOW            =     0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

```
STATION LATITUDE                      =  39.18 DEGREES
MAXIMUM LEAF AREA INDEX               =   0.00
START OF GROWING SEASON (JULIAN DATE) =    102
END OF GROWING SEASON (JULIAN DATE)   =    300
EVAPORATIVE ZONE DEPTH                =   9.0  INCHES
AVERAGE ANNUAL WIND SPEED             =   9.30 MPH
```

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.001	0.000	0.000	0.000	0.000	0.017
	0.000	0.083	2.478	0.070	0.003	0.497
EVAPOTRANSPIRATION	1.826	1.852	2.705	2.062	1.728	4.375
	1.390	3.389	0.869	3.032	2.314	1.288
LATERAL DRAINAGE COLLECTED	3.3942	4.4312	1.2790	0.7227	0.5600	0.4085
FROM LAYER 9	0.3026	0.4626	0.2280	0.4091	2.6686	1.6880
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.002	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.001	0.001
STD. DEVIATION OF DAILY	0.001	0.001	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.001	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.148	11428.088	7.15
EVAPOTRANSPIRATION	26.832	97400.617	60.97
DRAINAGE COLLECTED FROM LAYER 9	16.5546	60093.148	37.62
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0005		
CHANGE IN WATER STORAGE	-2.525	-9165.396	-5.74
SOIL WATER AT START OF YEAR	151.672	550568.250	
SOIL WATER AT END OF YEAR	149.147	541402.875	
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	-0.176	0.00

****

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.001	0.000	0.000	0.000	0.000	0.017
	0.000	0.083	2.478	0.070	0.003	0.497
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	1.826	1.852	2.705	2.062	1.728	4.375
	1.390	3.389	0.869	3.032	2.314	1.288
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	3.3942	4.4312	1.2790	0.7227	0.5600	0.4085
	0.3026	0.4626	0.2280	0.4091	2.6686	1.6880
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0011	0.0016	0.0004	0.0002	0.0002	0.0001
	0.0001	0.0002	0.0001	0.0001	0.0009	0.0005

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

****

****

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

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01 (0.000)	159756.3	100.00
RUNOFF	3.148 (0.0000)	11428.09	7.153
EVAPOTRANSPIRATION	26.832 (0.0000)	97400.62	60.968
LATERAL DRAINAGE COLLECTED FROM LAYER 9	16.55459 (0.00000)	60093.148	37.61551
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000 (0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.000 (0.000)		
CHANGE IN WATER STORAGE	-2.525 (0.0000)	-9165.40	-5.737

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.478	8995.4043
DRAINAGE COLLECTED FROM LAYER 9	0.27350	992.81702
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 10	0.003	
MAXIMUM HEAD ON TOP OF LAYER 10	0.034	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3698	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

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

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

****

****

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6619	0.2218
2	62.0183	0.0760
3	3.3049	0.2754
4	53.5971	0.0744
5	3.2067	0.2672
6	7.0080	0.0730
7	11.8742	0.2474
8	5.4721	0.2280
9	0.0017	0.0113
10	0.0000	0.0000
SNOW WATER	0.000	

****
****

HELP MODEL PRINTOUTS

CLOSED – FIVE LIFTS

Floor slope 2%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:       C:\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\DATA10.D10
OUTPUT DATA FILE:            C:\CF5S2.OUT


TIME:  16:27     DATE:   6/26/2020


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

     TITLE:  CLOSED FILL @5 LIFTS (TOP=33%), S=2%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00 INCHES
POROSITY	=	0.4190 VOL/VOL
FIELD CAPACITY	=	0.3070 VOL/VOL
WILTING POINT	=	0.1800 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3967 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05 CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1630 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	12.8000002000 CM/SEC
SLOPE	=	33.00 PERCENT
DRAINAGE LENGTH	=	95.0 FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

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.	=	0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY	=	0.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	4 - POOR

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4530 VOL/VOL

FIELD CAPACITY	=	0.1900 VOL/VOL
WILTING POINT	=	0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2126 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03 CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	240.00 INCHES
POROSITY	=	0.1680 VOL/VOL
FIELD CAPACITY	=	0.0730 VOL/VOL
WILTING POINT	=	0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0767 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4530 VOL/VOL
FIELD CAPACITY	=	0.1900 VOL/VOL
WILTING POINT	=	0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2934 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03 CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	144.00 INCHES
POROSITY	=	0.1680 VOL/VOL
FIELD CAPACITY	=	0.0730 VOL/VOL
WILTING POINT	=	0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0766 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

```
THICKNESS                    =     12.00   INCHES
POROSITY                     =      0.4530 VOL/VOL
FIELD CAPACITY               =      0.1900 VOL/VOL
WILTING POINT                =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.2849 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                         LAYER 10
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                    =     96.00   INCHES
POROSITY                     =      0.1680 VOL/VOL
FIELD CAPACITY               =      0.0730 VOL/VOL
WILTING POINT                =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0735 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                         LAYER 11
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                    =     48.00   INCHES
POROSITY                     =      0.4530 VOL/VOL
FIELD CAPACITY               =      0.1900 VOL/VOL
WILTING POINT                =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.2433 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                         LAYER 12
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                    =     24.00   INCHES
POROSITY                     =      0.4570 VOL/VOL
FIELD CAPACITY               =      0.1310 VOL/VOL
WILTING POINT                =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.2239 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                         LAYER 13
                         --------
```



```
            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =      0.15   INCHES
POROSITY                     =      0.8500 VOL/VOL
FIELD CAPACITY               =      0.0100 VOL/VOL
WILTING POINT                =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0480 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   4.42000008000     CM/SEC
SLOPE                        =      2.00   PERCENT
DRAINAGE LENGTH              =    250.0    FEET


                         LAYER 14
                         --------

            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          =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS     =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY        =  1 - PERFECT


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

  NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     69.00
FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      1.350  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =     71.852  INCHES
TOTAL INITIAL WATER                =     71.852  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


           EVAPOTRANSPIRATION AND WEATHER DATA
           -----------------------------------

  NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
                BALTIMORE             MARYLAND
```

STATION LATITUDE = 39.18 DEGREES
MAXIMUM LEAF AREA INDEX = 0.00
START OF GROWING SEASON (JULIAN DATE) = 102
END OF GROWING SEASON (JULIAN DATE) = 300
EVAPORATIVE ZONE DEPTH = 9.0 INCHES
AVERAGE ANNUAL WIND SPEED = 9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	2.0601	1.8750	0.9683	0.6009	0.4643	0.3585
FROM LAYER 13	0.3176	0.3180	0.2653	0.2046	0.2207	0.1756
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.033	0.033	0.016	0.010	0.007	0.006
TOP OF LAYER 14	0.005	0.005	0.004	0.003	0.004	0.003
STD. DEVIATION OF DAILY	0.032	0.011	0.002	0.001	0.001	0.001
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	7.8290	28419.262	17.79
PERC./LEAKAGE THROUGH LAYER 14	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0108		
CHANGE IN WATER STORAGE	-7.827	-28411.191	-17.78
SOIL WATER AT START OF YEAR	74.410	270108.594	
SOIL WATER AT END OF YEAR	66.583	241697.406	
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	0.036	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1239	0.0856	0.0762	0.0610	0.0536	0.0450
FROM LAYER 13	0.0409	0.0365	0.0318	0.0299	0.0266	0.0253
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.002	0.002	0.001	0.001	0.001	0.001
TOP OF LAYER 14	0.001	0.001	0.001	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6362	2309.430	1.51
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0009		
CHANGE IN WATER STORAGE	-0.191	-695.103	-0.45
SOIL WATER AT START OF YEAR	66.583	241697.406	
SOIL WATER AT END OF YEAR	65.725	238580.969	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.053	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0234	0.0198	0.0205	0.0187	0.0182	0.0166
FROM LAYER 13	0.0163	0.0154	0.0142	0.0140	0.0130	0.0128
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2029	736.422	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-1.287	-4671.320	-2.51
SOIL WATER AT START OF YEAR	65.725	238580.969	
SOIL WATER AT END OF YEAR	64.707	234887.500	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.019	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
	0.0138	0.0129	0.0115	0.0110	0.0099	0.0096
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1345	488.349	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0002		
CHANGE IN WATER STORAGE	-1.848	-6708.010	-4.88

SOIL WATER AT START OF YEAR	64.707	234887.500	
SOIL WATER AT END OF YEAR	63.257	229622.969	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.027	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0090	0.0077	0.0081	0.0074	0.0073	0.0067
	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.000	0.000	0.008	0.001	0.003	0.001
	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.000	0.008	0.000	0.003	0.001
	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0813	295.053	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6798.205	4.06
SOIL WATER AT START OF YEAR	63.257	229622.969	
SOIL WATER AT END OF YEAR	65.130	236421.172	
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	0.006	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0051	0.0045	0.0048	0.0006	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.002	0.003	0.001	0.003	0.001
	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.001	0.002	0.002	0.000	0.003	0.001
	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0150	54.497	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-765.869	-0.55
SOIL WATER AT START OF YEAR	65.130	236421.172	
SOIL WATER AT END OF YEAR	64.919	235655.297	
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

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	64.919	235655.297	
SOIL WATER AT END OF YEAR	65.315	237093.187	
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

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	65.315	237093.187	
SOIL WATER AT END OF YEAR	65.400	237403.422	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.659	0.17
SOIL WATER AT START OF YEAR	65.400	237403.422	
SOIL WATER AT END OF YEAR	64.206	233068.453	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.120	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	64.206	233068.453	
SOIL WATER AT END OF YEAR	65.370	237293.828	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF5S3.OUT


TIME:  16:44     DATE:   6/26/2020


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

     TITLE:  CLOSED FILL @5 LIFTS (TOP=33%), S=3%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```



```
                                  LAYER  2
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     18.00   INCHES
           POROSITY                   =      0.4190 VOL/VOL
           FIELD CAPACITY             =      0.3070 VOL/VOL
           WILTING POINT              =      0.1800 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                                  LAYER  3
                                  --------

                     TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.25   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
           SLOPE                      =     33.00   PERCENT
           DRAINAGE LENGTH            =     95.0    FEET


                                  LAYER  4
                                  --------

                     TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
           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.  =  0.399999993000E-12 CM/SEC
           FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
           FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
           FML PLACEMENT QUALITY      =  4 - POOR


                                  LAYER  5
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
```

```
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2126 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  6
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    240.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0767 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2934 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    144.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0766 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  9
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2849 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0735 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2433 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2239 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0480 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000 CM/SEC
SLOPE	=	3.00 PERCENT
DRAINAGE LENGTH	=	250.0 FEET

LAYER 14

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	=	0.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00
FRACTION OF AREA ALLOWING RUNOFF	=	100.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000 ACRES
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816 INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263 INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350 INCHES
INITIAL SNOW WATER	=	0.000 INCHES
INITIAL WATER IN LAYER MATERIALS	=	71.852 INCHES
TOTAL INITIAL WATER	=	71.852 INCHES
TOTAL SUBSURFACE INFLOW	=	0.00 INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	2.0771	1.8637	0.9657	0.6002	0.4637	0.3583
	0.3174	0.3179	0.2649	0.2044	0.2209	0.1753
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.000	0.000
	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.000	0.000	0.000	0.000
	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.022	0.022	0.010	0.007	0.005	0.004
	0.003	0.003	0.003	0.002	0.002	0.002
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.022	0.007	0.002	0.001	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		
DRAINAGE COLLECTED FROM LAYER 13	7.8297	28421.635	17.79
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0072		
CHANGE IN WATER STORAGE	-7.827	-28413.545	-17.79
SOIL WATER AT START OF YEAR	74.410	270108.594	
SOIL WATER AT END OF YEAR	66.583	241695.047	
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	0.017	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1237	0.0855	0.0761	0.0609	0.0535	0.0449
	0.0409	0.0365	0.0318	0.0299	0.0265	0.0253
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.001	0.001	0.001	0.001	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6357	2307.454	1.51
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0006		
CHANGE IN WATER STORAGE	-0.191	-693.164	-0.45
SOIL WATER AT START OF YEAR	66.583	241695.047	
SOIL WATER AT END OF YEAR	65.725	238580.547	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.016	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED FROM LAYER 3	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0234	0.0198	0.0205	0.0186	0.0182	0.0166
	0.0163	0.0154	0.0142	0.0140	0.0130	0.0128
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.012	0.002	0.008	0.001	0.001	0.005
	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.009	0.001	0.007	0.000	0.001	0.004
	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2028	736.229	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0002		
CHANGE IN WATER STORAGE	-1.287	-4671.126	-2.51
SOIL WATER AT START OF YEAR	65.725	238580.547	
SOIL WATER AT END OF YEAR	64.707	234887.266	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.018	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
FROM LAYER 13	0.0138	0.0129	0.0115	0.0110	0.0099	0.0096
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1345	488.296	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6707.941	-4.88

SOIL WATER AT START OF YEAR	64.707	234887.266	
SOIL WATER AT END OF YEAR	63.257	229622.812	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.011	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0090	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0813	294.987	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6798.274	4.06
SOIL WATER AT START OF YEAR	63.257	229622.812	
SOIL WATER AT END OF YEAR	65.130	236421.094	
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	0.003	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0051	0.0045	0.0048	0.0006	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.002	0.003	0.001	0.003	0.001
	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.001	0.002	0.002	0.000	0.003	0.001
	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48
DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0150	54.411	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-765.786	-0.55
SOIL WATER AT START OF YEAR	65.130	236421.094	
SOIL WATER AT END OF YEAR	64.919	235655.297	
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	0.004	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED FROM LAYER 3	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	64.919	235655.297	
SOIL WATER AT END OF YEAR	65.315	237093.187	
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

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	65.315	237093.187	
SOIL WATER AT END OF YEAR	65.400	237403.422	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.659	0.17
SOIL WATER AT START OF YEAR	65.400	237403.422	
SOIL WATER AT END OF YEAR	64.206	233068.453	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.120	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	64.206	233068.453	
SOIL WATER AT END OF YEAR	65.370	237293.828	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

HELP MODEL PRINTOUTS

CLOSED – FIVE LIFTS

Floor slope 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:\DATA4.D4
TEMPERATURE DATA FILE:       C:\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\DATA10.D10
OUTPUT DATA FILE:            C:\CF5S4.OUT


TIME:  16:59     DATE:   6/26/2020


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

     TITLE:  CLOSED FILL @5 LIFTS (TOP=33%), S=4%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```

```
                    LAYER  2
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                  =     18.00   INCHES
POROSITY                   =      0.4190 VOL/VOL
FIELD CAPACITY             =      0.3070 VOL/VOL
WILTING POINT              =      0.1800 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                    LAYER  3
                    --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                  =      0.25   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
SLOPE                      =     33.00   PERCENT
DRAINAGE LENGTH            =     95.0    FEET


                    LAYER  4
                    --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  36
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.  =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY      =  4 - POOR


                    LAYER  5
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
```



```
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2177 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                    LAYER  6
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    240.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0763 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                    LAYER  7
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2909 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                    LAYER  8
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    144.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0770 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                    LAYER  9
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
```

```
THICKNESS                 =     12.00   INCHES
POROSITY                  =      0.4530 VOL/VOL
FIELD CAPACITY            =      0.1900 VOL/VOL
WILTING POINT             =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.2868 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```

```
                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                 =     96.00   INCHES
POROSITY                  =      0.1680 VOL/VOL
FIELD CAPACITY            =      0.0730 VOL/VOL
WILTING POINT             =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.0731 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC
```

```
                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                 =     48.00   INCHES
POROSITY                  =      0.4530 VOL/VOL
FIELD CAPACITY            =      0.1900 VOL/VOL
WILTING POINT             =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.2389 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC
```

```
                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                 =     24.00   INCHES
POROSITY                  =      0.4570 VOL/VOL
FIELD CAPACITY            =      0.1310 VOL/VOL
WILTING POINT             =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.2241 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC
```

```
                        LAYER 13
                        --------
```



```
          TYPE 2 - LATERAL DRAINAGE LAYER
            MATERIAL TEXTURE NUMBER   0
THICKNESS                 =      0.15   INCHES
POROSITY                  =      0.8500 VOL/VOL
FIELD CAPACITY            =      0.0100 VOL/VOL
WILTING POINT             =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.0382 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =   4.42000008000     CM/SEC
SLOPE                     =      4.00   PERCENT
DRAINAGE LENGTH           =    250.0    FEET
```

```
                        LAYER 14
                        --------

          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       =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS  =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY     =  1 - PERFECT
```

```
          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     69.00
FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      1.350  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =     71.621  INCHES
TOTAL INITIAL WATER                =     71.621  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR
```

```
          EVAPOTRANSPIRATION AND WEATHER DATA
          -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
           BALTIMORE             MARYLAND
```

STATION LATITUDE = 39.18 DEGREES
MAXIMUM LEAF AREA INDEX = 0.00
START OF GROWING SEASON (JULIAN DATE) = 102
END OF GROWING SEASON (JULIAN DATE) = 300
EVAPORATIVE ZONE DEPTH = 9.0 INCHES
AVERAGE ANNUAL WIND SPEED = 9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	1.8408	1.8377	0.9615	0.5991	0.4642	0.3580
FROM LAYER 13	0.3198	0.3180	0.2740	0.2107	0.2150	0.1832
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.015	0.016	0.008	0.005	0.004	0.003
TOP OF LAYER 14	0.003	0.003	0.002	0.002	0.002	0.001
STD. DEVIATION OF DAILY	0.014	0.005	0.001	0.001	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	7.5818	27522.086	17.23
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0053		
CHANGE IN WATER STORAGE	-7.580	-27513.994	-17.22
SOIL WATER AT START OF YEAR	74.239	269488.031	
SOIL WATER AT END OF YEAR	66.660	241974.047	
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	0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1283	0.0880	0.0780	0.0622	0.0545	0.0456
FROM LAYER 13	0.0415	0.0369	0.0322	0.0302	0.0268	0.0255
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.001	0.001	0.001	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6500	2359.378	1.54
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0004		
CHANGE IN WATER STORAGE	-0.205	-745.064	-0.49
SOIL WATER AT START OF YEAR	66.660	241974.047	
SOIL WATER AT END OF YEAR	65.787	238807.656	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.040	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0236	0.0199	0.0207	0.0188	0.0183	0.0167
FROM LAYER 13	0.0164	0.0155	0.0143	0.0141	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2042	741.219	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.288	-4676.084	-2.51
SOIL WATER AT START OF YEAR	65.787	238807.656	
SOIL WATER AT END OF YEAR	64.768	235109.406	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.015	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0114	0.0106	0.0106	0.0099
FROM LAYER 13	0.0134	0.0130	0.0116	0.0111	0.0100	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1349	489.661	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.326	-4.88

SOIL WATER AT START OF YEAR	64.768	235109.406	
SOIL WATER AT END OF YEAR	63.318	229843.562	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.030	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0817	296.712	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.872	6796.529	4.06
SOIL WATER AT START OF YEAR	63.318	229843.562	
SOIL WATER AT END OF YEAR	65.190	236640.094	
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	0.023	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0011	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0156	56.619	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-767.974	-0.55
SOIL WATER AT START OF YEAR	65.190	236640.094	
SOIL WATER AT END OF YEAR	64.979	235872.125	
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	-0.016	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	64.979	235872.125	
SOIL WATER AT END OF YEAR	65.375	237310.000	
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

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	65.375	237310.000	
SOIL WATER AT END OF YEAR	65.460	237620.234	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	65.460	237620.234	
SOIL WATER AT END OF YEAR	64.266	233285.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.219	-0.29
SOIL WATER AT START OF YEAR	64.266	233285.250	
SOIL WATER AT END OF YEAR	65.430	237510.656	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.013	0.00

****

HELP MODEL PRINTOUTS

CLOSED – FIVE LIFTS

Floor slope 5%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF5S5.OUT


TIME:  17:13     DATE:   6/26/2020


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

     TITLE:  CLOSED FILL @5 LIFTS (TOP=33%), S=5%

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


     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   9
          THICKNESS                  =      6.00   INCHES
          POROSITY                   =      0.5010 VOL/VOL
          FIELD CAPACITY             =      0.2840 VOL/VOL
          WILTING POINT              =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```



```
                                  LAYER  2
                                  --------

                   TYPE 1 - VERTICAL PERCOLATION LAYER
                       MATERIAL TEXTURE NUMBER   0
          THICKNESS                  =     18.00   INCHES
          POROSITY                   =      0.4190 VOL/VOL
          FIELD CAPACITY             =      0.3070 VOL/VOL
          WILTING POINT              =      0.1800 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                                  LAYER  3
                                  --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                       MATERIAL TEXTURE NUMBER   0
          THICKNESS                  =      0.25   INCHES
          POROSITY                   =      0.8500 VOL/VOL
          FIELD CAPACITY             =      0.0100 VOL/VOL
          WILTING POINT              =      0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
          SLOPE                      =     33.00   PERCENT
          DRAINAGE LENGTH            =     95.0    FEET


                                  LAYER  4
                                  --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                       MATERIAL TEXTURE NUMBER  36
          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.  =  0.399999993000E-12 CM/SEC
          FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
          FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
          FML PLACEMENT QUALITY      =  4 - POOR


                                  LAYER  5
                                  --------

                   TYPE 1 - VERTICAL PERCOLATION LAYER
                       MATERIAL TEXTURE NUMBER   6
          THICKNESS                  =     12.00   INCHES
          POROSITY                   =      0.4530 VOL/VOL
```

```
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2177 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  6
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    240.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0763 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2909 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    144.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0770 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  9
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2868 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0731 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2389 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2241 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```

```
            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
   THICKNESS                  =      0.15   INCHES
   POROSITY                   =      0.8500 VOL/VOL
   FIELD CAPACITY             =      0.0100 VOL/VOL
   WILTING POINT              =      0.0050 VOL/VOL
   INITIAL SOIL WATER CONTENT =      0.0333 VOL/VOL
   EFFECTIVE SAT. HYD. COND.  =   4.42000008000     CM/SEC
   SLOPE                      =      5.00   PERCENT
   DRAINAGE LENGTH            =    250.0    FEET


                        LAYER 14
                        --------

            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        =      0.00   HOLES/ACRE
   FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
   FML PLACEMENT QUALITY      =  1 - PERFECT



        GENERAL DESIGN AND EVAPORATIVE ZONE DATA
        ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     69.00
FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      1.350  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =     71.620  INCHES
TOTAL INITIAL WATER                =     71.620  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


         EVAPOTRANSPIRATION AND WEATHER DATA
         -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
          BALTIMORE            MARYLAND
```



```
            STATION LATITUDE                      =  39.18 DEGREES
            MAXIMUM LEAF AREA INDEX               =   0.00
            START OF GROWING SEASON (JULIAN DATE) =    102
            END OF GROWING SEASON (JULIAN DATE)   =    300
            EVAPORATIVE ZONE DEPTH                =   9.0  INCHES
            AVERAGE ANNUAL WIND SPEED             =   9.30 MPH
            AVERAGE 1ST QUARTER RELATIVE HUMIDITY =  62.00 %
            AVERAGE 2ND QUARTER RELATIVE HUMIDITY =  65.00 %
            AVERAGE 3RD QUARTER RELATIVE HUMIDITY =  71.00 %
            AVERAGE 4TH QUARTER RELATIVE HUMIDITY =  68.00 %


        NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
                 COEFFICIENTS FOR    BALTIMORE           MARYLAND

                 NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

    JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
    -------     -------     -------     -------     -------     -------
      3.47        3.02        3.93        3.00        3.89        3.43
      3.85        3.74        3.98        3.16        3.12        3.35


        NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
                 COEFFICIENTS FOR    BALTIMORE           MARYLAND

            NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

    JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
    -------     -------     -------     -------     -------     -------
     32.40       35.50       43.70       53.20       62.80       71.70
     76.50       74.50       67.40       55.30       45.50       36.60


        NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
                 COEFFICIENTS FOR    BALTIMORE           MARYLAND
                   AND STATION LATITUDE  =  39.18 DEGREES



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

                  MONTHLY TOTALS (IN INCHES) FOR YEAR    1
-------------------------------------------------------------------------------

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

PRECIPITATION                   2.00    1.42    3.53    1.61    2.69    4.35
                                2.02    3.97    7.14    4.15    3.78    7.35
```

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	1.8450	1.8345	0.9608	0.5988	0.4640	0.3579
FROM LAYER 13	0.3197	0.3179	0.2739	0.2107	0.2150	0.1831
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.012	0.013	0.006	0.004	0.003	0.002
TOP OF LAYER 14	0.002	0.002	0.002	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.011	0.004	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		
DRAINAGE COLLECTED FROM LAYER 13	7.5813	27520.152	17.23
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0042		
CHANGE IN WATER STORAGE	-7.579	-27512.055	-17.22
SOIL WATER AT START OF YEAR	74.238	269482.719	
SOIL WATER AT END OF YEAR	66.659	241970.656	
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	0.008	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1283	0.0880	0.0780	0.0622	0.0545	0.0456
FROM LAYER 13	0.0415	0.0369	0.0322	0.0302	0.0268	0.0255
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.001	0.001	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6498	2358.760	1.54
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0004		
CHANGE IN WATER STORAGE	-0.205	-744.455	-0.49
SOIL WATER AT START OF YEAR	66.659	241970.656	
SOIL WATER AT END OF YEAR	65.786	238804.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.032	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED FROM LAYER 3	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0236	0.0199	0.0207	0.0188	0.0183	0.0167
	0.0164	0.0155	0.0143	0.0141	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.012	0.002	0.008	0.001	0.001	0.005
	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.009	0.001	0.007	0.000	0.001	0.004
	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2042	741.161	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.288	-4676.028	-2.51
SOIL WATER AT START OF YEAR	65.786	238804.875	
SOIL WATER AT END OF YEAR	64.768	235106.703	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.011	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
FROM LAYER 13	0.0134	0.0130	0.0116	0.0111	0.0100	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1349	489.646	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.326	-4.88

SOIL WATER AT START OF YEAR	64.768	235106.703	
SOIL WATER AT END OF YEAR	63.317	229840.859	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.046	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0817	296.692	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6796.557	4.06
SOIL WATER AT START OF YEAR	63.317	229840.859	
SOIL WATER AT END OF YEAR	65.189	236637.406	
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	0.015	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0011	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48
DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0156	56.594	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-767.946	-0.55
SOIL WATER AT START OF YEAR	65.189	236637.406	
SOIL WATER AT END OF YEAR	64.978	235869.469	
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	-0.018	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	64.978	235869.469	
SOIL WATER AT END OF YEAR	65.374	237307.344	
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

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	65.374	237307.344	
SOIL WATER AT END OF YEAR	65.459	237617.578	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	65.459	237617.578	
SOIL WATER AT END OF YEAR	64.265	233282.578	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.219	-0.29
SOIL WATER AT START OF YEAR	64.265	233282.578	
SOIL WATER AT END OF YEAR	65.429	237508.000	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.013	0.00

****

HELP MODEL PRINTOUTS

CLOSED – FIVE LIFTS

Floor slope 6%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:       C:\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\DATA10.D10
OUTPUT DATA FILE:            C:\CF5S6.OUT


TIME:  17:28     DATE:   6/26/2020


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

     TITLE:  CLOSED FILL @5 LIFTS (TOP=33%), S=6%

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


     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   9
           THICKNESS                    =      6.00   INCHES
           POROSITY                     =      0.5010 VOL/VOL
           FIELD CAPACITY               =      0.2840 VOL/VOL
           WILTING POINT                =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT   =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =  0.190000006000E-03 CM/SEC
```

```
                     LAYER  2
                     --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   0
   THICKNESS                  =     18.00   INCHES
   POROSITY                   =      0.4190 VOL/VOL
   FIELD CAPACITY             =      0.3070 VOL/VOL
   WILTING POINT              =      0.1800 VOL/VOL
   INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
   EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                     LAYER  3
                     --------

               TYPE 2 - LATERAL DRAINAGE LAYER
                 MATERIAL TEXTURE NUMBER   0
   THICKNESS                  =      0.25   INCHES
   POROSITY                   =      0.8500 VOL/VOL
   FIELD CAPACITY             =      0.0100 VOL/VOL
   WILTING POINT              =      0.0050 VOL/VOL
   INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
   EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
   SLOPE                      =     33.00   PERCENT
   DRAINAGE LENGTH            =     95.0    FEET


                     LAYER  4
                     --------

               TYPE 4 - FLEXIBLE MEMBRANE LINER
                 MATERIAL TEXTURE NUMBER  36
   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.  =  0.399999993000E-12 CM/SEC
   FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
   FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
   FML PLACEMENT QUALITY      =  4 - POOR


                     LAYER  5
                     --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   6
   THICKNESS                  =     12.00   INCHES
   POROSITY                   =      0.4530 VOL/VOL
```


```
   FIELD CAPACITY             =      0.1900 VOL/VOL
   WILTING POINT              =      0.0850 VOL/VOL
   INITIAL SOIL WATER CONTENT =      0.2187 VOL/VOL
   EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                     LAYER  6
                     --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER  19
   THICKNESS                  =    240.00   INCHES
   POROSITY                   =      0.1680 VOL/VOL
   FIELD CAPACITY             =      0.0730 VOL/VOL
   WILTING POINT              =      0.0190 VOL/VOL
   INITIAL SOIL WATER CONTENT =      0.0773 VOL/VOL
   EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                     LAYER  7
                     --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   6
   THICKNESS                  =     12.00   INCHES
   POROSITY                   =      0.4530 VOL/VOL
   FIELD CAPACITY             =      0.1900 VOL/VOL
   WILTING POINT              =      0.0850 VOL/VOL
   INITIAL SOIL WATER CONTENT =      0.2914 VOL/VOL
   EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                     LAYER  8
                     --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER  19
   THICKNESS                  =    144.00   INCHES
   POROSITY                   =      0.1680 VOL/VOL
   FIELD CAPACITY             =      0.0730 VOL/VOL
   WILTING POINT              =      0.0190 VOL/VOL
   INITIAL SOIL WATER CONTENT =      0.0766 VOL/VOL
   EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                     LAYER  9
                     --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   6
```

```
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2851 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =     96.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0730 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     48.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2399 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                  =     24.00   INCHES
POROSITY                   =      0.4570 VOL/VOL
FIELD CAPACITY             =      0.1310 VOL/VOL
WILTING POINT              =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2251 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```



```
          TYPE 2 - LATERAL DRAINAGE LAYER
            MATERIAL TEXTURE NUMBER   0
THICKNESS                  =      0.15   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0129 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =   4.42000008000      CM/SEC
SLOPE                      =      6.00   PERCENT
DRAINAGE LENGTH            =    250.0    FEET


                        LAYER 14
                        --------

          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        =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY      =  1 - PERFECT


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     69.00
FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      1.350  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =     71.860  INCHES
TOTAL INITIAL WATER                =     71.860  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


           EVAPOTRANSPIRATION AND WEATHER DATA
           -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
           BALTIMORE             MARYLAND
```

```
        STATION LATITUDE                          =  39.18 DEGREES
        MAXIMUM LEAF AREA INDEX                   =   0.00
        START OF GROWING SEASON (JULIAN DATE)     =    102
        END OF GROWING SEASON (JULIAN DATE)       =    300
        EVAPORATIVE ZONE DEPTH                    =   9.0  INCHES
        AVERAGE ANNUAL WIND SPEED                 =   9.30 MPH
        AVERAGE 1ST QUARTER RELATIVE HUMIDITY     =  62.00 %
        AVERAGE 2ND QUARTER RELATIVE HUMIDITY     =  65.00 %
        AVERAGE 3RD QUARTER RELATIVE HUMIDITY     =  71.00 %
        AVERAGE 4TH QUARTER RELATIVE HUMIDITY     =  68.00 %


    NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    BALTIMORE           MARYLAND

             NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

  JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
  -------     -------     -------     -------     -------     -------
    3.47        3.02        3.93        3.00        3.89        3.43
    3.85        3.74        3.98        3.16        3.12        3.35


    NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    BALTIMORE           MARYLAND

        NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

  JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
  -------     -------     -------     -------     -------     -------
   32.40       35.50       43.70       53.20       62.80       71.70
   76.50       74.50       67.40       55.30       45.50       36.60


    NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    BALTIMORE           MARYLAND
               AND STATION LATITUDE  =  39.18 DEGREES



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

                  MONTHLY TOTALS (IN INCHES) FOR YEAR    1
-------------------------------------------------------------------------------

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

PRECIPITATION                     2.00    1.42    3.53    1.61    2.69    4.35
                                  2.02    3.97    7.14    4.15    3.78    7.35
```



```
RUNOFF                            0.000   0.000   0.000   0.000   0.000   0.000
                                  0.000   0.000   4.173   0.000   0.000   0.573

EVAPOTRANSPIRATION                1.833   2.097   2.964   2.218   1.993   4.944
                                  1.724   3.594   1.231   3.100   2.343   1.288

LATERAL DRAINAGE COLLECTED        1.3421  0.3250  0.1830  0.1138  0.0001  0.0033
  FROM LAYER  3                   0.0034  0.4224  0.2873  2.1071  0.3056  4.8415

PERCOLATION/LEAKAGE THROUGH       0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
  LAYER  4                        0.0000  0.0000  0.0000  0.0000  0.0000  0.0000

LATERAL DRAINAGE COLLECTED        1.9747  1.9095  0.9762  0.6045  0.4672  0.3597
  FROM LAYER 13                   0.3209  0.3181  0.2754  0.2111  0.2150  0.1847

PERCOLATION/LEAKAGE THROUGH       0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
  LAYER 14                        0.0000  0.0000  0.0000  0.0000  0.0000  0.0000

-------------------------------------------------------------------------------
                   MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)
-------------------------------------------------------------------------------


AVERAGE DAILY HEAD ON             0.003   0.001   0.000   0.000   0.000   0.000
  TOP OF LAYER  4                 0.000   0.001   0.001   0.005   0.001   0.012

STD. DEVIATION OF DAILY           0.004   0.000   0.000   0.000   0.000   0.000
  HEAD ON TOP OF LAYER  4         0.000   0.001   0.000   0.005   0.000   0.010

AVERAGE DAILY HEAD ON             0.011   0.011   0.005   0.003   0.003   0.002
  TOP OF LAYER 14                 0.002   0.002   0.002   0.001   0.001   0.001

STD. DEVIATION OF DAILY           0.010   0.004   0.001   0.000   0.000   0.000
  HEAD ON TOP OF LAYER 14         0.000   0.000   0.000   0.000   0.000   0.000

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


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

                         ANNUAL TOTALS FOR YEAR    1
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                          44.01          159756.297    100.00

  RUNOFF                                  4.746          17226.219     10.78

  EVAPOTRANSPIRATION                     29.328         106459.836     66.64

  DRAINAGE COLLECTED FROM LAYER  3        9.9345         36062.125     22.57

  PERC./LEAKAGE THROUGH LAYER  4          0.000000           0.000      0.00

  AVG. HEAD ON TOP OF LAYER  4            0.0020
```

DRAINAGE COLLECTED FROM LAYER 13	7.8171	28376.209	17.76
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0036		
CHANGE IN WATER STORAGE	-7.815	-28368.127	-17.76
SOIL WATER AT START OF YEAR	74.486	270384.000	
SOIL WATER AT END OF YEAR	66.671	242015.891	
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	0.024	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1292	0.0885	0.0784	0.0625	0.0547	0.0458
	0.0416	0.0370	0.0323	0.0303	0.0269	0.0256
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.001	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6527	2369.454	1.55
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-0.208	-755.173	-0.49
SOIL WATER AT START OF YEAR	66.671	242015.891	
SOIL WATER AT END OF YEAR	65.796	238839.391	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.007	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0237	0.0200	0.0207	0.0188	0.0183	0.0167
FROM LAYER 13	0.0164	0.0155	0.0143	0.0141	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2045	742.168	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.288	-4677.053	-2.51
SOIL WATER AT START OF YEAR	65.796	238839.391	
SOIL WATER AT END OF YEAR	64.777	235140.172	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.006	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0114	0.0107	0.0106	0.0099
FROM LAYER 13	0.0133	0.0131	0.0116	0.0111	0.0100	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1350	489.919	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.575	-4.88

SOIL WATER AT START OF YEAR	64.777	235140.172	
SOIL WATER AT END OF YEAR	63.326	229874.094	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.022	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0818	297.040	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6796.225	4.06
SOIL WATER AT START OF YEAR	63.326	229874.094	
SOIL WATER AT END OF YEAR	65.198	236670.312	
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	-0.001	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0012	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0157	57.037	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-768.390	-0.55
SOIL WATER AT START OF YEAR	65.198	236670.312	
SOIL WATER AT END OF YEAR	64.987	235901.922	
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	-0.018	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	64.987	235901.922	
SOIL WATER AT END OF YEAR	65.383	237339.797	
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

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	65.383	237339.797	
SOIL WATER AT END OF YEAR	65.468	237650.047	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	65.468	237650.047	
SOIL WATER AT END OF YEAR	64.274	233315.047	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001 0.000	0.005 0.006	0.004 0.002	0.001 0.000	0.001 0.000	0.001 0.005
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000 0.000	0.004 0.008	0.003 0.001	0.000 0.000	0.000 0.000	0.000 0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	64.274	233315.047	
SOIL WATER AT END OF YEAR	65.438	237540.422	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

HELP MODEL PRINTOUTS

CLOSED – FIVE LIFTS

Floor slope 33%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF5S33.OUT


TIME:  17:45     DATE:   6/26/2020


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

     TITLE:  CLOSED FILL @5 LIFTS (TOP=33%), S=33%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```



```
                                  LAYER  2
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     18.00   INCHES
           POROSITY                   =      0.4190 VOL/VOL
           FIELD CAPACITY             =      0.3070 VOL/VOL
           WILTING POINT              =      0.1800 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                                  LAYER  3
                                  --------

                      TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.25   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
           SLOPE                      =     33.00   PERCENT
           DRAINAGE LENGTH            =     95.0    FEET


                                  LAYER  4
                                  --------

                      TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
           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.  =  0.399999993000E-12 CM/SEC
           FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
           FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
           FML PLACEMENT QUALITY      =  4 - POOR


                                  LAYER  5
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
```

```
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2218 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                      LAYER  6
                      --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    240.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0777 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                      LAYER  7
                      --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2881 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                      LAYER  8
                      --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    144.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0781 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                      LAYER  9
                      --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
```


```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3043 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                      LAYER 10
                      --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0788 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                      LAYER 11
                      --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2561 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                      LAYER 12
                      --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2260 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                      LAYER 13
                      --------
```

```
              TYPE 2 - LATERAL DRAINAGE LAYER
                MATERIAL TEXTURE NUMBER   0
   THICKNESS                  =      0.15   INCHES
   POROSITY                   =      0.8500 VOL/VOL
   FIELD CAPACITY             =      0.0100 VOL/VOL
   WILTING POINT              =      0.0050 VOL/VOL
   INITIAL SOIL WATER CONTENT =      0.0117 VOL/VOL
   EFFECTIVE SAT. HYD. COND.  =   4.42000008000     CM/SEC
   SLOPE                      =     33.00   PERCENT
   DRAINAGE LENGTH            =    250.0    FEET


                          LAYER 14
                          --------

              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        =      0.00   HOLES/ACRE
   FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
   FML PLACEMENT QUALITY      =  1 - PERFECT



          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     69.00
FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      1.350  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =     73.756  INCHES
TOTAL INITIAL WATER                =     73.756  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


           EVAPOTRANSPIRATION AND WEATHER DATA
           -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
          BALTIMORE              MARYLAND
```



```
             STATION LATITUDE                       =  39.18 DEGREES
             MAXIMUM LEAF AREA INDEX                =   0.00
             START OF GROWING SEASON (JULIAN DATE)  =    102
             END OF GROWING SEASON (JULIAN DATE)    =    300
             EVAPORATIVE ZONE DEPTH                 =   9.0  INCHES
             AVERAGE ANNUAL WIND SPEED              =   9.30 MPH
             AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  62.00 %
             AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  65.00 %
             AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  71.00 %
             AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  68.00 %


         NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
                  COEFFICIENTS FOR    BALTIMORE          MARYLAND

                  NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

     JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
     -------     -------     -------     -------     -------     -------
       3.47        3.02        3.93        3.00        3.89        3.43
       3.85        3.74        3.98        3.16        3.12        3.35


         NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
                  COEFFICIENTS FOR    BALTIMORE          MARYLAND

             NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

     JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
     -------     -------     -------     -------     -------     -------
      32.40       35.50       43.70       53.20       62.80       71.70
      76.50       74.50       67.40       55.30       45.50       36.60


         NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
                  COEFFICIENTS FOR    BALTIMORE          MARYLAND
                    AND STATION LATITUDE  =  39.18 DEGREES



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

                  MONTHLY TOTALS (IN INCHES) FOR YEAR    1
-------------------------------------------------------------------------------

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

PRECIPITATION                     2.00    1.42    3.53    1.61    2.69    4.35
                                  2.02    3.97    7.14    4.15    3.78    7.35
```

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	3.8101	1.9370	0.9839	0.6084	0.4696	0.3623
	0.3211	0.3176	0.2780	0.2131	0.2148	0.1886
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.000	0.000
	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.000	0.000	0.000	0.000
	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.018	0.010	0.005	0.003	0.002	0.002
	0.002	0.002	0.001	0.001	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.014	0.003	0.001	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		
DRAINAGE COLLECTED FROM LAYER 13	9.7046	35227.555	22.05
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0040		
CHANGE IN WATER STORAGE	-9.702	-35219.379	-22.05
SOIL WATER AT START OF YEAR	76.419	277400.094	
SOIL WATER AT END OF YEAR	66.716	242180.719	
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	-0.060	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1316	0.0898	0.0793	0.0631	0.0552	0.0461
	0.0419	0.0372	0.0325	0.0305	0.0270	0.0257
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6598	2395.044	1.57
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-0.215	-780.735	-0.51
SOIL WATER AT START OF YEAR	66.716	242180.719	
SOIL WATER AT END OF YEAR	65.834	238978.672	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.027	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED FROM LAYER 3	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0238	0.0200	0.0208	0.0189	0.0184	0.0168
	0.0164	0.0156	0.0143	0.0141	0.0131	0.0129
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.012	0.002	0.008	0.001	0.001	0.005
	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.009	0.001	0.007	0.000	0.001	0.004
	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2051	744.557	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.289	-4679.435	-2.51
SOIL WATER AT START OF YEAR	65.834	238978.672	
SOIL WATER AT END OF YEAR	64.815	235277.078	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.007	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0124	0.0111	0.0115	0.0107	0.0106	0.0099
	0.0131	0.0131	0.0117	0.0112	0.0101	0.0097
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1351	490.569	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.849	-6710.212	-4.88

SOIL WATER AT START OF YEAR	64.815	235277.078	
SOIL WATER AT END OF YEAR	63.364	230010.344	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.017	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0081	0.0075	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0821	297.869	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6795.394	4.06
SOIL WATER AT START OF YEAR	63.364	230010.344	
SOIL WATER AT END OF YEAR	65.236	236805.734	
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	0.009	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0015	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48
DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0160	58.084	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-769.470	-0.55
SOIL WATER AT START OF YEAR	65.236	236805.734	
SOIL WATER AT END OF YEAR	65.024	236036.266	
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	0.017	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	65.024	236036.266	
SOIL WATER AT END OF YEAR	65.420	237474.172	
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	-0.030	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	65.420	237474.172	
SOIL WATER AT END OF YEAR	65.505	237784.406	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	65.505	237784.406	
SOIL WATER AT END OF YEAR	64.311	233449.422	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.005	0.004	0.001	0.001	0.001
	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.004	0.003	0.000	0.000	0.000
	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	64.311	233449.422	
SOIL WATER AT END OF YEAR	65.475	237674.797	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

HELP MODEL PRINTOUTS

CLOSED – EIGHT (8) LIFTS

Floor slope 2%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF8S2.OUT


TIME:   9:12     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @8 LIFTS (TOP=33%), S=2%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```

```
                         LAYER  2
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                  =     18.00   INCHES
POROSITY                   =      0.4190 VOL/VOL
FIELD CAPACITY             =      0.3070 VOL/VOL
WILTING POINT              =      0.1800 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                         LAYER  3
                         --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                  =      0.25   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
SLOPE                      =     33.00   PERCENT
DRAINAGE LENGTH            =     95.0    FEET


                         LAYER  4
                         --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  36
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.  =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY      =  4 - POOR


                         LAYER  5
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
```



```
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2126 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                         LAYER  6
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    384.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0766 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                         LAYER  7
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2917 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                         LAYER  8
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    288.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0775 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                         LAYER  9
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
```

```
THICKNESS                 =     12.00   INCHES
POROSITY                  =      0.4530 VOL/VOL
FIELD CAPACITY            =      0.1900 VOL/VOL
WILTING POINT             =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.2917 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                 =     96.00   INCHES
POROSITY                  =      0.1680 VOL/VOL
FIELD CAPACITY            =      0.0730 VOL/VOL
WILTING POINT             =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.0763 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                 =     48.00   INCHES
POROSITY                  =      0.4530 VOL/VOL
FIELD CAPACITY            =      0.1900 VOL/VOL
WILTING POINT             =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.2513 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                 =     24.00   INCHES
POROSITY                  =      0.4570 VOL/VOL
FIELD CAPACITY            =      0.1310 VOL/VOL
WILTING POINT             =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.2250 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```



```
              TYPE 2 - LATERAL DRAINAGE LAYER
                MATERIAL TEXTURE NUMBER   0
THICKNESS                 =      0.15   INCHES
POROSITY                  =      0.8500 VOL/VOL
FIELD CAPACITY            =      0.0100 VOL/VOL
WILTING POINT             =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.0934 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  4.42000008000     CM/SEC
SLOPE                     =      2.00   PERCENT
DRAINAGE LENGTH           =    250.0    FEET


                        LAYER 14
                        --------

              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       =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS  =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY     =  1 - PERFECT


           GENERAL DESIGN AND EVAPORATIVE ZONE DATA
           ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     69.00
FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      1.350  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =     94.895  INCHES
TOTAL INITIAL WATER                =     94.895  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


            EVAPOTRANSPIRATION AND WEATHER DATA
            -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
                BALTIMORE             MARYLAND
```

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	3.2090	2.5783	1.0715	0.6322	0.4788	0.3656
FROM LAYER 13	0.3218	0.3197	0.2670	0.2053	0.2200	0.1767
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.052	0.046	0.017	0.011	0.008	0.006
TOP OF LAYER 14	0.005	0.005	0.004	0.003	0.004	0.003
STD. DEVIATION OF DAILY	0.051	0.021	0.003	0.001	0.001	0.001
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.8459	35740.457	22.37
PERC./LEAKAGE THROUGH LAYER 14	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0136		
CHANGE IN WATER STORAGE	-9.844	-35732.398	-22.37
SOIL WATER AT START OF YEAR	97.460	353780.125	
SOIL WATER AT END OF YEAR	87.616	318047.719	
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	0.046	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1245	0.0859	0.0765	0.0612	0.0537	0.0451
	0.0410	0.0365	0.0319	0.0300	0.0266	0.0253
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.002	0.002	0.001	0.001	0.001	0.001
	0.001	0.001	0.001	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6382	2316.546	1.51
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0009		
CHANGE IN WATER STORAGE	-0.193	-702.248	-0.46
SOIL WATER AT START OF YEAR	87.616	318047.719	
SOIL WATER AT END OF YEAR	86.756	314924.156	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.024	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0235	0.0198	0.0205	0.0187	0.0182	0.0166
FROM LAYER 13	0.0163	0.0154	0.0142	0.0140	0.0130	0.0128
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2031	737.114	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-1.287	-4671.985	-2.51
SOIL WATER AT START OF YEAR	86.756	314924.156	
SOIL WATER AT END OF YEAR	85.738	311230.031	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.009	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
FROM LAYER 13	0.0137	0.0129	0.0115	0.0110	0.0100	0.0096
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1346	488.540	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0002		
CHANGE IN WATER STORAGE	-1.848	-6708.190	-4.88

SOIL WATER AT START OF YEAR	85.738	311230.031	
SOIL WATER AT END OF YEAR	84.288	305965.312	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.017	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0090	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0813	295.293	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6797.969	4.06
SOIL WATER AT START OF YEAR	84.288	305965.312	
SOIL WATER AT END OF YEAR	86.161	312763.281	
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	0.001	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0051	0.0045	0.0048	0.0007	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.002	0.003	0.001	0.003	0.001
	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.001	0.002	0.002	0.000	0.003	0.001
	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0151	54.804	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-766.174	-0.55
SOIL WATER AT START OF YEAR	86.161	312763.281	
SOIL WATER AT END OF YEAR	85.950	311997.094	
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	-0.001	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	85.950	311997.094	
SOIL WATER AT END OF YEAR	86.346	313435.000	
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

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	86.346	313435.000	
SOIL WATER AT END OF YEAR	86.431	313745.219	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
FROM LAYER 3	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.003	0.001	0.002	0.005
TOP OF LAYER 4	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY	0.002	0.001	0.003	0.001	0.002	0.004
HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.659	0.17
SOIL WATER AT START OF YEAR	86.431	313745.219	
SOIL WATER AT END OF YEAR	85.237	309410.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.120	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	85.237	309410.250	
SOIL WATER AT END OF YEAR	86.401	313635.625	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

HELP MODEL PRINTOUTS

CLOSED – EIGHT (8) LIFTS

Floor slope 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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF8S3.OUT


TIME:   9:26     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @8 LIFTS (TOP=33%), S=3%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```



```
                                   LAYER  2
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     18.00   INCHES
           POROSITY                   =      0.4190 VOL/VOL
           FIELD CAPACITY             =      0.3070 VOL/VOL
           WILTING POINT              =      0.1800 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                                   LAYER  3
                                   --------

                       TYPE 2 - LATERAL DRAINAGE LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.25   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
           SLOPE                      =     33.00   PERCENT
           DRAINAGE LENGTH            =     95.0    FEET


                                   LAYER  4
                                   --------

                       TYPE 4 - FLEXIBLE MEMBRANE LINER
                         MATERIAL TEXTURE NUMBER  36
           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.  =  0.399999993000E-12 CM/SEC
           FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
           FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
           FML PLACEMENT QUALITY      =  4 - POOR


                                   LAYER  5
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
```

```
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2126 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  6
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    384.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0766 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2917 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    288.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0775 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  9
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2917 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0763 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2513 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2250 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```

```
           TYPE 2 - LATERAL DRAINAGE LAYER
             MATERIAL TEXTURE NUMBER   0
THICKNESS                  =      0.15   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0934 VOL/VOL
EFFECTIVE SAT. HYD. CONDUCTIVITY =   4.42000008000     CM/SEC
SLOPE                      =      3.00   PERCENT
DRAINAGE LENGTH            =    250.0    FEET


                        LAYER 14
                        --------

           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        =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY      =  1 - PERFECT



          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

  NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

 SCS RUNOFF CURVE NUMBER             =     69.00
 FRACTION OF AREA ALLOWING RUNOFF    =    100.0    PERCENT
 AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
 EVAPORATIVE ZONE DEPTH              =      9.0    INCHES
 INITIAL WATER IN EVAPORATIVE ZONE   =      2.816  INCHES
 UPPER LIMIT OF EVAPORATIVE STORAGE  =      4.263  INCHES
 LOWER LIMIT OF EVAPORATIVE STORAGE  =      1.350  INCHES
 INITIAL SNOW WATER                  =      0.000  INCHES
 INITIAL WATER IN LAYER MATERIALS    =     94.895  INCHES
 TOTAL INITIAL WATER                 =     94.895  INCHES
 TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR


           EVAPOTRANSPIRATION AND WEATHER DATA
           -----------------------------------

  NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
           BALTIMORE            MARYLAND
```



```
       STATION LATITUDE                        =  39.18 DEGREES
       MAXIMUM LEAF AREA INDEX                 =   0.00
       START OF GROWING SEASON (JULIAN DATE)   =    102
       END OF GROWING SEASON (JULIAN DATE)     =    300
       EVAPORATIVE ZONE DEPTH                  =   9.0  INCHES
       AVERAGE ANNUAL WIND SPEED               =   9.30 MPH
       AVERAGE 1ST QUARTER RELATIVE HUMIDITY   =  62.00 %
       AVERAGE 2ND QUARTER RELATIVE HUMIDITY   =  65.00 %
       AVERAGE 3RD QUARTER RELATIVE HUMIDITY   =  71.00 %
       AVERAGE 4TH QUARTER RELATIVE HUMIDITY   =  68.00 %


   NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
                   COEFFICIENTS FOR    BALTIMORE           MARYLAND

                   NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

   JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
   -------     -------     -------     -------     -------     -------
     3.47        3.02        3.93        3.00        3.89        3.43
     3.85        3.74        3.98        3.16        3.12        3.35


   NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
                   COEFFICIENTS FOR    BALTIMORE           MARYLAND

              NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

   JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
   -------     -------     -------     -------     -------     -------
    32.40       35.50       43.70       53.20       62.80       71.70
    76.50       74.50       67.40       55.30       45.50       36.60


   NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
                   COEFFICIENTS FOR    BALTIMORE           MARYLAND
                     AND STATION LATITUDE  =  39.18 DEGREES



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

                  MONTHLY TOTALS (IN INCHES) FOR YEAR    1
-------------------------------------------------------------------------------

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

PRECIPITATION                     2.00    1.42    3.53    1.61    2.69    4.35
                                  2.02    3.97    7.14    4.15    3.78    7.35
```

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	3.2387	2.5552	1.0685	0.6312	0.4782	0.3653
	0.3215	0.3196	0.2666	0.2051	0.2202	0.1764
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.000	0.000
	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.000	0.000	0.000	0.000
	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.035	0.030	0.011	0.007	0.005	0.004
	0.003	0.003	0.003	0.002	0.002	0.002
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.034	0.014	0.002	0.001	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		
DRAINAGE COLLECTED FROM LAYER 13	9.8465	35742.852	22.37
PERC./LEAKAGE THROUGH LAYER 14	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0091		
CHANGE IN WATER STORAGE	-9.844	-35734.805	-22.37
SOIL WATER AT START OF YEAR	97.460	353780.125	
SOIL WATER AT END OF YEAR	87.616	318045.312	
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	0.060	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1243	0.0858	0.0764	0.0611	0.0537	0.0450
	0.0410	0.0365	0.0319	0.0300	0.0266	0.0253
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.001	0.001	0.001	0.001	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6376	2314.556	1.51
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0006		
CHANGE IN WATER STORAGE	-0.193	-700.254	-0.46
SOIL WATER AT START OF YEAR	87.616	318045.312	
SOIL WATER AT END OF YEAR	86.756	314923.750	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.028	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED FROM LAYER 3	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0235	0.0198	0.0205	0.0187	0.0182	0.0166
	0.0163	0.0154	0.0142	0.0140	0.0130	0.0128
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.012	0.002	0.008	0.001	0.001	0.005
	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.009	0.001	0.007	0.000	0.001	0.004
	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2030	736.922	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0002		
CHANGE IN WATER STORAGE	-1.287	-4671.791	-2.51
SOIL WATER AT START OF YEAR	86.756	314923.750	
SOIL WATER AT END OF YEAR	85.738	311229.781	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.010	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
	0.0137	0.0129	0.0115	0.0110	0.0100	0.0096
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1346	488.487	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6708.107	-4.88

SOIL WATER AT START OF YEAR	85.738	311229.781	
SOIL WATER AT END OF YEAR	84.288	305965.156	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.013	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0090	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0813	295.226	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6798.025	4.06
SOIL WATER AT START OF YEAR	84.288	305965.156	
SOIL WATER AT END OF YEAR	86.161	312763.187	
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	0.013	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0051	0.0045	0.0048	0.0007	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0151	54.719	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-766.091	-0.55
SOIL WATER AT START OF YEAR	86.161	312763.187	
SOIL WATER AT END OF YEAR	85.950	311997.094	
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	0.001	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	85.950	311997.094	
SOIL WATER AT END OF YEAR	86.346	313435.000	
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

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	86.346	313435.000	
SOIL WATER AT END OF YEAR	86.431	313745.219	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.659	0.17
SOIL WATER AT START OF YEAR	86.431	313745.219	
SOIL WATER AT END OF YEAR	85.237	309410.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.120	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	85.237	309410.250	
SOIL WATER AT END OF YEAR	86.401	313635.625	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

HELP MODEL PRINTOUTS

CLOSED – EIGHT (8) LIFTS

Floor slope 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:\DATA4.D4
TEMPERATURE DATA FILE:       C:\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\DATA10.D10
OUTPUT DATA FILE:            C:\CF8S4.OUT


TIME:   9:42     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @8 LIFTS (TOP=33%), S=4%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```

```
                    LAYER  2
                    --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
THICKNESS                  =    18.00   INCHES
POROSITY                   =     0.4190 VOL/VOL
FIELD CAPACITY             =     0.3070 VOL/VOL
WILTING POINT              =     0.1800 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.3967 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                    LAYER  3
                    --------

              TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
THICKNESS                  =     0.25   INCHES
POROSITY                   =     0.8500 VOL/VOL
FIELD CAPACITY             =     0.0100 VOL/VOL
WILTING POINT              =     0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.1630 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
SLOPE                      =    33.00   PERCENT
DRAINAGE LENGTH            =    95.0    FEET


                    LAYER  4
                    --------

              TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  36
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.  =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY        =     0.00   HOLES/ACRE
FML INSTALLATION DEFECTS   =     0.00   HOLES/ACRE
FML PLACEMENT QUALITY      =  4 - POOR


                    LAYER  5
                    --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   6
THICKNESS                  =    12.00   INCHES
POROSITY                   =     0.4530 VOL/VOL
```


```
FIELD CAPACITY             =     0.1900 VOL/VOL
WILTING POINT              =     0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.2177 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                    LAYER  6
                    --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  19
THICKNESS                  =   384.00   INCHES
POROSITY                   =     0.1680 VOL/VOL
FIELD CAPACITY             =     0.0730 VOL/VOL
WILTING POINT              =     0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.0763 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                    LAYER  7
                    --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   6
THICKNESS                  =    12.00   INCHES
POROSITY                   =     0.4530 VOL/VOL
FIELD CAPACITY             =     0.1900 VOL/VOL
WILTING POINT              =     0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.2893 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                    LAYER  8
                    --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  19
THICKNESS                  =   288.00   INCHES
POROSITY                   =     0.1680 VOL/VOL
FIELD CAPACITY             =     0.0730 VOL/VOL
WILTING POINT              =     0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.0783 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                    LAYER  9
                    --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   6
```

```
THICKNESS                    =     12.00   INCHES
POROSITY                     =      0.4530 VOL/VOL
FIELD CAPACITY               =      0.1900 VOL/VOL
WILTING POINT                =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.2956 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                    =     96.00   INCHES
POROSITY                     =      0.1680 VOL/VOL
FIELD CAPACITY               =      0.0730 VOL/VOL
WILTING POINT                =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0750 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                    =     48.00   INCHES
POROSITY                     =      0.4530 VOL/VOL
FIELD CAPACITY               =      0.1900 VOL/VOL
WILTING POINT                =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.2507 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                    =     24.00   INCHES
POROSITY                     =      0.4570 VOL/VOL
FIELD CAPACITY               =      0.1310 VOL/VOL
WILTING POINT                =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.2255 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```



```
          TYPE 2 - LATERAL DRAINAGE LAYER
            MATERIAL TEXTURE NUMBER   0
THICKNESS                    =      0.15   INCHES
POROSITY                     =      0.8500 VOL/VOL
FIELD CAPACITY               =      0.0100 VOL/VOL
WILTING POINT                =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0427 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   4.42000008000     CM/SEC
SLOPE                        =      4.00   PERCENT
DRAINAGE LENGTH              =    250.0    FEET


                        LAYER 14
                        --------

          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          =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS     =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY        =  1 - PERFECT


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =    69.00
FRACTION OF AREA ALLOWING RUNOFF   =   100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =     1.000  ACRES
EVAPORATIVE ZONE DEPTH             =     9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =     2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =     4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =     1.350  INCHES
INITIAL SNOW WATER                 =     0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    94.940  INCHES
TOTAL INITIAL WATER                =    94.940  INCHES
TOTAL SUBSURFACE INFLOW            =     0.00   INCHES/YEAR


            EVAPOTRANSPIRATION AND WEATHER DATA
            -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
          BALTIMORE             MARYLAND
```

STATION LATITUDE = 39.18 DEGREES
MAXIMUM LEAF AREA INDEX = 0.00
START OF GROWING SEASON (JULIAN DATE) = 102
END OF GROWING SEASON (JULIAN DATE) = 300
EVAPORATIVE ZONE DEPTH = 9.0 INCHES
AVERAGE ANNUAL WIND SPEED = 9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	3.3047	2.5110	1.0618	0.6278	0.4775	0.3645
FROM LAYER 13	0.3235	0.3194	0.2750	0.2109	0.2150	0.1840
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.027	0.022	0.009	0.005	0.004	0.003
TOP OF LAYER 14	0.003	0.003	0.002	0.002	0.002	0.001
STD. DEVIATION OF DAILY	0.026	0.010	0.001	0.001	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.8752	35846.984	22.44
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0069		
CHANGE IN WATER STORAGE	-9.873	-35838.937	-22.43
SOIL WATER AT START OF YEAR	97.559	354138.781	
SOIL WATER AT END OF YEAR	87.686	318299.844	
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	0.060	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1288	0.0883	0.0782	0.0623	0.0546	0.0457
FROM LAYER 13	0.0416	0.0370	0.0322	0.0303	0.0268	0.0256
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.001	0.001	0.001	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6514	2364.603	1.55
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0004		
CHANGE IN WATER STORAGE	-0.207	-750.299	-0.49
SOIL WATER AT START OF YEAR	87.686	318299.844	
SOIL WATER AT END OF YEAR	86.812	315128.219	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.031	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED FROM LAYER 3	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0237	0.0199	0.0207	0.0188	0.0183	0.0167
	0.0164	0.0155	0.0143	0.0141	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.012	0.002	0.008	0.001	0.001	0.005
	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.009	0.001	0.007	0.000	0.001	0.004
	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2043	741.711	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.288	-4676.583	-2.51
SOIL WATER AT START OF YEAR	86.812	315128.219	
SOIL WATER AT END OF YEAR	85.793	311429.469	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.008	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0114	0.0106	0.0106	0.0099
FROM LAYER 13	0.0133	0.0130	0.0116	0.0111	0.0100	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1349	489.795	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.464	-4.88

SOIL WATER AT START OF YEAR	85.793	311429.469	
SOIL WATER AT END OF YEAR	84.343	306163.500	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.035	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0818	296.882	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.872	6796.335	4.06
SOIL WATER AT START OF YEAR	84.343	306163.500	
SOIL WATER AT END OF YEAR	86.215	312959.812	
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	0.047	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0052	0.0045	0.0048	0.0012	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.002	0.003	0.001	0.003	0.001
	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.001	0.002	0.002	0.000	0.003	0.001
	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0157	56.836	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-768.140	-0.55
SOIL WATER AT START OF YEAR	86.215	312959.812	
SOIL WATER AT END OF YEAR	86.003	312191.687	
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	-0.066	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	86.003	312191.687	
SOIL WATER AT END OF YEAR	86.399	313629.562	
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

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	86.399	313629.562	
SOIL WATER AT END OF YEAR	86.485	313939.812	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	86.485	313939.812	
SOIL WATER AT END OF YEAR	85.291	309604.812	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.219	-0.29
SOIL WATER AT START OF YEAR	85.291	309604.812	
SOIL WATER AT END OF YEAR	86.455	313830.219	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.013	0.00

****

HELP MODEL PRINTOUTS

CLOSED – EIGHT (8) LIFTS

Floor slope 5%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF8S5.OUT


TIME:   9:57     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @8 LIFTS (TOP=33%), S=5%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```



```
                                   LAYER  2
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     18.00   INCHES
           POROSITY                   =      0.4190 VOL/VOL
           FIELD CAPACITY             =      0.3070 VOL/VOL
           WILTING POINT              =      0.1800 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                                   LAYER  3
                                   --------

                       TYPE 2 - LATERAL DRAINAGE LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.25   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
           SLOPE                      =     33.00   PERCENT
           DRAINAGE LENGTH            =     95.0    FEET


                                   LAYER  4
                                   --------

                       TYPE 4 - FLEXIBLE MEMBRANE LINER
                         MATERIAL TEXTURE NUMBER  36
           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.  =  0.399999993000E-12 CM/SEC
           FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
           FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
           FML PLACEMENT QUALITY      =  4 - POOR


                                   LAYER  5
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
```

```
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2177 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  6
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    384.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0763 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2893 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    288.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0783 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  9
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2956 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0750 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2507 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2255 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0363 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000 CM/SEC
SLOPE	=	5.00 PERCENT
DRAINAGE LENGTH	=	250.0 FEET

LAYER 14

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	=	0.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00
FRACTION OF AREA ALLOWING RUNOFF	=	100.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000 ACRES
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816 INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263 INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350 INCHES
INITIAL SNOW WATER	=	0.000 INCHES
INITIAL WATER IN LAYER MATERIALS	=	94.939 INCHES
TOTAL INITIAL WATER	=	94.939 INCHES
TOTAL SUBSURFACE INFLOW	=	0.00 INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	3.3121	2.5046	1.0609	0.6275	0.4773	0.3644
FROM LAYER 13	0.3234	0.3194	0.2750	0.2109	0.2150	0.1839
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.022	0.018	0.007	0.004	0.003	0.002
TOP OF LAYER 14	0.002	0.002	0.002	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.021	0.008	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		
DRAINAGE COLLECTED FROM LAYER 13	9.8745	35844.258	22.44
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0055		
CHANGE IN WATER STORAGE	-9.872	-35836.195	-22.43
SOIL WATER AT START OF YEAR	97.557	354131.781	
SOIL WATER AT END OF YEAR	87.685	318295.594	
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	0.043	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1288	0.0883	0.0782	0.0623	0.0546	0.0457
FROM LAYER 13	0.0416	0.0370	0.0322	0.0303	0.0268	0.0256
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003 0.001	0.001 0.000	0.003 0.001	0.001 0.002	0.006 0.000	0.003 0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004 0.000	0.000 0.000	0.004 0.003	0.001 0.001	0.006 0.000	0.003 0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001 0.000	0.001 0.000	0.001 0.000	0.000 0.000	0.000 0.000	0.000 0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6512	2363.979	1.55
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0004		
CHANGE IN WATER STORAGE	-0.207	-749.662	-0.49
SOIL WATER AT START OF YEAR	87.685	318295.594	
SOIL WATER AT END OF YEAR	86.811	315124.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.044	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68 7.73	3.73 4.48	2.65 4.80	2.18 1.86	4.82 2.74	7.74 1.93
RUNOFF	1.002 3.590	0.000 0.145	0.000 0.039	0.000 0.000	0.132 0.000	0.263 0.000
EVAPOTRANSPIRATION	1.522 3.764	1.629 2.834	2.362 2.452	1.498 2.917	3.507 1.241	5.862 1.034
LATERAL DRAINAGE COLLECTED FROM LAYER 3	5.1067 0.9838	0.7695 1.2587	3.5188 0.3027	0.3294 1.4652	0.4095 0.2780	1.9031 0.3077
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0237 0.0164	0.0199 0.0155	0.0207 0.0143	0.0188 0.0141	0.0183 0.0130	0.0167 0.0129
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.012 0.002	0.002 0.003	0.008 0.001	0.001 0.003	0.001 0.001	0.005 0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.009 0.002	0.001 0.003	0.007 0.000	0.000 0.002	0.001 0.000	0.004 0.001
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2043	741.653	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.288	-4676.527	-2.51
SOIL WATER AT START OF YEAR	86.811	315124.625	
SOIL WATER AT END OF YEAR	85.792	311425.937	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.005	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0124	0.0111	0.0114	0.0106	0.0106	0.0099
	0.0133	0.0130	0.0116	0.0111	0.0100	0.0097
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1349	489.779	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.464	-4.88

SOIL WATER AT START OF YEAR	85.792	311425.937	
SOIL WATER AT END OF YEAR	84.342	306159.937	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.051	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0818	296.862	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6796.363	4.06
SOIL WATER AT START OF YEAR	84.342	306159.937	
SOIL WATER AT END OF YEAR	86.214	312956.312	
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	0.039	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0012	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0157	56.810	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-768.113	-0.55
SOIL WATER AT START OF YEAR	86.214	312956.312	
SOIL WATER AT END OF YEAR	86.002	312188.187	
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	-0.068	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	86.002	312188.187	
SOIL WATER AT END OF YEAR	86.398	313626.094	
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

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	86.398	313626.094	
SOIL WATER AT END OF YEAR	86.484	313936.312	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	86.484	313936.312	
SOIL WATER AT END OF YEAR	85.290	309601.312	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.219	-0.29
SOIL WATER AT START OF YEAR	85.290	309601.312	
SOIL WATER AT END OF YEAR	86.454	313826.719	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.013	0.00

****

a Montrose Environmental Group company

HELP MODEL PRINTOUTS

CLOSED – EIGHT (8) LIFTS

Floor slope 6%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:       C:\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\DATA10.D10
OUTPUT DATA FILE:            C:\CF8S6.OUT


TIME:  10:11     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @8 LIFTS (TOP=33%), S=6%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```

```
                    LAYER  2
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                  =     18.00   INCHES
POROSITY                   =      0.4190 VOL/VOL
FIELD CAPACITY             =      0.3070 VOL/VOL
WILTING POINT              =      0.1800 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                    LAYER  3
                    --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                  =      0.25   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
SLOPE                      =     33.00   PERCENT
DRAINAGE LENGTH            =     95.0    FEET


                    LAYER  4
                    --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  36
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.  =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY      =  4 - POOR


                    LAYER  5
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
```



```
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2187 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                    LAYER  6
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    384.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0771 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                    LAYER  7
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2884 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                    LAYER  8
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    288.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0775 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                    LAYER  9
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
```

```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2965 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0742 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2502 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2248 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```



```
             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.15   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0496 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   4.42000008000     CM/SEC
SLOPE                       =      6.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET


                        LAYER 14
                        --------

             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         =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  1 - PERFECT


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

  NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     69.00
FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      1.350  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =     94.912  INCHES
TOTAL INITIAL WATER                =     94.912  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


           EVAPOTRANSPIRATION AND WEATHER DATA
           -----------------------------------

  NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
            BALTIMORE             MARYLAND
```

STATION LATITUDE = 39.18 DEGREES
MAXIMUM LEAF AREA INDEX = 0.00
START OF GROWING SEASON (JULIAN DATE) = 102
END OF GROWING SEASON (JULIAN DATE) = 300
EVAPORATIVE ZONE DEPTH = 9.0 INCHES
AVERAGE ANNUAL WIND SPEED = 9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BALTIMORE MARYLAND AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	3.0468	2.6931	1.0859	0.6357	0.4819	0.3671
FROM LAYER 13	0.3250	0.3197	0.2765	0.2115	0.2150	0.1856
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.017	0.016	0.006	0.004	0.003	0.002
TOP OF LAYER 14	0.002	0.002	0.002	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.017	0.008	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.8439	35733.266	22.37
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0046		
CHANGE IN WATER STORAGE	-9.842	-35725.281	-22.36
SOIL WATER AT START OF YEAR	97.544	354085.312	
SOIL WATER AT END OF YEAR	87.702	318360.031	
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	0.119	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1298	0.0888	0.0786	0.0626	0.0548	0.0459
FROM LAYER 13	0.0417	0.0371	0.0323	0.0303	0.0269	0.0256
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6544	2375.441	1.55
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-0.210	-761.127	-0.50
SOIL WATER AT START OF YEAR	87.702	318360.031	
SOIL WATER AT END OF YEAR	86.826	315177.594	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.040	0.00

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0237	0.0200	0.0207	0.0188	0.0183	0.0167
FROM LAYER 13	0.0164	0.0155	0.0143	0.0141	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2046	742.729	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.289	-4677.635	-2.51
SOIL WATER AT START OF YEAR	86.826	315177.594	
SOIL WATER AT END OF YEAR	85.807	311477.812	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.027	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0114	0.0107	0.0106	0.0099
FROM LAYER 13	0.0132	0.0131	0.0117	0.0112	0.0101	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1350	490.070	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.686	-4.88

SOIL WATER AT START OF YEAR	85.807	311477.812	
SOIL WATER AT END OF YEAR	84.356	306211.594	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.018	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0819	297.233	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6796.003	4.06
SOIL WATER AT START OF YEAR	84.356	306211.594	
SOIL WATER AT END OF YEAR	86.228	313007.594	
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	0.028	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0052	0.0045	0.0048	0.0013	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.002	0.003	0.001	0.003	0.001
	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.001	0.002	0.002	0.000	0.003	0.001
	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0158	57.283	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-768.611	-0.55
SOIL WATER AT START OF YEAR	86.228	313007.594	
SOIL WATER AT END OF YEAR	86.016	312239.000	
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	-0.043	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	86.016	312239.000	
SOIL WATER AT END OF YEAR	86.412	313676.875	
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

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	86.412	313676.875	
SOIL WATER AT END OF YEAR	86.498	313987.094	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	86.498	313987.094	
SOIL WATER AT END OF YEAR	85.304	309652.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	85.304	309652.125	
SOIL WATER AT END OF YEAR	86.468	313877.500	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

HELP MODEL PRINTOUTS

CLOSED – EIGHT (8) LIFTS

Floor slope 33%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF8S33.OUT


TIME:  10:25     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @8 LIFTS (TOP=33%), S=33%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```



```
                                 LAYER  2
                                 --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     18.00   INCHES
           POROSITY                   =      0.4190 VOL/VOL
           FIELD CAPACITY             =      0.3070 VOL/VOL
           WILTING POINT              =      0.1800 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                                 LAYER  3
                                 --------

                      TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.25   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
           SLOPE                      =     33.00   PERCENT
           DRAINAGE LENGTH            =     95.0    FEET


                                 LAYER  4
                                 --------

                      TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
           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.  =  0.399999993000E-12 CM/SEC
           FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
           FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
           FML PLACEMENT QUALITY      =  4 - POOR


                                 LAYER  5
                                 --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
```

```
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2218 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  6
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    384.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0774 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2842 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    288.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0777 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  9
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2934 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0731 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2471 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2261 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```

```
            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                  =      0.15   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0105 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =   4.42000008000     CM/SEC
SLOPE                      =     33.00   PERCENT
DRAINAGE LENGTH            =    250.0    FEET


                        LAYER 14
                        --------

            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        =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY      =  1 - PERFECT


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     69.00
FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      1.350  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =     94.806  INCHES
TOTAL INITIAL WATER                =     94.806  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


           EVAPOTRANSPIRATION AND WEATHER DATA
           -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
          BALTIMORE            MARYLAND
```



```
       STATION LATITUDE                      =  39.18 DEGREES
       MAXIMUM LEAF AREA INDEX               =   0.00
       START OF GROWING SEASON (JULIAN DATE) =    102
       END OF GROWING SEASON (JULIAN DATE)   =    300
       EVAPORATIVE ZONE DEPTH                =   9.0  INCHES
       AVERAGE ANNUAL WIND SPEED             =   9.30 MPH
       AVERAGE 1ST QUARTER RELATIVE HUMIDITY =  62.00 %
       AVERAGE 2ND QUARTER RELATIVE HUMIDITY =  65.00 %
       AVERAGE 3RD QUARTER RELATIVE HUMIDITY =  71.00 %
       AVERAGE 4TH QUARTER RELATIVE HUMIDITY =  68.00 %


   NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
            COEFFICIENTS FOR    BALTIMORE           MARYLAND

            NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL      FEB/AUG      MAR/SEP      APR/OCT      MAY/NOV      JUN/DEC
-------      -------      -------      -------      -------      -------
  3.47         3.02         3.93         3.00         3.89         3.43
  3.85         3.74         3.98         3.16         3.12         3.35


   NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
            COEFFICIENTS FOR    BALTIMORE           MARYLAND

       NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL      FEB/AUG      MAR/SEP      APR/OCT      MAY/NOV      JUN/DEC
-------      -------      -------      -------      -------      -------
 32.40        35.50        43.70        53.20        62.80        71.70
 76.50        74.50        67.40        55.30        45.50        36.60


   NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
            COEFFICIENTS FOR    BALTIMORE           MARYLAND
              AND STATION LATITUDE  =  39.18 DEGREES



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

                  MONTHLY TOTALS (IN INCHES) FOR YEAR    1
-------------------------------------------------------------------------------

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

PRECIPITATION                 2.00    1.42    3.53    1.61    2.69    4.35
                              2.02    3.97    7.14    4.15    3.78    7.35
```

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	2.7723	2.8131	1.1024	0.6416	0.4854	0.3709
FROM LAYER 13	0.3248	0.3192	0.2789	0.2143	0.2147	0.1900
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.013	0.015	0.005	0.003	0.002	0.002
TOP OF LAYER 14	0.002	0.002	0.001	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.015	0.007	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		
DRAINAGE COLLECTED FROM LAYER 13	9.7277	35311.586	22.10
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0040		
CHANGE IN WATER STORAGE	-9.725	-35303.543	-22.10
SOIL WATER AT START OF YEAR	97.469	353811.812	
SOIL WATER AT END OF YEAR	87.743	318508.281	
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	0.072	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1324	0.0903	0.0797	0.0633	0.0553	0.0463
FROM LAYER 13	0.0420	0.0373	0.0325	0.0305	0.0270	0.0257
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6624	2404.437	1.57
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-0.218	-790.096	-0.52
SOIL WATER AT START OF YEAR	87.743	318508.281	
SOIL WATER AT END OF YEAR	86.859	315296.844	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.059	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED FROM LAYER 3	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0238	0.0201	0.0208	0.0189	0.0184	0.0168
	0.0164	0.0156	0.0144	0.0142	0.0131	0.0129
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.012	0.002	0.008	0.001	0.001	0.005
	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.009	0.001	0.007	0.000	0.001	0.004
	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2054	745.421	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.289	-4680.293	-2.51
SOIL WATER AT START OF YEAR	86.859	315296.844	
SOIL WATER AT END OF YEAR	85.839	311594.406	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.001	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0115	0.0107	0.0106	0.0099
FROM LAYER 13	0.0130	0.0131	0.0117	0.0112	0.0101	0.0098
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1352	490.801	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.849	-6710.433	-4.88

SOIL WATER AT START OF YEAR	85.839	311594.406	
SOIL WATER AT END OF YEAR	84.388	306327.437	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.007	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0082	0.0075	0.0073	0.0068
FROM LAYER 13	0.0067	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0821	298.167	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6795.062	4.06
SOIL WATER AT START OF YEAR	84.388	306327.437	
SOIL WATER AT END OF YEAR	86.260	313122.500	
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	0.043	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0016	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0161	58.462	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-769.802	-0.55
SOIL WATER AT START OF YEAR	86.260	313122.500	
SOIL WATER AT END OF YEAR	86.048	312352.719	
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	-0.029	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.005	0.001	0.007	0.001	0.001	0.000
	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.005	0.000	0.007	0.001	0.000	0.000
	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	86.048	312352.719	
SOIL WATER AT END OF YEAR	86.444	313790.625	
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	-0.030	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED FROM LAYER 3	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.007	0.005	0.001	0.006	0.001	0.000
	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.008	0.007	0.001	0.006	0.000	0.000
	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	86.444	313790.625	
SOIL WATER AT END OF YEAR	86.529	314100.844	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	86.529	314100.844	
SOIL WATER AT END OF YEAR	85.335	309765.844	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	85.335	309765.844	
SOIL WATER AT END OF YEAR	86.499	313991.219	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

a Montrose Environmental Group company

HELP MODEL PRINTOUTS

CLOSED – THIRTEEN (13) LIFTS

Floor slope 2%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:       C:\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\DATA10.D10
OUTPUT DATA FILE:            C:\CF13S2.OUT


TIME:  10:44     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @13 LIFTS (TOP=33%), S=2%

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


     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   9
           THICKNESS                    =      6.00   INCHES
           POROSITY                     =      0.5010 VOL/VOL
           FIELD CAPACITY               =      0.2840 VOL/VOL
           WILTING POINT                =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT   =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =  0.190000006000E-03 CM/SEC
```

```
                    LAYER  2
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   0
THICKNESS                  =     18.00   INCHES
POROSITY                   =      0.4190 VOL/VOL
FIELD CAPACITY             =      0.3070 VOL/VOL
WILTING POINT              =      0.1800 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                    LAYER  3
                    --------

            TYPE 2 - LATERAL DRAINAGE LAYER
             MATERIAL TEXTURE NUMBER   0
THICKNESS                  =      0.25   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
SLOPE                      =     33.00   PERCENT
DRAINAGE LENGTH            =     95.0    FEET


                    LAYER  4
                    --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
             MATERIAL TEXTURE NUMBER  36
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.  =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY      =  4 - POOR


                    LAYER  5
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
```



```
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2126 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                    LAYER  6
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    624.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0761 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                    LAYER  7
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2885 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                    LAYER  8
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    528.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0756 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                    LAYER  9
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
```

```
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2836 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =     96.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0734 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     48.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2489 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                  =     24.00   INCHES
POROSITY                   =      0.4570 VOL/VOL
FIELD CAPACITY             =      0.1310 VOL/VOL
WILTING POINT              =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2252 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```



```
          TYPE 2 - LATERAL DRAINAGE LAYER
            MATERIAL TEXTURE NUMBER   0
THICKNESS                  =      0.15   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0588 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =   4.42000008000     CM/SEC
SLOPE                      =      2.00   PERCENT
DRAINAGE LENGTH            =    250.0    FEET


                        LAYER 14
                        --------

          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        =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY      =  1 - PERFECT


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

  NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =    69.00
FRACTION OF AREA ALLOWING RUNOFF   =   100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =     1.000  ACRES
EVAPORATIVE ZONE DEPTH             =     9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =     2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =     4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =     1.350  INCHES
INITIAL SNOW WATER                 =     0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =   130.034  INCHES
TOTAL INITIAL WATER                =   130.034  INCHES
TOTAL SUBSURFACE INFLOW            =     0.00   INCHES/YEAR


          EVAPOTRANSPIRATION AND WEATHER DATA
          -----------------------------------

  NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
              BALTIMORE             MARYLAND
```

STATION LATITUDE = 39.18 DEGREES
MAXIMUM LEAF AREA INDEX = 0.00
START OF GROWING SEASON (JULIAN DATE) = 102
END OF GROWING SEASON (JULIAN DATE) = 300
EVAPORATIVE ZONE DEPTH = 9.0 INCHES
AVERAGE ANNUAL WIND SPEED = 9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BALTIMORE MARYLAND AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	1.6931	3.9161	1.2438	0.6854	0.5022	0.3768
FROM LAYER 13	0.3284	0.3223	0.2696	0.2069	0.2186	0.1784
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.027	0.070	0.020	0.011	0.008	0.006
TOP OF LAYER 14	0.005	0.005	0.004	0.003	0.004	0.003
STD. DEVIATION OF DAILY	0.031	0.036	0.005	0.001	0.001	0.001
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.9414	36087.379	22.59
PERC./LEAKAGE THROUGH LAYER 14	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0140		
CHANGE IN WATER STORAGE	-9.939	-36079.273	-22.58
SOIL WATER AT START OF YEAR	132.594	481316.594	
SOIL WATER AT END OF YEAR	122.655	445237.312	
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	0.001	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1255	0.0865	0.0769	0.0614	0.0539	0.0452
FROM LAYER 13	0.0411	0.0366	0.0320	0.0301	0.0266	0.0254
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.002	0.002	0.001	0.001	0.001	0.001
TOP OF LAYER 14	0.001	0.001	0.001	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6412	2327.613	1.52
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0009		
CHANGE IN WATER STORAGE	-0.197	-713.326	-0.47
SOIL WATER AT START OF YEAR	122.655	445237.312	
SOIL WATER AT END OF YEAR	121.791	442102.656	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.013	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0235	0.0198	0.0206	0.0187	0.0182	0.0166
FROM LAYER 13	0.0163	0.0155	0.0142	0.0140	0.0130	0.0128
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2034	738.185	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-1.287	-4673.065	-2.51
SOIL WATER AT START OF YEAR	121.791	442102.656	
SOIL WATER AT END OF YEAR	120.773	438407.437	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.001	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
FROM LAYER 13	0.0136	0.0130	0.0116	0.0111	0.0100	0.0096
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1347	488.834	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0002		
CHANGE IN WATER STORAGE	-1.848	-6708.439	-4.88

SOIL WATER AT START OF YEAR	120.773	438407.437	
SOIL WATER AT END OF YEAR	119.323	433142.469	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.028	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0090	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0814	295.663	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6797.554	4.06
SOIL WATER AT START OF YEAR	119.323	433142.469	
SOIL WATER AT END OF YEAR	121.196	439940.031	
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	0.046	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0051	0.0045	0.0048	0.0008	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0152	55.279	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-766.645	-0.55
SOIL WATER AT START OF YEAR	121.196	439940.031	
SOIL WATER AT END OF YEAR	120.984	439173.406	
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	-0.005	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	120.984	439173.406	
SOIL WATER AT END OF YEAR	121.381	440611.312	
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	-0.030	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	121.381	440611.312	
SOIL WATER AT END OF YEAR	121.466	440921.531	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
FROM LAYER 3	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.003	0.001	0.002	0.005
TOP OF LAYER 4	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY	0.002	0.001	0.003	0.001	0.002	0.004
HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	121.466	440921.531	
SOIL WATER AT END OF YEAR	120.272	436586.531	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	120.272	436586.531	
SOIL WATER AT END OF YEAR	121.436	440811.906	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

HELP MODEL PRINTOUTS

CLOSED – THIRTEEN (13) LIFTS

Floor slope 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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF13S3.OUT


TIME:  10:59     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @13 LIFTS (TOP=33%), S=3%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```



```
                                 LAYER  2
                                 --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     18.00   INCHES
           POROSITY                   =      0.4190 VOL/VOL
           FIELD CAPACITY             =      0.3070 VOL/VOL
           WILTING POINT              =      0.1800 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                                 LAYER  3
                                 --------

                      TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.25   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
           SLOPE                      =     33.00   PERCENT
           DRAINAGE LENGTH            =     95.0    FEET


                                 LAYER  4
                                 --------

                      TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
           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.  =  0.399999993000E-12 CM/SEC
           FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
           FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
           FML PLACEMENT QUALITY      =  4 - POOR


                                 LAYER  5
                                 --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
```

```
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2126 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  6
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    624.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0761 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2885 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    528.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0756 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  9
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
```


```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2836 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0734 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2489 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2252 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0588 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000 CM/SEC
SLOPE	=	3.00 PERCENT
DRAINAGE LENGTH	=	250.0 FEET

LAYER 14

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	=	0.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00
FRACTION OF AREA ALLOWING RUNOFF	=	100.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000 ACRES
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816 INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263 INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350 INCHES
INITIAL SNOW WATER	=	0.000 INCHES
INITIAL WATER IN LAYER MATERIALS	=	130.034 INCHES
TOTAL INITIAL WATER	=	130.034 INCHES
TOTAL SUBSURFACE INFLOW	=	0.00 INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	1.7233	3.8942	1.2394	0.6842	0.5015	0.3765
FROM LAYER 13	0.3281	0.3222	0.2692	0.2066	0.2189	0.1781
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.019	0.046	0.013	0.008	0.005	0.004
TOP OF LAYER 14	0.004	0.003	0.003	0.002	0.002	0.002
STD. DEVIATION OF DAILY	0.021	0.024	0.003	0.001	0.001	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.9421	36089.762	22.59
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0093		
CHANGE IN WATER STORAGE	-9.940	-36081.684	-22.59
SOIL WATER AT START OF YEAR	132.594	481316.594	
SOIL WATER AT END OF YEAR	122.654	445234.906	
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	0.026	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1253	0.0864	0.0768	0.0614	0.0539	0.0452
FROM LAYER 13	0.0411	0.0366	0.0320	0.0300	0.0266	0.0254
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.001	0.001	0.001	0.001	0.001
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6407	2325.603	1.52
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0006		
CHANGE IN WATER STORAGE	-0.196	-711.332	-0.46
SOIL WATER AT START OF YEAR	122.654	445234.906	
SOIL WATER AT END OF YEAR	121.791	442102.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	0.003	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED FROM LAYER 3	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0235	0.0198	0.0206	0.0187	0.0182	0.0166
	0.0163	0.0155	0.0142	0.0140	0.0130	0.0128
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.012	0.002	0.008	0.001	0.001	0.005
	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.009	0.001	0.007	0.000	0.001	0.004
	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2033	737.991	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0002		
CHANGE IN WATER STORAGE	-1.287	-4672.871	-2.51
SOIL WATER AT START OF YEAR	121.791	442102.250	
SOIL WATER AT END OF YEAR	120.773	438407.219	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.001	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
	0.0136	0.0130	0.0116	0.0111	0.0100	0.0096
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1347	488.781	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6708.356	-4.88

SOIL WATER AT START OF YEAR	120.773	438407.219	
SOIL WATER AT END OF YEAR	119.323	433142.344	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.058	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0090	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0814	295.596	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6797.609	4.06
SOIL WATER AT START OF YEAR	119.323	433142.344	
SOIL WATER AT END OF YEAR	121.196	439939.969	
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	0.058	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0051	0.0045	0.0048	0.0008	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0152	55.193	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-766.562	-0.55
SOIL WATER AT START OF YEAR	121.196	439939.969	
SOIL WATER AT END OF YEAR	120.984	439173.406	
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

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	120.984	439173.406	
SOIL WATER AT END OF YEAR	121.381	440611.312	
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	-0.030	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	121.381	440611.312	
SOIL WATER AT END OF YEAR	121.466	440921.531	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	121.466	440921.531	
SOIL WATER AT END OF YEAR	120.272	436586.531	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	120.272	436586.531	
SOIL WATER AT END OF YEAR	121.436	440811.906	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

HELP MODEL PRINTOUTS

CLOSED – THIRTEEN (13) LIFTS

Floor slope 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:\DATA4.D4
TEMPERATURE DATA FILE:       C:\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\DATA10.D10
OUTPUT DATA FILE:            C:\CF13S4.OUT


TIME:  11:13     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @13 LIFTS (TOP=33%), S=4%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```

```
                        LAYER  2
                        --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   0
    THICKNESS                  =     18.00   INCHES
    POROSITY                   =      0.4190 VOL/VOL
    FIELD CAPACITY             =      0.3070 VOL/VOL
    WILTING POINT              =      0.1800 VOL/VOL
    INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
    EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                        LAYER  3
                        --------

               TYPE 2 - LATERAL DRAINAGE LAYER
                 MATERIAL TEXTURE NUMBER   0
    THICKNESS                  =      0.25   INCHES
    POROSITY                   =      0.8500 VOL/VOL
    FIELD CAPACITY             =      0.0100 VOL/VOL
    WILTING POINT              =      0.0050 VOL/VOL
    INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
    EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
    SLOPE                      =     33.00   PERCENT
    DRAINAGE LENGTH            =     95.0    FEET


                        LAYER  4
                        --------

               TYPE 4 - FLEXIBLE MEMBRANE LINER
                 MATERIAL TEXTURE NUMBER  36
    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.  =  0.399999993000E-12 CM/SEC
    FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
    FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
    FML PLACEMENT QUALITY      =  4 - POOR


                        LAYER  5
                        --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   6
    THICKNESS                  =     12.00   INCHES
    POROSITY                   =      0.4530 VOL/VOL
```



```
    FIELD CAPACITY             =      0.1900 VOL/VOL
    WILTING POINT              =      0.0850 VOL/VOL
    INITIAL SOIL WATER CONTENT =      0.2177 VOL/VOL
    EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                        LAYER  6
                        --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER  19
    THICKNESS                  =    624.00   INCHES
    POROSITY                   =      0.1680 VOL/VOL
    FIELD CAPACITY             =      0.0730 VOL/VOL
    WILTING POINT              =      0.0190 VOL/VOL
    INITIAL SOIL WATER CONTENT =      0.0758 VOL/VOL
    EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                        LAYER  7
                        --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   6
    THICKNESS                  =     12.00   INCHES
    POROSITY                   =      0.4530 VOL/VOL
    FIELD CAPACITY             =      0.1900 VOL/VOL
    WILTING POINT              =      0.0850 VOL/VOL
    INITIAL SOIL WATER CONTENT =      0.2862 VOL/VOL
    EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                        LAYER  8
                        --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER  19
    THICKNESS                  =    528.00   INCHES
    POROSITY                   =      0.1680 VOL/VOL
    FIELD CAPACITY             =      0.0730 VOL/VOL
    WILTING POINT              =      0.0190 VOL/VOL
    INITIAL SOIL WATER CONTENT =      0.0762 VOL/VOL
    EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                        LAYER  9
                        --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   6
```

```
THICKNESS                 =     12.00   INCHES
POROSITY                  =      0.4530 VOL/VOL
FIELD CAPACITY            =      0.1900 VOL/VOL
WILTING POINT             =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.2841 VOL/VOL
EFFECTIVE SAT. HYD. COND.  = 0.720000011000E-03 CM/SEC
```

LAYER 10

```
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                 =     96.00   INCHES
POROSITY                  =      0.1680 VOL/VOL
FIELD CAPACITY            =      0.0730 VOL/VOL
WILTING POINT             =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.0731 VOL/VOL
EFFECTIVE SAT. HYD. COND.  = 0.100000005000E-02 CM/SEC
```

LAYER 11

```
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                 =     48.00   INCHES
POROSITY                  =      0.4530 VOL/VOL
FIELD CAPACITY            =      0.1900 VOL/VOL
WILTING POINT             =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.2454 VOL/VOL
EFFECTIVE SAT. HYD. COND.  = 0.720000011000E-03 CM/SEC
```

LAYER 12

```
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                 =     24.00   INCHES
POROSITY                  =      0.4570 VOL/VOL
FIELD CAPACITY            =      0.1310 VOL/VOL
WILTING POINT             =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.2263 VOL/VOL
EFFECTIVE SAT. HYD. COND.  = 0.100000005000E-02 CM/SEC
```

LAYER 13

```
            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                 =      0.15   INCHES
POROSITY                  =      0.8500 VOL/VOL
FIELD CAPACITY            =      0.0100 VOL/VOL
WILTING POINT             =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.0343 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  4.42000008000     CM/SEC
SLOPE                     =      4.00   PERCENT
DRAINAGE LENGTH           =    250.0    FEET
```

LAYER 14

```
            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       =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS  =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY     =  1 - PERFECT
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

```
SCS RUNOFF CURVE NUMBER              =     69.00
FRACTION OF AREA ALLOWING RUNOFF     =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE   =      1.000  ACRES
EVAPORATIVE ZONE DEPTH               =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE    =      2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE   =      4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE   =      1.350  INCHES
INITIAL SNOW WATER                   =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS     =    130.029  INCHES
TOTAL INITIAL WATER                  =    130.029  INCHES
TOTAL SUBSURFACE INFLOW              =      0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

```
        STATION LATITUDE                          =  39.18 DEGREES
        MAXIMUM LEAF AREA INDEX                   =   0.00
        START OF GROWING SEASON (JULIAN DATE)     =    102
        END OF GROWING SEASON (JULIAN DATE)       =    300
        EVAPORATIVE ZONE DEPTH                    =   9.0  INCHES
        AVERAGE ANNUAL WIND SPEED                 =   9.30 MPH
        AVERAGE 1ST QUARTER RELATIVE HUMIDITY     =  62.00 %
        AVERAGE 2ND QUARTER RELATIVE HUMIDITY     =  65.00 %
        AVERAGE 3RD QUARTER RELATIVE HUMIDITY     =  71.00 %
        AVERAGE 4TH QUARTER RELATIVE HUMIDITY     =  68.00 %


    NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
              COEFFICIENTS FOR    BALTIMORE           MARYLAND

              NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

  JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
  -------     -------     -------     -------     -------     -------
    3.47        3.02        3.93        3.00        3.89        3.43
    3.85        3.74        3.98        3.16        3.12        3.35


    NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
              COEFFICIENTS FOR    BALTIMORE           MARYLAND

        NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

  JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
  -------     -------     -------     -------     -------     -------
   32.40       35.50       43.70       53.20       62.80       71.70
   76.50       74.50       67.40       55.30       45.50       36.60


    NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
              COEFFICIENTS FOR    BALTIMORE           MARYLAND
                AND STATION LATITUDE  =  39.18 DEGREES


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

                  MONTHLY TOTALS (IN INCHES) FOR YEAR    1
-------------------------------------------------------------------------------

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

PRECIPITATION                     2.00    1.42    3.53    1.61    2.69    4.35
                                  2.02    3.97    7.14    4.15    3.78    7.35
```



```
RUNOFF                           0.000   0.000   0.000   0.000   0.000   0.000
                                 0.000   0.000   4.173   0.000   0.000   0.573

EVAPOTRANSPIRATION               1.833   2.097   2.964   2.218   1.993   4.944
                                 1.724   3.594   1.231   3.100   2.343   1.288

LATERAL DRAINAGE COLLECTED       1.3421  0.3250  0.1830  0.1138  0.0001  0.0033
  FROM LAYER  3                  0.0034  0.4224  0.2873  2.1071  0.3056  4.8415

PERCOLATION/LEAKAGE THROUGH      0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
  LAYER  4                       0.0000  0.0000  0.0000  0.0000  0.0000  0.0000

LATERAL DRAINAGE COLLECTED       1.7671  3.8415  1.2254  0.6748  0.4988  0.3750
  FROM LAYER 13                  0.3294  0.3217  0.2765  0.2115  0.2150  0.1852

PERCOLATION/LEAKAGE THROUGH      0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
  LAYER 14                       0.0000  0.0000  0.0000  0.0000  0.0000  0.0000

-------------------------------------------------------------------------------
                   MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)
-------------------------------------------------------------------------------


AVERAGE DAILY HEAD ON            0.003   0.001   0.000   0.000   0.000   0.000
  TOP OF LAYER  4                0.000   0.001   0.001   0.005   0.001   0.012

STD. DEVIATION OF DAILY          0.004   0.000   0.000   0.000   0.000   0.000
  HEAD ON TOP OF LAYER  4        0.000   0.001   0.000   0.005   0.000   0.010

AVERAGE DAILY HEAD ON            0.014   0.034   0.010   0.006   0.004   0.003
  TOP OF LAYER 14                0.003   0.003   0.002   0.002   0.002   0.001

STD. DEVIATION OF DAILY          0.016   0.018   0.002   0.001   0.000   0.000
  HEAD ON TOP OF LAYER 14        0.000   0.000   0.000   0.000   0.000   0.000

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


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

                          ANNUAL TOTALS FOR YEAR    1
-------------------------------------------------------------------------------
                                          INCHES         CU. FEET     PERCENT
                                        ---------       ----------    -------
  PRECIPITATION                           44.01         159756.297    100.00

  RUNOFF                                   4.746         17226.219     10.78

  EVAPOTRANSPIRATION                      29.328        106459.836     66.64

  DRAINAGE COLLECTED FROM LAYER  3         9.9345        36062.125     22.57

  PERC./LEAKAGE THROUGH LAYER  4           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  4             0.0020
```

DRAINAGE COLLECTED FROM LAYER 13	9.9218	36015.992	22.54
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0070		
CHANGE IN WATER STORAGE	-9.920	-36007.934	-22.54
SOIL WATER AT START OF YEAR	132.647	481507.750	
SOIL WATER AT END OF YEAR	122.727	445499.812	
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	0.046	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1295	0.0887	0.0785	0.0625	0.0547	0.0458
FROM LAYER 13	0.0416	0.0370	0.0323	0.0303	0.0269	0.0256
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.001	0.001	0.001	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6536	2372.502	1.55
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0004		
CHANGE IN WATER STORAGE	-0.209	-758.247	-0.50
SOIL WATER AT START OF YEAR	122.727	445499.812	
SOIL WATER AT END OF YEAR	121.851	442320.219	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	0.018	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0237	0.0200	0.0207	0.0188	0.0183	0.0167
FROM LAYER 13	0.0164	0.0155	0.0143	0.0141	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2045	742.453	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.289	-4677.275	-2.51
SOIL WATER AT START OF YEAR	121.851	442320.219	
SOIL WATER AT END OF YEAR	120.832	438620.812	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.057	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0114	0.0107	0.0106	0.0099
FROM LAYER 13	0.0133	0.0131	0.0116	0.0112	0.0100	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1350	489.996	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.658	-4.88

SOIL WATER AT START OF YEAR	120.832	438620.812	
SOIL WATER AT END OF YEAR	119.381	433354.625	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.028	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0819	297.138	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.872	6796.086	4.06
SOIL WATER AT START OF YEAR	119.381	433354.625	
SOIL WATER AT END OF YEAR	121.254	440150.719	
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	0.040	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0052	0.0045	0.0048	0.0013	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.002	0.003	0.001	0.003	0.001
	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.001	0.002	0.002	0.000	0.003	0.001
	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0157	57.162	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-768.500	-0.55
SOIL WATER AT START OF YEAR	121.254	440150.719	
SOIL WATER AT END OF YEAR	121.042	439382.219	
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	-0.032	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	121.042	439382.219	
SOIL WATER AT END OF YEAR	121.438	440820.125	
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	-0.030	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	121.438	440820.125	
SOIL WATER AT END OF YEAR	121.524	441130.344	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	121.524	441130.344	
SOIL WATER AT END OF YEAR	120.329	436795.344	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	120.329	436795.344	
SOIL WATER AT END OF YEAR	121.493	441020.750	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

HELP MODEL PRINTOUTS

CLOSED – THIRTEEN (13) LIFTS

Floor slope 5%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF13S5.OUT


TIME:  11:26     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @13 LIFTS (TOP=33%), S=5%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```



```
                                  LAYER  2
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     18.00   INCHES
           POROSITY                   =      0.4190 VOL/VOL
           FIELD CAPACITY             =      0.3070 VOL/VOL
           WILTING POINT              =      0.1800 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                                  LAYER  3
                                  --------

                      TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.25   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
           SLOPE                      =     33.00   PERCENT
           DRAINAGE LENGTH            =     95.0    FEET


                                  LAYER  4
                                  --------

                      TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
           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.  =  0.399999993000E-12 CM/SEC
           FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
           FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
           FML PLACEMENT QUALITY      =  4 - POOR


                                  LAYER  5
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
```

```
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2177 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  6
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    624.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0758 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2862 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    528.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0762 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  9
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2841 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0731 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2454 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2263 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0304	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	5.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

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	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	130.029	INCHES
TOTAL INITIAL WATER	=	130.029	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	1.7789	3.8314	1.2241	0.6745	0.4986	0.3749
	0.3293	0.3216	0.2764	0.2114	0.2150	0.1851
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.000	0.000
	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.000	0.000	0.000	0.000
	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.011	0.027	0.008	0.004	0.003	0.002
	0.002	0.002	0.002	0.001	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.013	0.014	0.002	0.001	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

	INCHES	CU. FEET	PERCENT
DRAINAGE COLLECTED FROM LAYER 13	9.9214	36014.629	22.54
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0056		
CHANGE IN WATER STORAGE	-9.919	-36006.574	-22.54
SOIL WATER AT START OF YEAR	132.646	481503.531	
SOIL WATER AT END OF YEAR	122.726	445496.937	
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	0.050	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1295	0.0887	0.0785	0.0625	0.0547	0.0458
	0.0416	0.0370	0.0323	0.0303	0.0269	0.0256
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.001	0.001	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6534	2371.877	1.55
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0004		
CHANGE IN WATER STORAGE	-0.209	-757.610	-0.50
SOIL WATER AT START OF YEAR	122.726	445496.937	
SOIL WATER AT END OF YEAR	121.851	442318.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	0.007	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED FROM LAYER 3	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0237	0.0200	0.0207	0.0188	0.0183	0.0167
	0.0164	0.0155	0.0143	0.0141	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.012	0.002	0.008	0.001	0.001	0.005
	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.009	0.001	0.007	0.000	0.001	0.004
	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2045	742.394	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.288	-4677.219	-2.51
SOIL WATER AT START OF YEAR	121.851	442318.000	
SOIL WATER AT END OF YEAR	120.832	438618.625	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.054	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0114	0.0107	0.0106	0.0099
FROM LAYER 13	0.0133	0.0131	0.0116	0.0112	0.0100	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1350	489.980	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.658	-4.88

SOIL WATER AT START OF YEAR	120.832	438618.625	
SOIL WATER AT END OF YEAR	119.381	433352.469	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.044	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0819	297.117	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6796.114	4.06
SOIL WATER AT START OF YEAR	119.381	433352.469	
SOIL WATER AT END OF YEAR	121.253	440148.562	
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	0.032	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0013	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0157	57.136	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-768.473	-0.55
SOIL WATER AT START OF YEAR	121.253	440148.562	
SOIL WATER AT END OF YEAR	121.041	439380.094	
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	-0.034	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	121.041	439380.094	
SOIL WATER AT END OF YEAR	121.437	440818.000	
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	-0.030	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	121.437	440818.000	
SOIL WATER AT END OF YEAR	121.523	441128.250	
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	-0.014	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	121.523	441128.250	
SOIL WATER AT END OF YEAR	120.329	436793.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.005	0.004	0.001	0.001	0.001
	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.004	0.003	0.000	0.000	0.000
	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	120.329	436793.250	
SOIL WATER AT END OF YEAR	121.493	441018.625	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

HELP MODEL PRINTOUTS

CLOSED – THIRTEEN (13) LIFTS

Floor slope 6%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:       C:\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\DATA10.D10
OUTPUT DATA FILE:            C:\CF13S6.OUT


TIME:  11:40     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @13 LIFTS (TOP=33%), S=6%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```

```
                    LAYER  2
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   0
THICKNESS                  =     18.00   INCHES
POROSITY                   =      0.4190 VOL/VOL
FIELD CAPACITY             =      0.3070 VOL/VOL
WILTING POINT              =      0.1800 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                    LAYER  3
                    --------

            TYPE 2 - LATERAL DRAINAGE LAYER
             MATERIAL TEXTURE NUMBER   0
THICKNESS                  =      0.25   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
SLOPE                      =     33.00   PERCENT
DRAINAGE LENGTH            =     95.0    FEET


                    LAYER  4
                    --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
             MATERIAL TEXTURE NUMBER  36
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.  =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY      =  4 - POOR


                    LAYER  5
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
```


```
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2187 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                    LAYER  6
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    624.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0764 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                    LAYER  7
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2833 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                    LAYER  8
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    528.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0754 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                    LAYER  9
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
```

```
THICKNESS                    =     12.00   INCHES
POROSITY                     =      0.4530 VOL/VOL
FIELD CAPACITY               =      0.1900 VOL/VOL
WILTING POINT                =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.2834 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                    =     96.00   INCHES
POROSITY                     =      0.1680 VOL/VOL
FIELD CAPACITY               =      0.0730 VOL/VOL
WILTING POINT                =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0730 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                    =     48.00   INCHES
POROSITY                     =      0.4530 VOL/VOL
FIELD CAPACITY               =      0.1900 VOL/VOL
WILTING POINT                =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.2468 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                    =     24.00   INCHES
POROSITY                     =      0.4570 VOL/VOL
FIELD CAPACITY               =      0.1310 VOL/VOL
WILTING POINT                =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.2266 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```



```
          TYPE 2 - LATERAL DRAINAGE LAYER
            MATERIAL TEXTURE NUMBER   0
THICKNESS                    =      0.15   INCHES
POROSITY                     =      0.8500 VOL/VOL
FIELD CAPACITY               =      0.0100 VOL/VOL
WILTING POINT                =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0121 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   4.42000008000     CM/SEC
SLOPE                        =      6.00   PERCENT
DRAINAGE LENGTH              =    250.0    FEET


                        LAYER 14
                        --------

          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          =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS     =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY        =  1 - PERFECT


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     69.00
FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      1.350  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    130.012  INCHES
TOTAL INITIAL WATER                =    130.012  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


          EVAPOTRANSPIRATION AND WEATHER DATA
          -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
          BALTIMORE             MARYLAND
```

STATION LATITUDE = 39.18 DEGREES
MAXIMUM LEAF AREA INDEX = 0.00
START OF GROWING SEASON (JULIAN DATE) = 102
END OF GROWING SEASON (JULIAN DATE) = 300
EVAPORATIVE ZONE DEPTH = 9.0 INCHES
AVERAGE ANNUAL WIND SPEED = 9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BALTIMORE MARYLAND AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	1.5045	4.0152	1.2646	0.6864	0.5050	0.3786
FROM LAYER 13	0.3313	0.3222	0.2780	0.2123	0.2150	0.1870
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.008	0.024	0.007	0.004	0.003	0.002
TOP OF LAYER 14	0.002	0.002	0.002	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.012	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.9001	35937.242	22.50
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0047		
CHANGE IN WATER STORAGE	-9.898	-35929.195	-22.49
SOIL WATER AT START OF YEAR	132.638	481474.844	
SOIL WATER AT END OF YEAR	122.740	445545.625	
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	0.060	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1306	0.0893	0.0789	0.0628	0.0550	0.0460
FROM LAYER 13	0.0418	0.0372	0.0324	0.0304	0.0269	0.0256
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6569	2384.573	1.56
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-0.212	-770.239	-0.50
SOIL WATER AT START OF YEAR	122.740	445545.625	
SOIL WATER AT END OF YEAR	121.861	442354.062	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.060	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0237	0.0200	0.0208	0.0188	0.0183	0.0168
FROM LAYER 13	0.0164	0.0156	0.0143	0.0141	0.0131	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2048	743.579	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.289	-4678.466	-2.51
SOIL WATER AT START OF YEAR	121.861	442354.062	
SOIL WATER AT END OF YEAR	120.841	438653.437	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.007	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0114	0.0107	0.0106	0.0099
FROM LAYER 13	0.0132	0.0131	0.0117	0.0112	0.0101	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1351	490.300	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.935	-4.88

SOIL WATER AT START OF YEAR	120.841	438653.437	
SOIL WATER AT END OF YEAR	119.390	433387.000	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.001	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0081	0.0075	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0820	297.527	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6795.698	4.06
SOIL WATER AT START OF YEAR	119.390	433387.000	
SOIL WATER AT END OF YEAR	121.262	440182.687	
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	0.039	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0052	0.0045	0.0048	0.0014	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.002	0.003	0.001	0.003	0.001
	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.001	0.002	0.002	0.000	0.003	0.001
	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0159	57.657	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-768.999	-0.55
SOIL WATER AT START OF YEAR	121.262	440182.687	
SOIL WATER AT END OF YEAR	121.051	439413.687	
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	-0.028	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	121.051	439413.687	
SOIL WATER AT END OF YEAR	121.447	440851.594	
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

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	121.447	440851.594	
SOIL WATER AT END OF YEAR	121.532	441161.812	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
FROM LAYER 3	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.003	0.001	0.002	0.005
TOP OF LAYER 4	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY	0.002	0.001	0.003	0.001	0.002	0.004
HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.659	0.17
SOIL WATER AT START OF YEAR	121.532	441161.812	
SOIL WATER AT END OF YEAR	120.338	436826.844	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.120	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001 0.000	0.005 0.006	0.004 0.002	0.001 0.000	0.001 0.000	0.001 0.005
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000 0.000	0.004 0.008	0.003 0.001	0.000 0.000	0.000 0.000	0.000 0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	120.338	436826.844	
SOIL WATER AT END OF YEAR	121.502	441052.219	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF13S33.OUT


TIME:  11:54     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @13 LIFTS (TOP=33%), S=33%

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


     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   9
           THICKNESS                  =     6.00    INCHES
           POROSITY                   =     0.5010 VOL/VOL
           FIELD CAPACITY             =     0.2840 VOL/VOL
           WILTING POINT              =     0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =     0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```



```
                                   LAYER  2
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =    18.00    INCHES
           POROSITY                   =     0.4190 VOL/VOL
           FIELD CAPACITY             =     0.3070 VOL/VOL
           WILTING POINT              =     0.1800 VOL/VOL
           INITIAL SOIL WATER CONTENT =     0.3967 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                                   LAYER  3
                                   --------

                       TYPE 2 - LATERAL DRAINAGE LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     0.25    INCHES
           POROSITY                   =     0.8500 VOL/VOL
           FIELD CAPACITY             =     0.0100 VOL/VOL
           WILTING POINT              =     0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =     0.1630 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
           SLOPE                      =    33.00    PERCENT
           DRAINAGE LENGTH            =    95.0     FEET


                                   LAYER  4
                                   --------

                       TYPE 4 - FLEXIBLE MEMBRANE LINER
                         MATERIAL TEXTURE NUMBER  36
           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.  =  0.399999993000E-12 CM/SEC
           FML PINHOLE DENSITY        =     0.00    HOLES/ACRE
           FML INSTALLATION DEFECTS   =     0.00    HOLES/ACRE
           FML PLACEMENT QUALITY      =  4 - POOR


                                   LAYER  5
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =    12.00    INCHES
           POROSITY                   =     0.4530 VOL/VOL
```

```
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2218 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  6
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    624.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0765 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2785 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    528.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0753 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  9
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2712 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0730 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2463 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2271 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```

```
            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                  =     0.15   INCHES
POROSITY                   =     0.8500 VOL/VOL
FIELD CAPACITY             =     0.0100 VOL/VOL
WILTING POINT              =     0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =     0.0112 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  4.42000008000     CM/SEC
SLOPE                      =    33.00   PERCENT
DRAINAGE LENGTH            =   250.0    FEET


                        LAYER 14
                        --------

            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        =     0.00   HOLES/ACRE
FML INSTALLATION DEFECTS   =     0.00   HOLES/ACRE
FML PLACEMENT QUALITY      = 1 - PERFECT


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

  NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =    69.00
FRACTION OF AREA ALLOWING RUNOFF   =   100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =     1.000  ACRES
EVAPORATIVE ZONE DEPTH             =     9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =     2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =     4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =     1.350  INCHES
INITIAL SNOW WATER                 =     0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =   129.842  INCHES
TOTAL INITIAL WATER                =   129.842  INCHES
TOTAL SUBSURFACE INFLOW            =     0.00   INCHES/YEAR


           EVAPOTRANSPIRATION AND WEATHER DATA
           -----------------------------------

  NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
           BALTIMORE            MARYLAND
```



```
STATION LATITUDE                        =  39.18 DEGREES
MAXIMUM LEAF AREA INDEX                 =   0.00
START OF GROWING SEASON (JULIAN DATE)   =    102
END OF GROWING SEASON (JULIAN DATE)     =    300
EVAPORATIVE ZONE DEPTH                  =   9.0  INCHES
AVERAGE ANNUAL WIND SPEED               =   9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY   =  62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY   =  65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY   =  71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY   =  68.00 %


    NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
                COEFFICIENTS FOR    BALTIMORE          MARYLAND

                NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

  JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
  -------     -------     -------     -------     -------     -------
    3.47        3.02        3.93        3.00        3.89        3.43
    3.85        3.74        3.98        3.16        3.12        3.35


    NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
                COEFFICIENTS FOR    BALTIMORE          MARYLAND

             NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

  JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
  -------     -------     -------     -------     -------     -------
   32.40       35.50       43.70       53.20       62.80       71.70
   76.50       74.50       67.40       55.30       45.50       36.60


    NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
                COEFFICIENTS FOR    BALTIMORE          MARYLAND
                  AND STATION LATITUDE  =  39.18 DEGREES


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

                  MONTHLY TOTALS (IN INCHES) FOR YEAR    1
-------------------------------------------------------------------------------

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

PRECIPITATION                   2.00    1.42    3.53    1.61    2.69    4.35
                                2.02    3.97    7.14    4.15    3.78    7.35
```

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	1.3085	4.0198	1.2687	0.6869	0.5061	0.3813
	0.3302	0.3215	0.2796	0.2150	0.2147	0.1906
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.000	0.000
	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.000	0.000	0.000	0.000
	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.006	0.022	0.006	0.003	0.002	0.002
	0.002	0.002	0.001	0.001	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.007	0.011	0.001	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		
DRAINAGE COLLECTED FROM LAYER 13	9.7229	35294.078	22.09
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0041		
CHANGE IN WATER STORAGE	-9.721	-35286.016	-22.09
SOIL WATER AT START OF YEAR	132.505	480994.656	
SOIL WATER AT END OF YEAR	122.785	445708.656	
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	0.051	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1328	0.0905	0.0798	0.0634	0.0554	0.0463
	0.0420	0.0374	0.0325	0.0305	0.0271	0.0258
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6635	2408.522	1.57
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-0.219	-794.195	-0.52
SOIL WATER AT START OF YEAR	122.785	445708.656	
SOIL WATER AT END OF YEAR	121.899	442493.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.046	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED FROM LAYER 3	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0238	0.0201	0.0208	0.0189	0.0184	0.0168
	0.0164	0.0156	0.0144	0.0142	0.0131	0.0129
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.012	0.002	0.008	0.001	0.001	0.005
	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.009	0.001	0.007	0.000	0.001	0.004
	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2055	745.795	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.289	-4680.681	-2.51
SOIL WATER AT START OF YEAR	121.899	442493.125	
SOIL WATER AT END OF YEAR	120.879	438790.281	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.015	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0115	0.0107	0.0106	0.0099
FROM LAYER 13	0.0130	0.0132	0.0117	0.0112	0.0101	0.0098
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1352	490.901	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.849	-6710.489	-4.88

SOIL WATER AT START OF YEAR	120.879	438790.281	
SOIL WATER AT END OF YEAR	119.428	433523.281	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.038	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0082	0.0075	0.0073	0.0068
FROM LAYER 13	0.0067	0.0064	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0822	298.296	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6794.923	4.06
SOIL WATER AT START OF YEAR	119.428	433523.281	
SOIL WATER AT END OF YEAR	121.300	440318.219	
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	0.053	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0016	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0162	58.626	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-769.968	-0.55
SOIL WATER AT START OF YEAR	121.300	440318.219	
SOIL WATER AT END OF YEAR	121.088	439548.250	
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	-0.026	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	121.088	439548.250	
SOIL WATER AT END OF YEAR	121.484	440986.125	
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

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	121.484	440986.125	
SOIL WATER AT END OF YEAR	121.569	441296.344	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	121.569	441296.344	
SOIL WATER AT END OF YEAR	120.375	436961.375	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.219	-0.29
SOIL WATER AT START OF YEAR	120.375	436961.375	
SOIL WATER AT END OF YEAR	121.539	441186.781	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.013	0.00

****

a Montrose Environmental Group company

HELP MODEL PRINTOUTS

CLOSED – SEVENTEEN (17) LIFTS

Floor slope 2%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:       C:\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\DATA10.D10
OUTPUT DATA FILE:            C:\CF17S2.OUT


TIME:  12: 9     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @17 LIFTS (TOP=33%), S=2%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.190000006000E-03 CM/SEC
```

```
                     LAYER  2
                     --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER   0
     THICKNESS                   =     18.00   INCHES
     POROSITY                    =      0.4190 VOL/VOL
     FIELD CAPACITY              =      0.3070 VOL/VOL
     WILTING POINT               =      0.1800 VOL/VOL
     INITIAL SOIL WATER CONTENT  =      0.3967 VOL/VOL
     EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-05 CM/SEC


                     LAYER  3
                     --------

               TYPE 2 - LATERAL DRAINAGE LAYER
                MATERIAL TEXTURE NUMBER   0
     THICKNESS                   =      0.25   INCHES
     POROSITY                    =      0.8500 VOL/VOL
     FIELD CAPACITY              =      0.0100 VOL/VOL
     WILTING POINT               =      0.0050 VOL/VOL
     INITIAL SOIL WATER CONTENT  =      0.1630 VOL/VOL
     EFFECTIVE SAT. HYD. COND.   =   12.8000002000     CM/SEC
     SLOPE                       =     33.00   PERCENT
     DRAINAGE LENGTH             =     95.0    FEET


                     LAYER  4
                     --------

               TYPE 4 - FLEXIBLE MEMBRANE LINER
                MATERIAL TEXTURE NUMBER  36
     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.   =  0.399999993000E-12 CM/SEC
     FML PINHOLE DENSITY         =      0.00   HOLES/ACRE
     FML INSTALLATION DEFECTS    =      0.00   HOLES/ACRE
     FML PLACEMENT QUALITY       =  4 - POOR


                     LAYER  5
                     --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER   6
     THICKNESS                   =     12.00   INCHES
     POROSITY                    =      0.4530 VOL/VOL
```



```
     FIELD CAPACITY              =      0.1900 VOL/VOL
     WILTING POINT               =      0.0850 VOL/VOL
     INITIAL SOIL WATER CONTENT  =      0.2126 VOL/VOL
     EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                     LAYER  6
                     --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER  19
     THICKNESS                   =    816.00   INCHES
     POROSITY                    =      0.1680 VOL/VOL
     FIELD CAPACITY              =      0.0730 VOL/VOL
     WILTING POINT               =      0.0190 VOL/VOL
     INITIAL SOIL WATER CONTENT  =      0.0756 VOL/VOL
     EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                     LAYER  7
                     --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER   6
     THICKNESS                   =     12.00   INCHES
     POROSITY                    =      0.4530 VOL/VOL
     FIELD CAPACITY              =      0.1900 VOL/VOL
     WILTING POINT               =      0.0850 VOL/VOL
     INITIAL SOIL WATER CONTENT  =      0.2864 VOL/VOL
     EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                     LAYER  8
                     --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER  19
     THICKNESS                   =    720.00   INCHES
     POROSITY                    =      0.1680 VOL/VOL
     FIELD CAPACITY              =      0.0730 VOL/VOL
     WILTING POINT               =      0.0190 VOL/VOL
     INITIAL SOIL WATER CONTENT  =      0.0747 VOL/VOL
     EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                     LAYER  9
                     --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER   6
```

```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2802 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0732 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2487 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2260 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```



```
            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.15   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0645 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   4.42000008000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET


                        LAYER 14
                        --------

            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         =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  1 - PERFECT


           GENERAL DESIGN AND EVAPORATIVE ZONE DATA
           ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     69.00
FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      1.350  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    158.030  INCHES
TOTAL INITIAL WATER                =    158.030  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


            EVAPOTRANSPIRATION AND WEATHER DATA
            -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
               BALTIMORE             MARYLAND
```

STATION LATITUDE = 39.18 DEGREES
MAXIMUM LEAF AREA INDEX = 0.00
START OF GROWING SEASON (JULIAN DATE) = 102
END OF GROWING SEASON (JULIAN DATE) = 300
EVAPORATIVE ZONE DEPTH = 9.0 INCHES
AVERAGE ANNUAL WIND SPEED = 9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	1.1652	4.2577	1.3390	0.7138	0.5141	0.3825
FROM LAYER 13	0.3318	0.3236	0.2708	0.2078	0.2177	0.1792
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.019	0.076	0.022	0.012	0.008	0.006
TOP OF LAYER 14	0.005	0.005	0.005	0.003	0.004	0.003
STD. DEVIATION OF DAILY	0.014	0.034	0.005	0.001	0.001	0.001
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.9033	35948.809	22.50
PERC./LEAKAGE THROUGH LAYER 14	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0140		
CHANGE IN WATER STORAGE	-9.901	-35940.746	-22.50
SOIL WATER AT START OF YEAR	160.591	582944.000	
SOIL WATER AT END OF YEAR	150.690	547003.250	
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	0.043	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1260	0.0867	0.0771	0.0616	0.0540	0.0453
FROM LAYER 13	0.0412	0.0367	0.0320	0.0301	0.0267	0.0254
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.002	0.002	0.001	0.001	0.001	0.001
TOP OF LAYER 14	0.001	0.001	0.001	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6427	2333.127	1.52
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0009		
CHANGE IN WATER STORAGE	-0.198	-718.810	-0.47
SOIL WATER AT START OF YEAR	150.690	547003.250	
SOIL WATER AT END OF YEAR	149.825	543863.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.043	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0235	0.0198	0.0206	0.0187	0.0182	0.0167
FROM LAYER 13	0.0163	0.0155	0.0143	0.0141	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2035	738.716	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-1.288	-4673.702	-2.51
SOIL WATER AT START OF YEAR	149.825	543863.125	
SOIL WATER AT END OF YEAR	148.806	540167.250	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.107	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
	0.0136	0.0130	0.0116	0.0111	0.0100	0.0097
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1347	488.979	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0002		
CHANGE IN WATER STORAGE	-1.848	-6708.522	-4.88

SOIL WATER AT START OF YEAR	148.806	540167.250	
SOIL WATER AT END OF YEAR	147.356	534902.250	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.090	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0091	0.0077	0.0081	0.0074	0.0073	0.0067
	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.000	0.000	0.008	0.001	0.003	0.001
	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.000	0.008	0.000	0.003	0.001
	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0815	295.847	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6797.388	4.06
SOIL WATER AT START OF YEAR	147.356	534902.250	
SOIL WATER AT END OF YEAR	149.229	541699.625	
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	0.029	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0051	0.0045	0.0048	0.0009	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.002	0.003	0.001	0.003	0.001
	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.001	0.002	0.002	0.000	0.003	0.001
	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0153	55.514	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-766.866	-0.55
SOIL WATER AT START OF YEAR	149.229	541699.625	
SOIL WATER AT END OF YEAR	149.017	540932.750	
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	-0.018	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	149.017	540932.750	
SOIL WATER AT END OF YEAR	149.413	542370.687	
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	-0.030	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	149.413	542370.687	
SOIL WATER AT END OF YEAR	149.499	542680.875	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	149.499	542680.875	
SOIL WATER AT END OF YEAR	148.305	538345.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.005	0.004	0.001	0.001	0.001
	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.004	0.003	0.000	0.000	0.000
	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	148.305	538345.875	
SOIL WATER AT END OF YEAR	149.469	542571.312	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

HELP MODEL PRINTOUTS

CLOSED – SEVENTEEN (17) LIFTS

Floor slope 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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF17S3.OUT


TIME:  12:24     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @17 LIFTS (TOP=33%), S=3%

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


     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   9
           THICKNESS                   =      6.00   INCHES
           POROSITY                    =      0.5010 VOL/VOL
           FIELD CAPACITY              =      0.2840 VOL/VOL
           WILTING POINT               =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.190000006000E-03 CM/SEC
```



```
                                  LAYER  2
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                   =     18.00   INCHES
           POROSITY                    =      0.4190 VOL/VOL
           FIELD CAPACITY              =      0.3070 VOL/VOL
           WILTING POINT               =      0.1800 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.3967 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-05 CM/SEC


                                  LAYER  3
                                  --------

                      TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                   =      0.25   INCHES
           POROSITY                    =      0.8500 VOL/VOL
           FIELD CAPACITY              =      0.0100 VOL/VOL
           WILTING POINT               =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.1630 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =   12.8000002000     CM/SEC
           SLOPE                       =     33.00   PERCENT
           DRAINAGE LENGTH             =     95.0    FEET


                                  LAYER  4
                                  --------

                      TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
           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.   =  0.399999993000E-12 CM/SEC
           FML PINHOLE DENSITY         =      0.00   HOLES/ACRE
           FML INSTALLATION DEFECTS    =      0.00   HOLES/ACRE
           FML PLACEMENT QUALITY       =  4 - POOR


                                  LAYER  5
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
           THICKNESS                   =     12.00   INCHES
           POROSITY                    =      0.4530 VOL/VOL
```

```
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2126 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  6
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    816.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0756 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2864 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    720.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0747 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  9
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2802 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0732 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2487 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2260 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```

```
            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =      0.15   INCHES
POROSITY                     =      0.8500 VOL/VOL
FIELD CAPACITY               =      0.0100 VOL/VOL
WILTING POINT                =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0502 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   4.42000008000     CM/SEC
SLOPE                        =      3.00   PERCENT
DRAINAGE LENGTH              =    250.0    FEET


                        LAYER 14
                        --------

            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          =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS     =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY        =  1 - PERFECT


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

   NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     69.00
FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      1.350  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    158.028  INCHES
TOTAL INITIAL WATER                =    158.028  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


           EVAPOTRANSPIRATION AND WEATHER DATA
           -----------------------------------

   NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
            BALTIMORE             MARYLAND
```



```
      STATION LATITUDE                         =  39.18 DEGREES
      MAXIMUM LEAF AREA INDEX                  =   0.00
      START OF GROWING SEASON (JULIAN DATE)    =    102
      END OF GROWING SEASON (JULIAN DATE)      =    300
      EVAPORATIVE ZONE DEPTH                   =   9.0  INCHES
      AVERAGE ANNUAL WIND SPEED                =   9.30 MPH
      AVERAGE 1ST QUARTER RELATIVE HUMIDITY    =  62.00 %
      AVERAGE 2ND QUARTER RELATIVE HUMIDITY    =  65.00 %
      AVERAGE 3RD QUARTER RELATIVE HUMIDITY    =  71.00 %
      AVERAGE 4TH QUARTER RELATIVE HUMIDITY    =  68.00 %


   NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
            COEFFICIENTS FOR    BALTIMORE           MARYLAND

            NORMAL MEAN MONTHLY PRECIPITATION (INCHES)
```

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

```
   NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
            COEFFICIENTS FOR    BALTIMORE           MARYLAND

      NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)
```

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

```
   NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
            COEFFICIENTS FOR    BALTIMORE           MARYLAND
              AND STATION LATITUDE  =  39.18 DEGREES


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

                  MONTHLY TOTALS (IN INCHES) FOR YEAR    1
-------------------------------------------------------------------------------
```

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

```
RUNOFF                          0.000   0.000   0.000   0.000   0.000   0.000
                                0.000   0.000   4.173   0.000   0.000   0.573

EVAPOTRANSPIRATION              1.833   2.097   2.964   2.218   1.993   4.944
                                1.724   3.594   1.231   3.100   2.343   1.288

LATERAL DRAINAGE COLLECTED      1.3421  0.3250  0.1830  0.1138  0.0001  0.0033
  FROM LAYER  3                 0.0034  0.4224  0.2873  2.1071  0.3056  4.8415

PERCOLATION/LEAKAGE THROUGH     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
  LAYER  4                      0.0000  0.0000  0.0000  0.0000  0.0000  0.0000

LATERAL DRAINAGE COLLECTED      1.1679  4.2622  1.3338  0.7125  0.5134  0.3821
  FROM LAYER 13                 0.3315  0.3235  0.2705  0.2075  0.2181  0.1789

PERCOLATION/LEAKAGE THROUGH     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
  LAYER 14                      0.0000  0.0000  0.0000  0.0000  0.0000  0.0000

-------------------------------------------------------------------------------
                   MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)
-------------------------------------------------------------------------------

AVERAGE DAILY HEAD ON           0.003   0.001   0.000   0.000   0.000   0.000
  TOP OF LAYER  4               0.000   0.001   0.001   0.005   0.001   0.012

STD. DEVIATION OF DAILY         0.004   0.000   0.000   0.000   0.000   0.000
  HEAD ON TOP OF LAYER  4       0.000   0.001   0.000   0.005   0.000   0.010

AVERAGE DAILY HEAD ON           0.013   0.051   0.014   0.008   0.006   0.004
  TOP OF LAYER 14               0.004   0.003   0.003   0.002   0.002   0.002

STD. DEVIATION OF DAILY         0.010   0.022   0.003   0.001   0.001   0.000
  HEAD ON TOP OF LAYER 14       0.000   0.000   0.000   0.000   0.000   0.000

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


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

                          ANNUAL TOTALS FOR YEAR    1
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                           44.01         159756.297    100.00

  RUNOFF                                   4.746         17226.219     10.78

  EVAPOTRANSPIRATION                      29.328        106459.836     66.64

  DRAINAGE COLLECTED FROM LAYER  3         9.9345        36062.125     22.57

  PERC./LEAKAGE THROUGH LAYER  4           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  4             0.0020
```



```
  DRAINAGE COLLECTED FROM LAYER 13         9.9018        35943.449     22.50

  PERC./LEAKAGE THROUGH LAYER 14           0.000003          0.009      0.00

  AVG. HEAD ON TOP OF LAYER 14             0.0093

  CHANGE IN WATER STORAGE                 -9.900        -35935.371    -22.49

  SOIL WATER AT START OF YEAR            160.586        582928.375

  SOIL WATER AT END OF YEAR              150.687        546993.000

  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            0.029      0.00

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


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

                  MONTHLY TOTALS (IN INCHES) FOR YEAR    2
-------------------------------------------------------------------------------

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

PRECIPITATION                    2.34    3.29    4.39    6.53    6.65    1.73
                                 2.90    0.64    6.81    1.56    1.53    3.78

RUNOFF                           0.000   2.063   3.416   0.000   0.000   0.000
                                 0.000   0.000   2.802   0.000   0.000   0.000

EVAPOTRANSPIRATION               1.206   0.755   2.121   3.251   4.338   2.361
                                 3.743   0.317   1.780   2.269   1.620   0.732

LATERAL DRAINAGE COLLECTED       1.3916  0.2059  1.1493  0.4217  2.6773  1.2558
  FROM LAYER  3                  0.2311  0.0654  0.5398  0.7612  0.1991  0.0323

PERCOLATION/LEAKAGE THROUGH      0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
  LAYER  4                       0.0000  0.0000  0.0000  0.0000  0.0000  0.0000

LATERAL DRAINAGE COLLECTED       0.1258  0.0866  0.0770  0.0615  0.0540  0.0453
  FROM LAYER 13                  0.0412  0.0367  0.0320  0.0301  0.0267  0.0254

PERCOLATION/LEAKAGE THROUGH      0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
  LAYER 14                       0.0000  0.0000  0.0000  0.0000  0.0000  0.0000

-------------------------------------------------------------------------------
                   MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)
-------------------------------------------------------------------------------
```

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.001	0.001	0.001	0.001	0.001
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6422	2331.107	1.52
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0006		
CHANGE IN WATER STORAGE	-0.197	-716.760	-0.47
SOIL WATER AT START OF YEAR	150.687	546993.000	
SOIL WATER AT END OF YEAR	149.822	543854.937	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.073	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED FROM LAYER 3	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0235	0.0198	0.0206	0.0187	0.0182	0.0167
	0.0163	0.0155	0.0143	0.0140	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.012	0.002	0.008	0.001	0.001	0.005
	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.009	0.001	0.007	0.000	0.001	0.004
	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2034	738.522	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0002		
CHANGE IN WATER STORAGE	-1.287	-4673.480	-2.51
SOIL WATER AT START OF YEAR	149.822	543854.937	
SOIL WATER AT END OF YEAR	148.804	540159.312	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.079	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
FROM LAYER 13	0.0136	0.0130	0.0116	0.0111	0.0100	0.0096
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1347	488.926	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6708.522	-4.88

SOIL WATER AT START OF YEAR	148.804	540159.312	
SOIL WATER AT END OF YEAR	147.354	534894.250	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.037	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0090	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0815	295.780	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6797.443	4.06
SOIL WATER AT START OF YEAR	147.354	534894.250	
SOIL WATER AT END OF YEAR	149.226	541691.687	
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	0.041	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0051	0.0045	0.0048	0.0008	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0153	55.428	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-766.755	-0.55
SOIL WATER AT START OF YEAR	149.226	541691.687	
SOIL WATER AT END OF YEAR	149.015	540924.937	
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	-0.043	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	149.015	540924.937	
SOIL WATER AT END OF YEAR	149.411	542362.875	
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	-0.030	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	149.411	542362.875	
SOIL WATER AT END OF YEAR	149.497	542673.062	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	149.497	542673.062	
SOIL WATER AT END OF YEAR	148.303	538338.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.005	0.004	0.001	0.001	0.001
	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.004	0.003	0.000	0.000	0.000
	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	148.303	538338.125	
SOIL WATER AT END OF YEAR	149.467	542563.500	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

HELP MODEL PRINTOUTS

CLOSED – SEVENTEEN (17) LIFTS

Floor slope 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:\DATA4.D4
TEMPERATURE DATA FILE:       C:\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\DATA10.D10
OUTPUT DATA FILE:            C:\CF17S4.OUT


TIME:  12:38     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @17 LIFTS (TOP=33%), S=4%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```

```
                      LAYER  2
                      --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   0
THICKNESS                  =     18.00   INCHES
POROSITY                   =      0.4190 VOL/VOL
FIELD CAPACITY             =      0.3070 VOL/VOL
WILTING POINT              =      0.1800 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                      LAYER  3
                      --------

                TYPE 2 - LATERAL DRAINAGE LAYER
                 MATERIAL TEXTURE NUMBER   0
THICKNESS                  =      0.25   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
SLOPE                      =     33.00   PERCENT
DRAINAGE LENGTH            =     95.0    FEET


                      LAYER  4
                      --------

                TYPE 4 - FLEXIBLE MEMBRANE LINER
                 MATERIAL TEXTURE NUMBER  36
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.  =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY      =  4 - POOR


                      LAYER  5
                      --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
```


```
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2127 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                      LAYER  6
                      --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    816.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0754 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                      LAYER  7
                      --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2842 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                      LAYER  8
                      --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER  19
THICKNESS                  =    720.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0752 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                      LAYER  9
                      --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   6
```

```
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2789 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =     96.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0730 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     48.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2451 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                  =     24.00   INCHES
POROSITY                   =      0.4570 VOL/VOL
FIELD CAPACITY             =      0.1310 VOL/VOL
WILTING POINT              =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2272 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```



```
          TYPE 2 - LATERAL DRAINAGE LAYER
            MATERIAL TEXTURE NUMBER   0
THICKNESS                  =      0.15   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0361 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =   4.42000008000     CM/SEC
SLOPE                      =      4.00   PERCENT
DRAINAGE LENGTH            =    250.0    FEET


                        LAYER 14
                        --------

          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        =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY      =  1 - PERFECT


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     69.00
FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      1.350  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    158.018  INCHES
TOTAL INITIAL WATER                =    158.018  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


           EVAPOTRANSPIRATION AND WEATHER DATA
           -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
          BALTIMORE             MARYLAND
```

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BALTIMORE MARYLAND AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	1.1642	4.2852	1.3175	0.7071	0.5107	0.3808
FROM LAYER 13	0.3306	0.3231	0.2700	0.2071	0.2184	0.1786
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.009	0.038	0.011	0.006	0.004	0.003
TOP OF LAYER 14	0.003	0.003	0.002	0.002	0.002	0.001
STD. DEVIATION OF DAILY	0.007	0.018	0.003	0.001	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.8933	35912.512	22.48
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0070		
CHANGE IN WATER STORAGE	-9.891	-35904.352	-22.47
SOIL WATER AT START OF YEAR	160.576	582891.250	
SOIL WATER AT END OF YEAR	150.685	546986.875	
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	-0.054	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1256	0.0865	0.0769	0.0615	0.0539	0.0452
FROM LAYER 13	0.0412	0.0367	0.0320	0.0301	0.0267	0.0254
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.001	0.001	0.001	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6415	2328.732	1.52
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0004		
CHANGE IN WATER STORAGE	-0.197	-714.434	-0.47
SOIL WATER AT START OF YEAR	150.685	546986.875	
SOIL WATER AT END OF YEAR	149.821	543851.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.024	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0235	0.0198	0.0206	0.0187	0.0182	0.0166
FROM LAYER 13	0.0163	0.0155	0.0142	0.0140	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2034	738.293	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.287	-4673.148	-2.51
SOIL WATER AT START OF YEAR	149.821	543851.125	
SOIL WATER AT END OF YEAR	148.803	540155.812	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.024	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
	0.0136	0.0130	0.0116	0.0111	0.0100	0.0096
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1347	488.863	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6708.578	-4.88

SOIL WATER AT START OF YEAR	148.803	540155.812	
SOIL WATER AT END OF YEAR	147.353	534890.687	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.081	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0090	0.0077	0.0081	0.0074	0.0073	0.0067
	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.000	0.000	0.008	0.001	0.003	0.001
	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.000	0.008	0.000	0.003	0.001
	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0815	295.701	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6797.665	4.06
SOIL WATER AT START OF YEAR	147.353	534890.687	
SOIL WATER AT END OF YEAR	149.225	541688.375	
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	-0.102	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0051	0.0045	0.0048	0.0008	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0152	55.327	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-766.700	-0.55
SOIL WATER AT START OF YEAR	149.225	541688.375	
SOIL WATER AT END OF YEAR	149.014	540921.687	
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	0.003	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	149.014	540921.687	
SOIL WATER AT END OF YEAR	149.410	542359.562	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

	INCHES	CU. FEET	PERCENT
ANNUAL WATER BUDGET BALANCE	0.0000	-0.030	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	149.410	542359.562	
SOIL WATER AT END OF YEAR	149.496	542669.812	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	149.496	542669.812	
SOIL WATER AT END OF YEAR	148.302	538334.812	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	148.302	538334.812	
SOIL WATER AT END OF YEAR	149.466	542560.187	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

HELP MODEL PRINTOUTS

CLOSED – SEVENTEEN (17) LIFTS

Floor slope 5%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF17S5.OUT


TIME:  12:52     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @17 LIFTS (TOP=33%), S=5%

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


     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   9
          THICKNESS                  =      6.00   INCHES
          POROSITY                   =      0.5010 VOL/VOL
          FIELD CAPACITY             =      0.2840 VOL/VOL
          WILTING POINT              =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```



```
                                LAYER  2
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   0
          THICKNESS                  =     18.00   INCHES
          POROSITY                   =      0.4190 VOL/VOL
          FIELD CAPACITY             =      0.3070 VOL/VOL
          WILTING POINT              =      0.1800 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                                LAYER  3
                                --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                      MATERIAL TEXTURE NUMBER   0
          THICKNESS                  =      0.25   INCHES
          POROSITY                   =      0.8500 VOL/VOL
          FIELD CAPACITY             =      0.0100 VOL/VOL
          WILTING POINT              =      0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
          SLOPE                      =     33.00   PERCENT
          DRAINAGE LENGTH            =     95.0    FEET


                                LAYER  4
                                --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                      MATERIAL TEXTURE NUMBER  36
          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.  =  0.399999993000E-12 CM/SEC
          FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
          FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
          FML PLACEMENT QUALITY      =  4 - POOR


                                LAYER  5
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                  =     12.00   INCHES
          POROSITY                   =      0.4530 VOL/VOL
```

```
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2177 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  6
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    816.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0754 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2842 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    720.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0752 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  9
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2789 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0730 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2451 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2272 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```

```
            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                  =      0.15   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0318 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =   4.42000008000     CM/SEC
SLOPE                      =      5.00   PERCENT
DRAINAGE LENGTH            =    250.0    FEET


                        LAYER 14
                        --------

            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        =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY      =  1 - PERFECT


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     69.00
FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      1.350  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    158.078  INCHES
TOTAL INITIAL WATER                =    158.078  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


          EVAPOTRANSPIRATION AND WEATHER DATA
          -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
           BALTIMORE             MARYLAND
```



```
    STATION LATITUDE                        =  39.18 DEGREES
    MAXIMUM LEAF AREA INDEX                 =   0.00
    START OF GROWING SEASON (JULIAN DATE)   =    102
    END OF GROWING SEASON (JULIAN DATE)     =    300
    EVAPORATIVE ZONE DEPTH                  =   9.0  INCHES
    AVERAGE ANNUAL WIND SPEED               =   9.30 MPH
    AVERAGE 1ST QUARTER RELATIVE HUMIDITY   =  62.00 %
    AVERAGE 2ND QUARTER RELATIVE HUMIDITY   =  65.00 %
    AVERAGE 3RD QUARTER RELATIVE HUMIDITY   =  71.00 %
    AVERAGE 4TH QUARTER RELATIVE HUMIDITY   =  68.00 %


NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    BALTIMORE           MARYLAND

         NORMAL MEAN MONTHLY PRECIPITATION (INCHES)
```

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

```
NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    BALTIMORE           MARYLAND

    NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)
```

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

```
NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    BALTIMORE           MARYLAND
           AND STATION LATITUDE  =  39.18 DEGREES


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

                  MONTHLY TOTALS (IN INCHES) FOR YEAR    1
-------------------------------------------------------------------------------
```

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	1.1602	4.3087	1.3266	0.7032	0.5113	0.3811
FROM LAYER 13	0.3328	0.3230	0.2773	0.2118	0.2150	0.1858
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.008	0.031	0.009	0.005	0.003	0.003
TOP OF LAYER 14	0.002	0.002	0.002	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.006	0.014	0.002	0.001	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.9368	36070.723	22.58
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0056		
CHANGE IN WATER STORAGE	-9.935	-36062.547	-22.57
SOIL WATER AT START OF YEAR	160.695	583322.187	
SOIL WATER AT END OF YEAR	150.760	547259.625	
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	-0.071	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1299	0.0889	0.0786	0.0626	0.0548	0.0459
FROM LAYER 13	0.0417	0.0371	0.0323	0.0304	0.0269	0.0256
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.001	0.001	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6547	2376.627	1.55
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0004		
CHANGE IN WATER STORAGE	-0.210	-762.346	-0.50
SOIL WATER AT START OF YEAR	150.760	547259.625	
SOIL WATER AT END OF YEAR	149.883	544075.937	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.008	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED FROM LAYER 3	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0237	0.0200	0.0207	0.0188	0.0183	0.0167
	0.0164	0.0155	0.0143	0.0141	0.0131	0.0129
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.012	0.002	0.008	0.001	0.001	0.005
	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.009	0.001	0.007	0.000	0.001	0.004
	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2046	742.838	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.289	-4677.690	-2.51
SOIL WATER AT START OF YEAR	149.883	544075.937	
SOIL WATER AT END OF YEAR	148.864	540376.062	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.027	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0114	0.0107	0.0106	0.0099
FROM LAYER 13	0.0132	0.0131	0.0117	0.0112	0.0101	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1350	490.100	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.741	-4.88

SOIL WATER AT START OF YEAR	148.864	540376.062	
SOIL WATER AT END OF YEAR	147.413	535109.812	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.008	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0081	0.0075	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0819	297.271	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6796.003	4.06
SOIL WATER AT START OF YEAR	147.413	535109.812	
SOIL WATER AT END OF YEAR	149.285	541905.812	
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	-0.010	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0013	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48
DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0158	57.332	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-768.694	-0.55
SOIL WATER AT START OF YEAR	149.285	541905.812	
SOIL WATER AT END OF YEAR	149.074	541137.125	
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	-0.008	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	149.074	541137.125	
SOIL WATER AT END OF YEAR	149.470	542575.062	
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	-0.030	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	149.470	542575.062	
SOIL WATER AT END OF YEAR	149.555	542885.312	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	149.555	542885.312	
SOIL WATER AT END OF YEAR	148.361	538550.312	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.005	0.004	0.001	0.001	0.001
	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.004	0.003	0.000	0.000	0.000
	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	148.361	538550.312	
SOIL WATER AT END OF YEAR	149.525	542775.687	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

HELP MODEL PRINTOUTS

CLOSED – SEVENTEEN (17) LIFTS

Floor slope 6%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:       C:\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\DATA10.D10
OUTPUT DATA FILE:            C:\CF17S6.OUT


TIME:  13: 5     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @17 LIFTS (TOP=33%), S=6%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```

```
                     LAYER  2
                     --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   0
THICKNESS                   =     18.00   INCHES
POROSITY                    =      0.4190 VOL/VOL
FIELD CAPACITY              =      0.3070 VOL/VOL
WILTING POINT               =      0.1800 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3967 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-05 CM/SEC


                     LAYER  3
                     --------

           TYPE 2 - LATERAL DRAINAGE LAYER
             MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.1630 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   12.8000002000     CM/SEC
SLOPE                       =     33.00   PERCENT
DRAINAGE LENGTH             =     95.0    FEET


                     LAYER  4
                     --------

           TYPE 4 - FLEXIBLE MEMBRANE LINER
             MATERIAL TEXTURE NUMBER  36
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.   =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY         =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  4 - POOR


                     LAYER  5
                     --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
```



```
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2187 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                     LAYER  6
                     --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    816.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0759 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                     LAYER  7
                     --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2802 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                     LAYER  8
                     --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    720.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0745 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                     LAYER  9
                     --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
```

```
THICKNESS                  =     12.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2784 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                  =     96.00   INCHES
POROSITY                   =      0.1680 VOL/VOL
FIELD CAPACITY             =      0.0730 VOL/VOL
WILTING POINT              =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0730 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                  =     48.00   INCHES
POROSITY                   =      0.4530 VOL/VOL
FIELD CAPACITY             =      0.1900 VOL/VOL
WILTING POINT              =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2475 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                  =     24.00   INCHES
POROSITY                   =      0.4570 VOL/VOL
FIELD CAPACITY             =      0.1310 VOL/VOL
WILTING POINT              =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.2273 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```



```
          TYPE 2 - LATERAL DRAINAGE LAYER
            MATERIAL TEXTURE NUMBER   0
THICKNESS                  =      0.15   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0150 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =   4.42000008000      CM/SEC
SLOPE                      =      6.00   PERCENT
DRAINAGE LENGTH            =    250.0    FEET


                        LAYER 14
                        --------

          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        =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY      = 1 - PERFECT


         GENERAL DESIGN AND EVAPORATIVE ZONE DATA
         ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =     69.00
FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.816  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      4.263  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      1.350  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    158.055  INCHES
TOTAL INITIAL WATER                =    158.055  INCHES
TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR


          EVAPOTRANSPIRATION AND WEATHER DATA
          -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
                BALTIMORE              MARYLAND
```

```
STATION LATITUDE                            =  39.18 DEGREES
MAXIMUM LEAF AREA INDEX                     =   0.00
START OF GROWING SEASON (JULIAN DATE)       =    102
END OF GROWING SEASON (JULIAN DATE)         =    300
EVAPORATIVE ZONE DEPTH                      =   9.0  INCHES
AVERAGE ANNUAL WIND SPEED                   =   9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY       =  62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY       =  65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY       =  71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY       =  68.00 %
```

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BALTIMORE MARYLAND AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	1.1964	4.1621	1.3766	0.7171	0.5187	0.3855
FROM LAYER 13	0.3349	0.3237	0.2788	0.2129	0.2150	0.1879
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.006	0.025	0.007	0.004	0.003	0.002
TOP OF LAYER 14	0.002	0.002	0.002	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.004	0.012	0.002	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.9095	35971.379	22.52
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0047		
CHANGE IN WATER STORAGE	-9.907	-35963.289	-22.51
SOIL WATER AT START OF YEAR	160.681	583273.437	
SOIL WATER AT END OF YEAR	150.774	547310.125	
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	0.015	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1311	0.0896	0.0791	0.0630	0.0551	0.0461
FROM LAYER 13	0.0418	0.0372	0.0324	0.0304	0.0270	0.0257
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6585	2390.189	1.56
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-0.214	-775.861	-0.51
SOIL WATER AT START OF YEAR	150.774	547310.125	
SOIL WATER AT END OF YEAR	149.893	544112.937	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.055	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0238	0.0200	0.0208	0.0189	0.0184	0.0168
FROM LAYER 13	0.0164	0.0156	0.0143	0.0141	0.0131	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2050	744.100	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.289	-4679.020	-2.51
SOIL WATER AT START OF YEAR	149.893	544112.937	
SOIL WATER AT END OF YEAR	148.874	540411.750	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0115	0.0107	0.0106	0.0099
FROM LAYER 13	0.0131	0.0131	0.0117	0.0112	0.0101	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1351	490.440	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6710.018	-4.88

SOIL WATER AT START OF YEAR	148.874	540411.750	
SOIL WATER AT END OF YEAR	147.423	535145.250	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.056	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0081	0.0075	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0820	297.706	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6795.504	4.06
SOIL WATER AT START OF YEAR	147.423	535145.250	
SOIL WATER AT END OF YEAR	149.295	541940.750	
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	0.053	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0015	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0159	57.885	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-769.193	-0.55
SOIL WATER AT START OF YEAR	149.295	541940.750	
SOIL WATER AT END OF YEAR	149.083	541171.562	
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	-0.063	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.854	1.00
SOIL WATER AT START OF YEAR	149.083	541171.562	
SOIL WATER AT END OF YEAR	149.479	542609.375	
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	0.026	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	149.479	542609.375	
SOIL WATER AT END OF YEAR	149.565	542919.625	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	149.565	542919.625	
SOIL WATER AT END OF YEAR	148.370	538584.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	148.370	538584.625	
SOIL WATER AT END OF YEAR	149.534	542810.000	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

HELP MODEL PRINTOUTS

FULL -HEIGHT – SEVENTEEN (17) LIFTS

Floor slope 33%

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF17S33.OUT


TIME:  13:21     DATE:   6/27/2020


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

     TITLE:  CLOSED FILL @17 LIFTS (TOP=33%), S=33%

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


     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   9
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.5010 VOL/VOL
           FIELD CAPACITY             =      0.2840 VOL/VOL
           WILTING POINT              =      0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2710 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.190000006000E-03 CM/SEC
```



```
                                 LAYER  2
                                 --------

                   TYPE 1 - VERTICAL PERCOLATION LAYER
                       MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     18.00   INCHES
           POROSITY                   =      0.4190 VOL/VOL
           FIELD CAPACITY             =      0.3070 VOL/VOL
           WILTING POINT              =      0.1800 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.3967 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-05 CM/SEC


                                 LAYER  3
                                 --------

                     TYPE 2 - LATERAL DRAINAGE LAYER
                       MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.25   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1630 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   12.8000002000     CM/SEC
           SLOPE                      =     33.00   PERCENT
           DRAINAGE LENGTH            =     95.0    FEET


                                 LAYER  4
                                 --------

                     TYPE 4 - FLEXIBLE MEMBRANE LINER
                       MATERIAL TEXTURE NUMBER  36
           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.  =  0.399999993000E-12 CM/SEC
           FML PINHOLE DENSITY        =      0.00   HOLES/ACRE
           FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
           FML PLACEMENT QUALITY      =  4 - POOR


                                 LAYER  5
                                 --------

                   TYPE 1 - VERTICAL PERCOLATION LAYER
                       MATERIAL TEXTURE NUMBER   6
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4530 VOL/VOL
```

```
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2218 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  6
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    816.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0760 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2754 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    720.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0744 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  9
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2672 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0730 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2474 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2280 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER 13
                        --------
```

```
            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                  =      0.15   INCHES
POROSITY                   =      0.8500 VOL/VOL
FIELD CAPACITY             =      0.0100 VOL/VOL
WILTING POINT              =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.0113 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =   4.42000008000     CM/SEC
SLOPE                      =     33.00   PERCENT
DRAINAGE LENGTH            =    250.0    FEET
```

```
                        LAYER 14
                        --------

            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        =      0.00   HOLES/ACRE
FML INSTALLATION DEFECTS   =      0.00   HOLES/ACRE
FML PLACEMENT QUALITY      =  1 - PERFECT
```

```
          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

 SCS RUNOFF CURVE NUMBER            =     69.00
 FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
 AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
 EVAPORATIVE ZONE DEPTH             =      9.0    INCHES
 INITIAL WATER IN EVAPORATIVE ZONE  =      2.816  INCHES
 UPPER LIMIT OF EVAPORATIVE STORAGE =      4.263  INCHES
 LOWER LIMIT OF EVAPORATIVE STORAGE =      1.350  INCHES
 INITIAL SNOW WATER                 =      0.000  INCHES
 INITIAL WATER IN LAYER MATERIALS   =    157.921  INCHES
 TOTAL INITIAL WATER                =    157.921  INCHES
 TOTAL SUBSURFACE INFLOW            =      0.00   INCHES/YEAR
```

```
           EVAPOTRANSPIRATION AND WEATHER DATA
           -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
          BALTIMORE              MARYLAND
```



```
 STATION LATITUDE                        =  39.18 DEGREES
 MAXIMUM LEAF AREA INDEX                 =   0.00
 START OF GROWING SEASON (JULIAN DATE)   =    102
 END OF GROWING SEASON (JULIAN DATE)     =    300
 EVAPORATIVE ZONE DEPTH                  =   9.0  INCHES
 AVERAGE ANNUAL WIND SPEED               =   9.30 MPH
 AVERAGE 1ST QUARTER RELATIVE HUMIDITY   =  62.00 %
 AVERAGE 2ND QUARTER RELATIVE HUMIDITY   =  65.00 %
 AVERAGE 3RD QUARTER RELATIVE HUMIDITY   =  71.00 %
 AVERAGE 4TH QUARTER RELATIVE HUMIDITY   =  68.00 %
```

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	1.2055	3.9763	1.3936	0.7200	0.5215	0.3901
	0.3333	0.3230	0.2802	0.2166	0.2145	0.1920
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.000	0.000
	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.000	0.000	0.000	0.000
	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.006	0.021	0.007	0.004	0.003	0.002
	0.002	0.002	0.001	0.001	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.004	0.011	0.002	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		
DRAINAGE COLLECTED FROM LAYER 13	9.7667	35452.973	22.19
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0041		
CHANGE IN WATER STORAGE	-9.764	-35444.789	-22.19
SOIL WATER AT START OF YEAR	160.584	582920.875	
SOIL WATER AT END OF YEAR	150.820	547476.062	
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	-0.070	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1336	0.0910	0.0801	0.0636	0.0556	0.0464
	0.0421	0.0374	0.0326	0.0306	0.0271	0.0258
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6661	2417.872	1.58
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-0.221	-803.611	-0.53
SOIL WATER AT START OF YEAR	150.820	547476.062	
SOIL WATER AT END OF YEAR	149.931	544251.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	0.020	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED FROM LAYER 3	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0239	0.0201	0.0209	0.0189	0.0184	0.0168
	0.0165	0.0156	0.0144	0.0142	0.0131	0.0130
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.012	0.002	0.008	0.001	0.001	0.005
	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.009	0.001	0.007	0.000	0.001	0.004
	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2057	746.648	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.290	-4681.512	-2.51
SOIL WATER AT START OF YEAR	149.931	544251.125	
SOIL WATER AT END OF YEAR	148.911	540547.437	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.007	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0112	0.0115	0.0107	0.0107	0.0099
FROM LAYER 13	0.0129	0.0132	0.0117	0.0112	0.0101	0.0098
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1353	491.129	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.849	-6710.738	-4.88

SOIL WATER AT START OF YEAR	148.911	540547.437	
SOIL WATER AT END OF YEAR	147.460	535280.187	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.017	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0092	0.0078	0.0082	0.0075	0.0073	0.0068
FROM LAYER 13	0.0067	0.0064	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0823	298.590	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6794.674	4.06
SOIL WATER AT START OF YEAR	147.460	535280.187	
SOIL WATER AT END OF YEAR	149.332	542074.875	
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	0.008	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0017	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0163	58.998	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-770.356	-0.55
SOIL WATER AT START OF YEAR	149.332	542074.875	
SOIL WATER AT END OF YEAR	149.120	541304.500	
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	-0.010	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	149.120	541304.500	
SOIL WATER AT END OF YEAR	149.516	542742.437	
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	-0.030	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	149.516	542742.437	
SOIL WATER AT END OF YEAR	149.601	543052.687	
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	-0.014	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	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 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	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. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	149.601	543052.687	
SOIL WATER AT END OF YEAR	148.407	538717.687	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	148.407	538717.687	
SOIL WATER AT END OF YEAR	149.571	542943.062	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

****

a Montrose Environmental Group company

ATTACHMENT 10B

Geocomposite Drainage Layer Permeability

ADVANCED GeoServices a Montrose Environmental Group company	**Subject:** Leachate Collection System, Geocomposite Drainage Net Requirements		
	Job No. 2018-3854	**Made by:** JCA	**Date** 07-15-20
	Ref.	**Checked by:** VEF	**Sheet** 1 **of** 1

Reviewed by PGS 08/29/2021

Objective:

Estimate the allowable transmissivity, final thickness, and allowable permeability (hydraulic conductivity) of the tri-planar geocomposite drainage net (GDN) portion of the geocomposite drainage layer in the leachate collection system.

Design Approach:

1. Using various design parameters and estimated material characteristics, estimate the vertical load imposed on the GDN.
2. Consider manufacturer's data for a high compressive strength, high flow geocomposite drainage net (GDN) product for use in the leachate collection system. (Reference 3)
3. Select reduction factors for use in calculating the allowable transmissivity and final thickness of the GDN to account for creep deformation of the GDN core, intrusion of the geotextile into the GDN core, chemical clogging of the GDN core and/or geotextile, and biological clogging of the GDN core and/or geotextile. (Reference 1, same reduction factors as bi-planar GDN)
4. Use the manufacturer's data (Reference 3) and selected reduction factors to estimate the allowable transmissivity, final thickness, and allowable permeability (hydraulic conductivity) of the GDN.

Calculation:

Based on the attached calculation sheet, the allowable transmissivity for this design is $5.25 \times 10^{-3} m^2/sec$. This corresponds to an estimated allowable permeability (hydraulic conductivity) of 9.84 cm/sec. Using a Factor of Safety (FS) of 2, the required permeability is 4.92 cm/sec. Additionally, the final thickness after loading is estimated to be 0.15 inch.

Conclusion:

Use the allowable permeability (hydraulic conductivity) and final thickness values in the modeling of the leachate production.

References:

1. *"Geotechnical Aspects of Landfill Design and Construction";* Qian, Koerner, and Gray; 1st Ed., 2002; Sect 8.4.3.
2. Project waste density analysis.
3. Manufacturer's data, various.
4. Site specific data, estimated.

ADVANCED GeoServices
a Montrose Environmental Group company

Project:			
P.N.:	2018-3854	**Page:**	1 of 2
By:	JCA	**Date:**	06/19/20
Checked:	VEF	**Date:**	07/15/20
Subject:	Leachate Collection System Geocomposite Drainage Net Requirements		

Reviewed by PGS 08/29/2021

Leachate Collection System Geocomposite Drainage Net

Description
Estimate the transmissivity and hydraulic conductivity of the geocomposite drainage net for the leachate collection system.

Vertical Loads

Cap System Thickness, D_1 =	3 4	ft
Overall Cap System Unit Weight, γ_1 =	115	pcf
Approximate Overall Cap System Pressure, σ_1 =	~~345~~ 460	psf
Maximum Waste Thickness, D_2 =	~~144~~ 120	ft
Approximate Waste Unit Weight, γ_2 =	48.7	pcf
Approximate Waste Pressure, σ_2 =	~~7,013~~	psf
Protective Cover Layer Thickness, D_3 =	4	ft
Approximate Protective Cover Layer Unit Weight, γ_3 =	115	pcf
Approximate Protective Cover Layer Pressure, σ_3 =	460	psf
Leachate Collection Layer Thickness, D_4 =	2	ft
Approximate Leachate Collection Layer Unit Weight, γ_4 =	115	pcf
Approximate Leachate Collection Layer Pressure, σ_4 =	230	psf

Approximate Total Vertical Pressure, $\sigma_T = \Sigma\sigma$ = ~~8,048~~ 6,994 psf = ~~385~~ 345 kPa

Landfill Bottom Slope

Landfill Bottom Slope, S = 3.0 % = 0.03 ft/ft

Geocomposite Drainage Net Product *(Reference 3)*

Product Type = GSE TenDrain 300

Estimated Transmissivity from 1-hr Seat Time, θ_1 = 5.25E-03 m^2/sec

Set Ultimate Transmissivity, $\theta_U = \theta_1$ = 5.25E-03 m^2/sec

Reduction Factors *(Reference 1)*

Creep deformation of the drainage core itself and/or intrusion of the adjacent geotextile into the dranage core space, RF_{CR} =	2.00	>>>>	*Range: 1.4 to 2.0*
Elastic deformation of the adjacent geotextile intruding into the drainage core space, RF_{IN} =	2.00	>>>>	*Range: 1.5 to 2.0*
Chemical clogging of the adjacent geotextile or the drainage core space, RF_{CC} =	2.00	>>>>	*Range: 1.5 to 2.0*
Biological clogging of the adjacent geotextile or the drainage core space, RF_{BC} =	1.75	>>>>	*Range: 1.5 to 2.0*

Mathematical product of all RFs, XRF = 14.0

Allowable Transmissivity *(Reference 1)*

Allowable transmissivity, $\theta_{all} = \theta_U / XRF$ = 3.75E-04 m^2/sec = 3.75E+00 cm^2/sec

Geocomposite Drainage Net Thickness *(References 1 and 3)*

Starting thickness, T_i =	300.0	mil	=	0.30	in
Final thickness, $T_f = T_i/RF_{CR}$ =	0.150	in	=	0.38	cm

Hydraulic Conductivity *(Reference 1)*

Allowable hydraulic conductivity, $K_{all} = \theta_{all}/T_f$ =	9.84	cm/sec
Factor of Safety =	2.0	
Required hydraulic conductivity, $K_{req'd} = K_{all} / FS$ =	4.92	cm/sec

References:
1 *"Geotechnical Aspects of Landfill Design and Construction"; Qian, Koerner,and Gray; 1st Ed., 2002; Sect 8.4.3.*
2 Project waste density analysis.
3 *Manufacturer's data, various.*
4 *Site specific data, estimated.*

REFERENCE 1

Pg 1/1

RF_{IN} = reduction factor for elastic deformation, or intrusion, of the adjacent geosynthetics into the geonet's core space;
RF_{CR} = reduction factor for creep deformation of the geonet and adjacent geosynthetics into geonet's core space;
RF_{CC} = reduction factor for chemical clogging and/or precipitation of chemicals in the geonet's core space; and
RF_{BC} = reduction factor for biological clogging in the geonet's core space.

Some guidelines as to various reduction factors to be used in different situations are given in Table 8.8. Note that these values are based on preliminary and relatively sparse information. Other reduction factors, such as installation damage, viscosity effects and temperature effects, could also have been incorporated. If needed, they can be included on a site-specific basis. An example problem follows, which illustrates the use of geonets and points out that high factors of safety are warranted in critical situations.

EXAMPLE 8.2

What is the allowable geonet flow rate to be used in the design of a secondary leachate collection (i.e., leak detection) system? Assume that laboratory testing at proper design load and proper hydraulic gradient gave a short-term between-rigid-plate index value of 1.2 gal/min-ft (14.9 liter/min-m).

Solution: Average values from Table 8.8 are used (however, note the large resulting reduction):

$$q_{allow} = \frac{q_{ult}}{RF_{IN} \times RF_{CR} \times RF_{CC} \times RF_{BC}} \tag{8.17}$$

$$= \frac{1.2}{1.75 \times 1.7 \times 1.75 \times 1.75}$$

$$= \frac{1.2}{9.11} = 0.13 \text{ gal/min-ft (1.6 liter/min-m)}$$

TABLE 8.8 Recommended Preliminary Reduction Factors for Determining Allowable Flow Rate or Transmissivity of Biplanar Geonets (Koerner, 1998)

Application Area	Reduction Factor Values			
	RF_{IN}	RF_{CR}*	RF_{CC}	RF_{BC}
Sport fields	1.0 to 1.2	1.0 to 1.5	1.0 to 1.2	1.1 to 1.3
Capillary break	1.1 to 1.3	1.0 to 1.2	1.1 to 1.5	1.1 to 1.3
Roof and plaza decks	1.2 to 1.4	1.0 to 1.2	1.0 to 1.2	1.1 to 1.3
Retaining walls, seeping rock and soil slopes	1.3 to 1.5	1.2 to 1.4	1.1 to 1.5	1.0 to 1.5
Drainage blankets	1.3 to 1.5	1.2 to 1.4	1.0 to 1.2	1.0 to 1.2
Surface water drains for landfill caps	1.3 to 1.5	1.1 to 1.4	1.0 to 1.2	1.2 to 1.5
Secondary leachate collection (landfill)	1.5 to 2.0	1.4 to 2.0	1.5 to 2.0	1.5 to 2.0
Primary leachate collection (landfill)	1.5 to 2.0	1.4 to 2.0	1.5 to 2.0	1.5 to 2.0

*These values are sensitive to the density of the resin used in the geonet's manufacture. The higher the density, the lower the reduction factor. Creep of the covering geotextile(s) is a product-specific issue.

REFERENCE 3 Pg 1/2

PRODUCT DATA SHEET

GSE TenDrain 300 mil Geocomposite

[*]

AT THE CORE:
A 300 mil thick TenDrain geonet heat-laminated on one or both sides with a nonwoven needlepunched geotextile.

GSE TenDrain geocomposite consists of a 300 mil thick GSE TenDrain geonet heat-laminated on one or both sides with a GSE nonwoven needle-punched geotextile. TenDrain 300 is comprised of a tri-planar structure consisting of middle ribs that provide direct channelized flow, with diagonally placed top and bottom ribs. The geotextile is available in mass per unit area range of 6 oz/yd² to 16 oz/yd². TenDrain 300 geocomposite provides high transmissivity under high and low loads.

Product Specifications

Tested Property	Test Method	Frequency	Minimum Average Roll Value[1]	
Geocomposite			6 oz/yd²	8 oz/yd²
Transmissivity[2], gal/min/ft, (m²/sec) at 1,000 psf Double-Sided Composite	ASTM D 4716	1/540,000 ft²	33.8 ($7x10^{-3}$)	33.8 ($7x10^{-3}$) *
Transmissivity[2], gal/min/ft, (m²/sec) at 15,000 psf Double-Sided Composite	ASTM D 4716	1/540,000 ft²	16.9 ($3.5x10^{-3}$)	16.9 ($3.5x10^{-3}$) *
Ply Adhesion, lb/in	ASTM D 7005	1/50,000 ft²	0.5	0.5
Geonet Core[1,3] – GSE TenDrain				
Geonet Core Thickness, mil	ASTM D 5199	1/50,000 ft²	300	300
Density, g/cm³	ASTM D 1505	1/50,000 ft²	0.94	0.94
Tensile Strength (MD), lb/in	ASTM D 7179	1/50,000 ft²	100	100
Carbon Black Content, %	ASTM D 4218	1/50,000 ft²	2.0	2.0
Creep Reduction Factor [4]	GRI-GC8	per formulation	1.1	1.1
Compressive Strength, psf	ASTM D 6364	1/540,000 ft²	80,000	80,000
Geotextile[1,3]				
Mass per Unit Area, oz/yd²	ASTM D 5261	1/90,000 ft²	6	8
Grab Tensile Strength, lb	ASTM D 4632	1/90,000 ft²	160	220
Grab Elongation, %	ASTM D 4632	1/90,000 ft²	50	50
CBR Puncture Strength, lb	ASTM D 6241	1/540,000 ft²	435	575
Trapezoidal Tear Strength, lb	ASTM D 4533	1/90,000 ft²	65	90
AOS, US sieve[1], (mm)	ASTM D 4751	1/540,000 ft²	70 (0.212)	80 (0.180)
Permittivity, sec⁻¹	ASTM D 4491	1/540,000 ft²	1.5	1.3
Water Flow Rate, gpm/ft²	ASTM D 4491	1/540,000 ft²	110	95
UV Resistance, % retained	ASTM D 4355 (after 500 hours)	per formulation	70	70
NOMINAL ROLL DIMENSIONS[5]				
Roll Width, ft			12.75	12.75
Roll Length, ft	Double-Sided Composite		152	152
Roll Area , ft²	Double-Sided Composite		1,938	1,938

NOTES:
- [1] All geotextile properties are minimum average roll values except AOS which is maximum average roll value and UV resistance is typical value. Geonet core thickness is minimum average value.
- [2] Gradient of 0.02, boundary condition: plate/sand/geocomposite/geomembrane/plate, water at 70°F for 1 hour.
- [3] Component properties prior to lamination.
- [4] 10,000 hour creep test under 15,000 psf at 40°C temperature.
- [5] Roll widths and lengths have a tolerance of ±1%.

GSE is a leading manufacturer and marketer of geosynthetic lining products and services. We've built a reputation of reliability through our dedication to providing consistency of product, price and protection to our global customers.

Our commitment to innovation, our focus on quality and our industry expertise allow us the flexibility to collaborate with our clients to develop a custom, purpose-fit solution.

GSE ENVIRONMENTAL™

[DURABILITY RUNS DEEP] For more information on this product and others, please visit us at GSEworld.com, call 800.435.2008 or contact your local sales office.

ADVANCED GeoServices

Engineering for the Environment. Planning for People.™

Reviewed by PGS 08/29/2021

Objective: Estimate the transmissivity (θ) of the geocomposite drainage net

Calculation

@ σ_v = 1,000 psf $\theta = 7.0 \times 10^{-3}$ m²/sec

@ σ_v = 15,000 psf $\theta = 3.5 \times 10^{-3}$ m²/sec

@ σ_v = 8048 psf :

$$\frac{8048 - 1000}{15{,}000 - 1{,}000} = 0.50$$

$$\theta = 7 - 0.50(7 - 3.5) = 7 - 1.75 = 5.25$$

$$\theta = 5.25 \times 10^{-3} \text{ m}^2/\text{sec}$$

SHEET 1	OF 1	PROJECT NO. 2018-3084	PROJECT NAME Oke Terrace
BY JCA		DATE 6/19/20	DESCRIPTION GDN Transmissivity
CHK. BY VEJ		DATE 7/4/20	

ADVANCED GeoServices
a Montrose Environmental Group company

ATTACHMENT 10C

Leachate Collection Pipes Flow Capacity

1. Purpose

The purpose of this analysis is to design the gravity leachate collection pipes with respect to flow.

2. Analysis Approach and Assumptions

a. The peak unit leachate flow from the project HELP modeling is used for both the lateral collection pipe, and the central, main leachate collection pipe.

b. Manning's Equation is used to calculate flow in each pipe. It is well-known that the roughness coefficient, n, used in Manning's Equation is not constant with flow depth. Therefore, the flow rate for a full-flow condition is calculated, and then adjusted to check actual flow conditions based on a graph that correlates the ratios of flow depth to pipe diameter (y/D) with the ratio of actual flow to full-flow (Q/Q_{full}), and the ratio of actual flow velocity to full-flow velocity (V/V_{full}). Such a graph is provided by Daugherty and Franzini (1977, Fig 11.8), and is based on *"Design and Construction of Sanitary and Storm Sewers"*, ASCE Manual of Engineering Practice, Vol 37, pg 94-95, 1960. This is taken from an earlier work by T.R. Camp entitled, *"Design of Sewers to Facilitate Flow"*, Sewage Works Journal, 18 (3), 1946.

c. Pipe perforations were designed based on orifice flow, a unit 1-foot length of pipe, the peak leachate flow, and the maximum leachate head build-up.

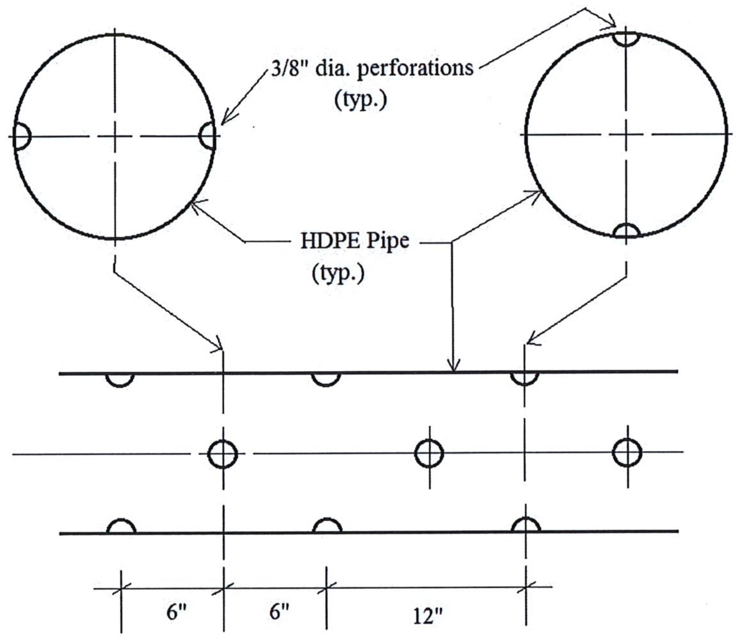
d. The longest collection lateral and the largest cell were chosen for collection lateral and the main collection pipe, respectively (largest contributing areas).

e. The factor of safety, FS, of the peak flow against flow capacity is also calculated.

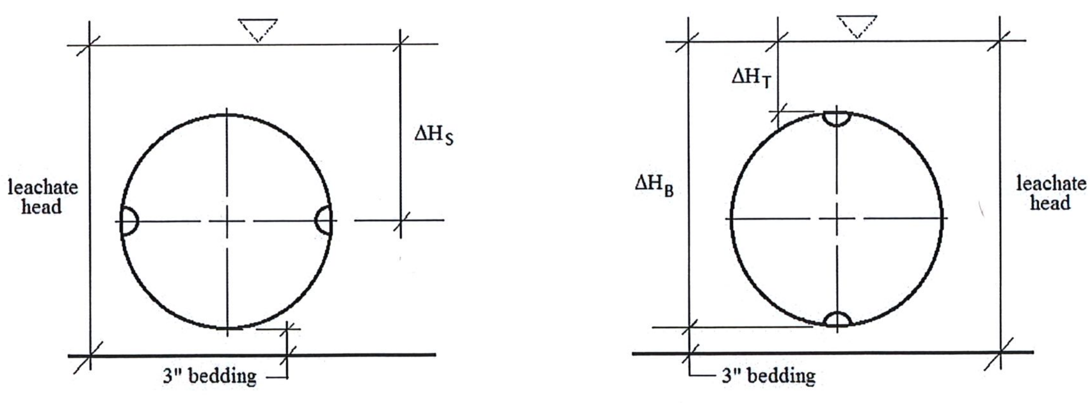
3. Calculations

Pipe Information: the pipe chosen for design is SDR 11 solid-wall HDPE pipe. The main collection pipe in each cell is chosen to be 8-inch nominal diameter. The lateral collection pipes are chosen to be 6-inch nominal diameter. The perforation pattern chosen for design has two, 3/8-in (0.375 in) diameter perforations every 6 inches to provide 4 perforations per foot of pipe length. The locations of the perforations are alternated as shown in the following figure:

Perforation Detail - Leachate Main & Lateral Collection Pipes



Based on orifice flow design, the following diagram depicts the positions of the orifices and the associated dimensions for head calculations:



(a) Perforations on side of pipe

(b) Perforations on top & bottom of pipe

Pipe Perforation Design

Reviewed by PGS 08/29/2021

Leachate Collection Lateral: The Using Manning's Equation, a roughness coefficient, n, of 0.012, and a pipe slope of 2% (minimum required), a full-flow capacity, Q_{full} of 0.59 cfs is calculated. The peak unit leachate flow from the project HELP modeling was estimated to be 9,724 gal/ac-day. The longest leachate collection lateral occurs in Cell 1, and is approximately 600 ft long. With a leachate pipe spacing of 250 ft, the contributing area is approximately 150,000 sf (3.44 ac). The peak flow, from this area is calculated to be 33,485 gal/day (0.052 cfs). The FS of the peak flow against the flow capacity is calculated as (0.59/0.052) cfs = 11.3. The flow depth, y, is estimated to be 1.07 in, and the flow velocity is estimated to be 1.77 fps.

Using a peak leachate head build-up of 12" (maximum allowable), the following flows are calculated for each orifice:

Top:	0.00239 cfs/ft of pipe
Side (each):	0.00365 cfs/ft of pipe
Bottom;	0.00458 cfs/ft of pipe

Based on these partial flows, a flow capacity of 0.01428 cfs/ft of pipe is provided. The lateral leachate collection pipe is estimated to need 0.000086 cfs/ft of pipe is needed. The FS against the flow capacity is calculated to be (0.01422/0.000086) = 165.4.

Leachate Collection Main (Header): The Using Manning's Equation, a roughness coefficient, n, of 0.012, and a pipe slope of 2% (minimum required), a full-flow capacity, Q_{full} of 1.17 cfs is calculated. The peak unit leachate flow from the project HELP modeling was estimated to be 9,724 gal/ac-day. The largest cell is Cell 1. This cell is 13.19 ac in size, but only 11.7 ac drains to the main leachate collection pipe. The balance (1.49 ac) drains to pipes located at the toe of the 3H:1V (33%) sideslopes. Using the 11.7-ac area, and the unit peak flow, a peak flow of 113,771 gal/day (0.176 cfs) is calculated. The FS of the peak flow against the flow capacity is calculated as (1.17/0.176) cfs = 6.6. The flow depth, y, is estimated to be 1.39 in, and the flow velocity is estimated to be 2.08 fps.

Using a peak leachate head build-up of 12" (maximum allowable), the following flows are calculated for each orifice:

Top:	0.00139 cfs/ft of pipe
Side (each):	0.00339 cfs/ft of pipe
Bottom;	0.00458 cfs/ft of pipe

Based on these partial flows, a flow capacity of 0.01275 cfs/ft of pipe is provided. The lateral leachate collection pipe is estimated to need 0.000191 cfs/ft of pipe is needed. The FS against the flow capacity is calculated to be (0.01275/0.000191) = 66.6.

4. Conclusions

Based on the foregoing, the following conclusions are offered:

a. The 6-inch HDPE SDR 11 solid-wall pipe provides adequate flow capacity for the lateral leachate collection pipe. Similarly, the 8-inch HDPE SDR 11 solid-wall pipe provides adequate flow capacity for the main leachate collection pipe.

b. The flow velocity in the lateral collection pipe is only slightly less than 2 fps, the minimum needed for the pipe to be "self-cleaning". The life of each landfill cell is relatively short, in most cases less than 12 months. The HELP modeling indicates the flow to diminish rapidly after closure. Consequently, the flow velocity in the lateral collection pipes is not considered critical. Therefore, cleanouts are not provided for the laterals. Additionally, the laterals are terminated in the deep parts of the landfill, making access to the up-gradient ends impractical.

c. The flow velocity in the central, main leachate collection pipe is estimated to be approximately 2.08 fps. This is equal to the minimum 2 fps flow velocity to be considered self-cleaning. The down-gradient end of the main collection pipes are provided with a clean-out to allow cleaning if needed.

5. References

1. Daugherty, Robert L., and Franzini, Joseph B.; *"Fluid Mechanics with Engineering Applications"*; McGraw-Hill Book Company, 1977.

2. Project HELP Modeling.

3. HDPE Pipe Manufacturer's Data.

a Montrose Environmental Group company

Project:			
P.N.:	2018-3084	**Page:**	1 of 1
By:	JCA	**Date:**	07/16/20
Checked:	VEJ	**Date:**	7/16/20
Subject:	Lateral Gravity Leachate Pipe Design		

Reviewed by PGS 08/29/2021

Objective *Design the gravity leachate collection pipes (lateral) for peak leachate flow.*

A. Pipe Capacity
Leachate Collection Pipe Data

Gravity Pipe Type:	Smooth-walled, solid HDPE, SDR 11						
Gravity Pipe Nominal Inside Diameter, D_N =	6	in					
Gravity Pipe Actual Inside Diameter, D =	5.349	in					
Full Flow Cross-Sectional Area, A =	22.46	in^2	=	0.16	ft^2		
Wetted Perimeter, Wp =	18.84	in	=	1.57	ft		
Hydraulic Radius, R_h =	1.19	in	=	0.10	ft	$R_h^{(2/3)}$ =	0.215
Slope, S =	2	%	=	0.020	ft/ft	$S^{(1/2)}$ =	0.141
Manning's Roughness Coefficient, n =	0.012						
Full-Flow Capacity, Q_{full} =	0.59	cfs					
Full-Flow Velocity, V_{full} =	3.8	fps					

Leachate Collection Pipe

Longest Lateral Leachate Collection Pipe, L =	600	ft >>>>>>>>>		(Cell 1)				
Lateral Leachate Collection Pipe Spacing, DL =	250	ft						
Drainage Area to Lateral Leachate Collection Pipe, DA =	150,000	ft^2	=	3.44	ac			
Leachate Flow/Unit Area, Q =	9,724	gal/ac-day						
Flow to Lateral Leachate Collection Pipe, Q =	33,485	gal/day	=	0.052	cfs	=	0.000086	cfs/ft of pipe
Factor of Safety Against Peak Flow, FS = Q_{full}/Q =	**11.3**							
Ratio Q/Q_{full} =	0.09							
Ratio y/D =	0.20							
Flow Depth, y =	1.07	in						
Ratio V/V_{full} =	0.47							
Flow Velocity, V =	1.77	fps						

B. Perforation Design
Pipe and Orifice data

Orifice Type =	(c)				
Coefficient, C_d =	0.86				
Gravity Pipe Nominal Inside Diameter, D_N =	6	in			
Gravity Pipe Actual Inside Diameter, D =	5.349	in			
Gravity Pipe Wall Thickness, t =	0.602	in			
Bedding Layer Thickness, B =	3	in			
Peak Leachate Head, LH =	12	in	=	1	ft
Gravitational Coefficient, g =	32.2	ft/sec^2			
Orifice Dia. =	0.375	in	=	0.03125	ft
Orifice Cross-Sectional Flow Area, A_o =	0.00077	ft^2			

Top Orifice Flow

ΔH_T = LH - B - 2t - D =	2.447	in	=	0.20	ft
Number of Top Orifices per Ft of Pipe =	1				
Top Orifice Flow, q_T =	0.00239	cfs/ft of pipe			
Total Top Orifice(s) Flow, Q_T =	0.00239	cfs/ft of pipe			

Side Orifice Flow

ΔH_S = LH - t - 0.5D =	5.724	in	=	0.48	ft
Number of Side Orifices per Ft of Pipe =	2				
Side Orifice Flow, q_S =	0.00365	cfs/ft of pipe			
Total Side Orifice(s) Flow, Q_S =	0.00731	cfs/ft of pipe			

Bottom Orifice Flow

ΔH_B = LH - B =	9.000	in	=	0.75	ft
Number of Bottom Orifices per Ft of Pipe =	1				
Bottom Orifice Flow, q_B =	0.00458	cfs/ft of pipe			
Total Bottom Orifice(s) Flow, Q_B =	0.00458	cfs/ft of pipe			

Total Orifice Flow

Total Unit Flow Capacity, $Q_t = Q_T + Q_S + Q_B$ =	0.01428	cfs/ft of pipe
Total Flow Capacity, Q =	0.000086	cfs/ft of pipe
Factor of Safety Against Peak Flow = FS = Qt/Q =	**165.4**	

References
1 Daugherty, Robert L., and Franzini, Joseph B.; *"Fluid Mechanics with Engineering Applications"*; McGraw-Hll Book Company, 1977.
2 Project HELP Modeling.
3 HDPE Pipe Manufacturer's Data.

ADVANCED GeoServices

a Montrose Environmental Group company

Project:			
P.N.:	2018-3084	**Page:**	1 of 1
By:	JCA	**Date:**	07/10/20
Checked:	VEJ	**Date:**	7/16/20
Subject:	Main Gravity Leachate Pipe Design		

Reviewed by PGS 08/29/2021

Objective *Design the gravity leachate collection pipes (main) for peak leachate flow.*

A. Pipe Capacity

Leachate Collection Pipe Data

Gravity Pipe Type:	Smooth-walled, solid HDPE, SDR 11						
Gravity Pipe Nominal Inside Diameter, D_N =	8	in					
Gravity Pipe Actual Inside Diameter, D =	6.963	in					
Full Flow Cross-Sectional Area, A =	38.06	in^2	=	0.26	ft^2		
Wetted Perimeter, Wp =	25.12	in	=	2.09	ft		
Hydraulic Radius, R_h =	1.52	in	=	0.13	ft	$R_h^{(2/3)}$ =	0.252
Slope, S =	2	%	=	0.020	ft/ft	$S^{(1/2)}$ =	0.141
Manning's Roughness Coefficient, n =	0.012						
Full-Flow Capacity, Q_{full} =	1.17	cfs					
Full-Flow Velocity, V_{full} =	4.4	fps					

Leachate Collection Pipe

Longest Main Leachate Collection Pipie, L =	920	ft		(Cell 1)			
Drainage Area to Main Leachate Collection Pipe, DA =	11.70	ac		(Cell 1)			
Leachate Flow/Unit Area, Q =	9,724	gal/ac-day					
Flow to Lateral Leachate Collection Pipe, Q =	113,771	gal/day	=	0.176	cfs	=	0.000191 cfs/ft of pipe
Factor of Safety Against Peak Flow, FS = Q_{full}/Q =	**6.6**						
Ratio Q/Q_{full} =	0.15						
Ratio y/D =	0.20						
Flow Depth, y =	1.39	in					
Ratio V/V_{full} =	0.47						
Flow Velocity, V =	2.08	fps					

B. Perforation Design

Pipe and Orifice data

Orifice Type =	(c)				
Coefficient, C_d =	0.86				
Gravity Pipe Nominal Inside Diameter, D_N =	8	in			
Gravity Pipe Actual Inside Diameter, D =	6.963	in			
Gravity Pipe Wall Thickness, t =	0.602	in			
Bedding Layer Thickness, B =	3	in			
Peak Leachate Head, LH =	12	in	=	1	ft
Gravitational Coefficient, g =	32.2	ft/sec^2			
Orifice Dia. =	0.375	in	=	0.03125	ft
Orifice Cross-Sectional Area, A_o =	0.00077	ft^2			

Top Orifice Flow

ΔH_T = LH - B - 2t - D =	0.833	in	=	0.07	ft
Number of Top Orifices per Ft of Pipe =	1				
Top Orifice Flow, q_T =	0.00139	cfs			
Total Top Orifice(s) Flow, Q_T =	0.00139	cfs			

Side Orifice Flow

ΔH_S = LH - t - 0.5D =	4.917	in	=	0.41	ft
Number of Side Orifices per Ft of Pipe =	2				
Side Orifice Flow, q_S =	0.00339	cfs			
Total Side Orifice(s) Flow, Q_S =	0.00677	cfs			

Bottom Orifice Flow

ΔH_B = LH - B =	9.000	in	=	0.75	ft
Number of Bottom Orifices per Ft of Pipe =	1				
Bottom Orifice Flow, q_B =	0.00458	cfs			
Total Bottom Orifice(s) Flow, Q_B =	0.00458	cfs			

Total Orifice Flow

Total Unit Flow Capacity, $Q_t = Q_T + Q_S + Q_B$ =	0.01275	cfs/ft of pipe
Total Flow Capacity, Q =	0.000191	cfs/ft of pipe
Factor of Safety Against Peak Flow = FS = Qt/Q =	**66.6**	

References

1 Daugherty, Robert L., and Franzini, Joseph B.; *"Fluid Mechanics with Engineering Applications"*; McGraw-Hll Book Company, 1977.

2 Project HELP Modeling.

3 HDPE Pipe Manufacturer's Data.

REFERENCE 1

Pg 1/2

PIPE FLOW

Manning's Formula

$$V\ (\text{fps}) = \frac{1.49}{n} R_h^{(2/3)}\, S^{(1/2)}$$

$$Q\ (\text{cfs}) = \frac{1.49}{n} A R_h^{(2/3)}\, S^{(1/2)}$$

$$A = \pi D^2$$

$$R_h = A/W_p$$

$$W_p = \pi D$$

where,

V = flow velocity, fps
Q = flow, cfs
A = cross-sectional flow area, ft^2
D = Pipe inside diameter, ft
R_h = hydraulic radius, ft
W_p = wetted perimeter, ft

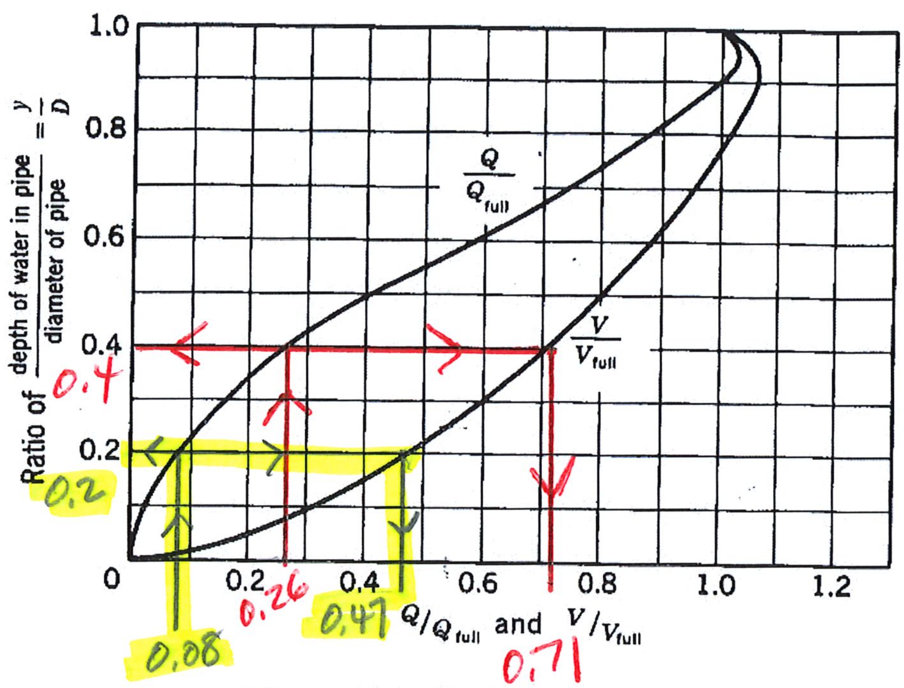
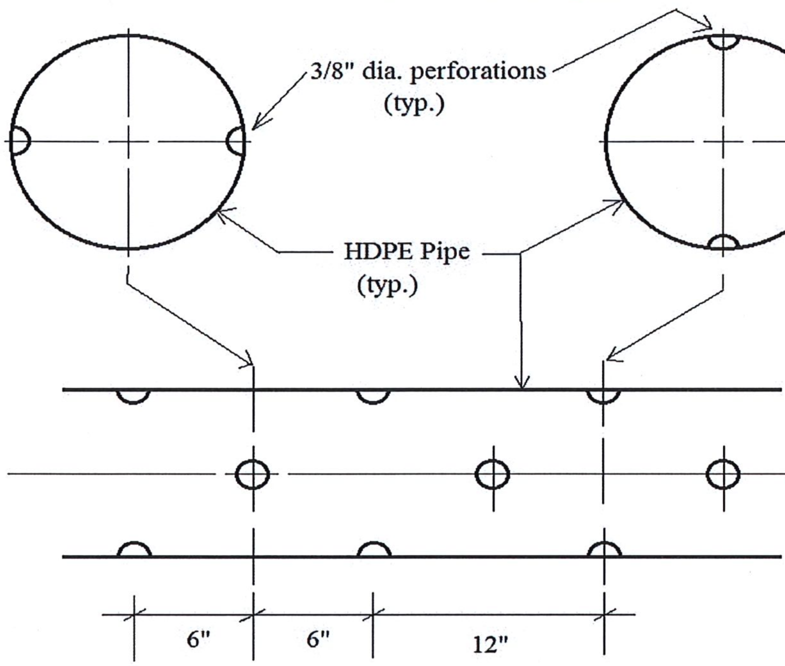
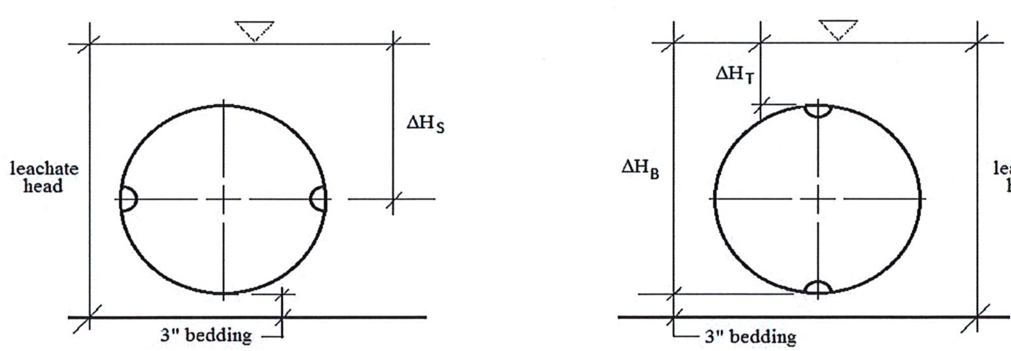


Figure 11.8. Hydraulic characteristics of circular pipe flowing partly full (*n* variable with depth).

Perforation Detail - Leachate Main & Lateral Collection Pipes





(a) Perforations on side of pipe

(b) Perforations on top & bottom of pipe

Pipe Perforation Design

REFERENCE 1

pg 2/2

ORIFICE FLOW

		Equation
Ideal flow rate	$Q_i = A_i V_i = A_o\sqrt{2g(\Delta H)}$	(12.8)
Actual flow rate	$Q = AV = C_c A_o(C_v\sqrt{2g(\Delta H)})$	(12.9)
and	$C_d = \dfrac{Q}{Q_i} = C_c C_v$	(12.10)

Combine Equations 12.9 and 12.10:

$$\boxed{Q = C_d A_o(\sqrt{2g(\Delta H)})}$$

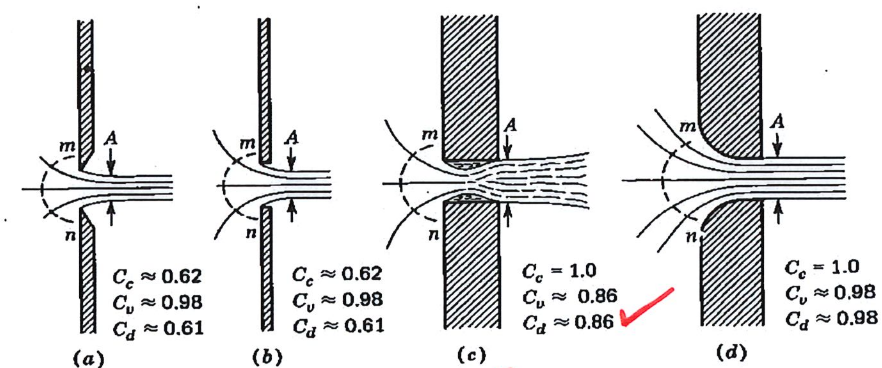


Figure 12.11. Types of orifice.

a Montrose Environmental Group company

ATTACHMENT 10D

Leachate Collection Pipe Stress

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Buried Pipe Design		
	Job No. 2018-3854	Made by: JCA	Date 07/15/20
	Ref.	Checked by: VEF VEF	Sheet 1 of 2

Reviewed by PGS 08/21/2021

1. Purpose

The purpose of this analysis is to design the leachate lateral and main collection pipes as buried pipes. ✓

2. Analysis Approach and Assumptions

a. Two loading conditions are considered:

Revised Landfill Height is lower, therefore Calculation still valid.

(1) final loading with completed landfill height; and, ✓
(2) construction loading to account for heavy equipment usage. ✓ No change

b. Vehicle loading was assumed to be AASHTO H20 (32,000 rear axle on a panel truck). ✓

c. The pipes considered for use 6-inch and 8-inch diameter, solid-wall HDPE pipes with SDR = 11, and 4, 3/8" diameter perforations per ft of pipe.. Pipe data was modified per Reference 2 to account for the perforations in the pipes. ✓

d. Wall crushing (compressive ring thrust), deflection, and buckling are checked for the loading conditions. Maximum value for deflection was set at 7.5% per Reference 4. ✓

3. Calculations

As indicated, the pipe data was modified to account for the perforations. This was accomplished by subtracting the cross-sectional area of the perforations from the pipe wall area. This results – *for the purposes of this calculation* – in a reduced pipe wall thickness, an increased SDR, an increased inside diameter, an increased mean diameter, and a reduced section moment of inertia. A comparison of the pipe data before and after modification is summarized in the following tables:

6" Pipe Data Modifications		
Before Modification	***Pipe Characteristic***	***After Modification***
6.553	Outside Diameter, in	6.553
5.349	Inside Diameter, in	5.402
0.602	Pipe Wall Thickness, in	0.575
11	SDR	11.4
2.976	Mean Radius, R, in	2.989
11.25	Pipe Wall Area, in^2	10.80
0.0182	Section Moment of Inertia, in^4/in	0.0159

✓

8" Pipe Data Modifications		
Before Modification	***Pipe Characteristic***	***After Modification***
8.531	Outside Diameter, in	8.531
6.963	Inside Diameter, in	7.017
0.784	Pipe Wall Thickness, in	0.757
11	SDR	11.3
3.874	Mean Radius, R, in	3.887
19.07	Pipe Wall Area, in^2	18.48
0.0402	Section Moment of Inertia, in^4/in	0.0362

√

The attached calculations provide the following factors of safety:

Pipe Stress Calculation Results		
6" Pipe	***Factor of safety for:***	***8" Pipe***
4.2	Compressive Ring Thrust Stress	4.4
2.4	Ring Deflection	2.5
2.6	Constrained Wall Buckling	2.7

√

4. Conclusions

Based on the foregoing, pipe product and backfill soils having engineering parameters consistent with the analysis, and installed consistent with the conditions described ion this analysis, should perform adequately with respect to compressive ring thrust stress, ring deflection, and constrained wall buckling.

5. Recommendations

Based on the foregoing, the following recommendations are offered:

a. The engineering properties of the pipe product and soil materials from this analysis should be incorporated into the Technical Specifications of the project.

b. If conditions, products, materials, and equipment during construction are not consistent with this analysis, additional analyses should be performed.

6. References

1. Performance Pipe Manufacturer's Data
2. Derivation of equations to modify basic pipe information to account for perforations.
3. Project design information.
4. Plastics Pipe Institute, *"Handbook of Polyethylene Pipe"*, 2nd Ed.

Reviewed by PGS 08/21/2021

Objective: *Check the structural adequacy of the leachate collection pipe.*

Basic Pipe Information (Solid Wall HDPE): *(Ref. 1)*

Material Code:	PE 4710	
Nominal Diameter =	6	in
Standard Dimension Ratio, SDR =	11	
Average Inside Diameter, ID =	5.349	in
Minimum Wall Thickness, t =	0.602	in
Outside Inside Diameter, OD = ID + 2t =	6.553	in
Moment of Inertia, $I = (t^3/12) =$	0.0182	in^4/in
Mean Radius, $R = (OD - t)/2 =$	2.976	in
Area of Pipe Wall, $= A = 2\pi Rt =$	11.25	in^2

Modifiy Basic Pipe Information to Account for Pipe Perforations: *(Ref. 2)*

Diameter of Perforation(s), $d_P =$	0.375	in	
Number of Perforations at Each Radial Axis, $N_P =$	2		
Area of Perforations, $A_P = N_P(t)\,d_P =$	0.452	in^2	
Modified Pipe Wall Area, $A' = A - A_P =$	10.80	in^2	
Modified Wall Thickness, $t' = (OD - \sqrt{(OD^2) - 4 \cdot A'/\pi})/2$	0.575	in	*(Ref. 2 p 1.)*
Modified Inside Diameter = $ID' = OD - 2t'$	5.402	in	
Modified Moment of Inertia, $I' = (t'^3/12) =$	0.0159	in^4/in	
Modified Mean Radius, $R' = (OD - t')/2 =$	2.989	in	
Modified SDR Designation, $SDR' = (OD/t') =$	11.4		

Static Load: *(Ref. 3)*

Fill height of cap above top of pipe, H =	3	ft
Soil Density, $\gamma =$	115	pcf
Fill height of waste above top of pipe, H =	144	ft
Waste Density, $\gamma =$	48.7	pcf
Fill height of protective cover layer above top of pipe, H =	4	ft
Soil Density, $\gamma =$	115	pcf
Fill height of leachate collection stone above top of pipe, H =	1	ft
Soil Density, $\gamma =$	125	pcf
Total Static Vertical Pressure on Top of Pipe, $Ps = \Sigma(H\gamma) =$	7,943	psf

ADVANCED GeoServices
a Montrose Environmental Group company

Project:			
P.N.:	2018-3084	**Page:**	2 of 3
By:	JCA	**Date:**	07/15/20
Checked:	VKJ	**Date:**	07-15-20
Subject:	6" Leachate Pipe Structural Design		

Reviewed by PGS 08/21/2021

Live Load: (Ref. 4, pp 199 & 203)

Axle Load, W_A =	$\boxed{32,000}$	lb				
Wheel Load, $W_W = W_A/2$	16,000	lb				
Vertical Depth over Pipe, H =	$\boxed{2.0}$	ft				
Impact Factor, I_F =	$\boxed{1.00}$					
Distance from Pipe Centerline to Wheel 1, X_1 =	$\boxed{0.0}$	ft				
Radial Distance from Wheel Load to Top of Pipe, r_1 =	2.00	ft				
Distance from Pipe Centerline to Wheel 2, X_2 =	$\boxed{6.0}$	ft				
Radial Distance from Wheel Load to Top of Pipe, r_2 =	6.32	ft				
Live Load from Wheel 1, P_{L1} =	1910.8	psf				
Live Load from Wheel 2, P_{L2} =	7.9	psf				
Design P_L =	$\boxed{1910.8}$	psf				
Internal Pressure Load:						
Vacuum,Pressure, P_I =	$\boxed{0.0}$	psi	=	0	psf	
Total Load						
Total Load, $P_T = P_S + P_L + P_I$ =	9,854	psf	=	68.4	psi	
Design for Compression Ring Thrust Stress:						(Ref. 4, pp 227 - 228)
Outside Diameter of Pipe, D_O = OD =	6.553	in				
Radius to Centroidal Axis of Pipe, $r_{CENT} = R'$ =	2.989	in				
One-Dimensional Soil Modulus, M_S =	$\boxed{2,610}$	psi				(Ref. 4, p 228, table 3-12)
Long Term Modulus of Elasticity of Pipe Material, E =	$\boxed{17,920}$	psi				(Ref. 4, p 99 table B.1.1 at 100 yr; p100 table B.1.2 at 110° F)
Pipe Wall Area, $A' = t'$ =	0.575	in^2/in				
Hoop Thrust Stiffness Ratio, S_A =	1.08					(Ref. 4, p 227, Eqn 3-22)
Vertical Arching Factor, VAF =	0.86					(Ref. 4, p 227, Eqn 3-21)
Vertical Pressure on Top of Pipe, $wH = P_S + P_I$ =	7,943	psf				
Radial Directed Earth Pressure, P_{RD} =	6,860	psf				(Ref. 4, p 228, Eqn 3-23)
Pipe Wall Compressive Stress, S =	271	psi	=	39,075	psf	(Ref. 4, p 229, from Eqn 3-14)
Allowable Compressive Stress, S_{ALL} =	$\boxed{1,150}$	psi	=	165,600	psf	(Ref. 4, p 102, table C.1)
Factor of Safety = FS = S_{ALL}/S =	**4.2**	**> 1.0**		**Design Acceptable**		

Project:			
P.N.:	2018-3084	**Page:**	3 of 3
By:	JCA	**Date:**	07/15/20
Checked:	UEJ	**Date:**	07-15-20
Subject:	6" Leachate Pipe Structural Design		

Reviewed by PGS 08/21/2021

Design for Ring Deflection:

Parameter	Value	Unit				Reference
Poisson's Ratio of Soil, μ =	$\boxed{0.15}$					(Ref. 4, p 230, table 3-13, for coarse sand)
Secant Modulus of Soil, E_S =	2,472	psi				(Ref. 4, p 230, Eqn 3-26)
Standard Dimension Ratio = SDR = SDR' =	11.4					
Long Term Modulus of Elasticity of Pipe Material, E =	17,920	psi				
Rigidity Factor, R_F =	1,857					(Ref. 4, p 230, Eqn 3-24)
Deformation Factor, D_F =	$\boxed{1.41}$					(Ref. 4, p 231, Fig. 3-6)
Soil Strain, ε_s =	2.23	%				(Ref. 4, p 231, Eqn 3-27)
Percent Ring Deflection, $(\Delta X/D_M)(100) = (D_F)(\varepsilon_s)$ =	3.15	%				(Ref. 4, p 231, Eqn 3-28)
Maximum Allowable Deflection, D_{MAX} =	7.5	%				(Ref. 4, p 218)
Factor of Safety, $FS = D_{MAX}/(D_F)(\varepsilon_S)$ =	**2.4**	**> 1.0**	**Design Acceptable**			

Design for Constrained Wall Buckling: (Ref. 4, using Luscher's Equations to account for possible leachate head)

Parameter	Value	Unit				Reference
Total Height of Cover on Top of Pipe, H =	152.0	ft				
Height of Water Above Top of Pipe, H_{GW} =	$\boxed{1.0}$	ft				
Buoyancy Factor, R =	1.0					(Ref. 4, p 222, Eqn 3-17)
Natural Log Base Number, e =	2.71828					
Elastic Soil Support Factor, B' =	1.0					(Ref. 4, p 222, Eqn 3-18)
Modulus of Soil Reaction for Pipe Bedding, E' =	$\boxed{3,000}$	psi				(Ref. 4, p 214, table 3-7)
Dimension Ration, DR = SDR' =	11.4					
Safety Factor, N =	$\boxed{2.0}$					(Ref. 4, p 222)
Allowable Constrained Buckling Pressure, P_{WC} =	178	psi	=	25,673	psf	(Ref. 4, p 221, Eqn 3-15)
Total Vertical Pressure, P_T =	68.4	psi	=	9,854	psf	
Factor of Safety, $FS = P_{WC}/P_T$ =	**2.6**	**> 1.0**	**Design Acceptable**			

Reference(s)
1 Performance Pipe Manufacturer's Data
2 Derivation of equations to modify basic pipe information to account for perforations.
3 Project design information.
4 Plastics Pipe Instutite, "Handbook of Polyehtylene Pipe", 2nd Ed.

Advanced GeoServices
a Montrose Environmental Group company

Project:			
P.N.:	2018-3084	**Page:**	1 of 3
By:	JCA	**Date:**	07/15/20
Checked:	VEJ	**Date:**	07.15.20
Subject:	8" Leachate Pipe Structural Design		

Reviewed by PGS 08/21/2021

Objective: *Check the structural adequacy of the leachate collection pipe.*

Basic Pipe Information (Solid Wall HDPE): *(Ref. 1)*

Material Code:	PE 4710	
Nominal Diameter =	8	in
Standard Dimension Ratio, SDR =	11	
Average Inside Diameter, ID =	6.963	in
Minimum Wall Thickness, t =	0.784	in
Outside Inside Diameter, OD = ID + 2t =	8.531	in
Moment of Inertia, $I = (t^3 / 12)$ =	0.0402	in^4/in
Mean Radius, R = (OD - t) / 2 =	3.874	in
Area of Pipe Wall, = $A = 2\pi Rt$ =	19.07	in^2

Modifiy Basic Pipe Information to Account for Pipe Perforations: *(Ref. 2)*

Diameter of Perforation(s), d_P =	0.375	in	
Number of Perforations at Each Radial Axis , N_P =	2		
Area of Perforations, $A_P = N_P(t)\, d_P$ =	0.588	in^2	
Modified Pipe Wall Area, $A' = A - A_P$ =	18.48	in^2	
Modified Wall Thickness, $t' = (OD - \sqrt{(OD^2) - 4*A'/\pi})/2$	0.757	in	(Ref. 2 p 1.)
Modified Inside Diameter = ID' = OD - 2t'	7.017	in	
Modified Moment of Inertia, $I' = (t'^3 / 12)$ =	0.0362	in^4/in	
Modified Mean Radius, R' = (OD - t') / 2 =	3.887	in	
Modified SDR Designation, SDR' = (OD / t') =	11.3		

Static Load: *(Ref. 3)*

Fill height of cap above top of pipe, H =	3	ft
Soil Density, γ =	115	pcf
Fill height of waste above top of pipe, H =	144	ft
Waste Density, γ =	47.4	pcf
Fill height of protective cover layer above top of pipe, H =	4	ft
Soil Density, γ =	115	pcf
Fill height of leachate collection stone above top of pipe, H =	1	ft
Soil Density, γ =	125	pcf
Total Static Vertical Pressure on Top of Pipe, Ps = $\Sigma(H\gamma)$ =	7,756	psf

ADVANCED GeoServices
a Montrose Environmental Group company

Project:			
P.N.:	2018-3084	**Page:**	2 of 3
By:	JCA	**Date:**	07/15/20
Checked:	JZJ	**Date:**	07.15.20
Subject:	8" Leachate Pipe Structural Design		

Reviewed by PGS 08/21/2021

Live Load: (Ref. 4, pp 199 & 203)

Axle Load, W_A =	32,000	lb				
Wheel Load, $W_W = W_A / 2$	16,000	lb				
Vertical Depth over Pipe, H =	2.0	ft				
Impact Factor, I_F =	1.00					
Distance from Pipe Centerline to Wheel 1, X_1 =	0.0	ft				
Radial Distance from Wheel Load to Top of Pipe, r_1 =	2.00	ft				
Distance from Pipe Centerline to Wheel 2, X_2 =	6.0	ft				
Radial Distance from Wheel Load to Top of Pipe, r_2 =	6.32	ft				
Live Load from Wheel 1, P_{L1} =	1910.8	psf				
Live Load from Wheel 2, P_{L2} =	7.9	psf				
Design P_L =	1910.8	psf				
Internal Pressure Load:						
Vacuum,Pressure, P_I =	0.0	psi	=	0	psf	
Total Load						
Total Load, $P_T = P_S + P_L + P_I$ =	9,666	psf	=	67.1	psi	
Design for Compression Ring Thrust Stress:						(Ref. 4, pp 227 - 228)
Outside Diameter of Pipe, D_O = OD =	8.531	in				
Radius to Centroidal Axis of Pipe, $r_{CENT} = R'$ =	3.887	in				
One-Dimensional Soil Modulus, M_S =	2,610	psi				(Ref. 4, p 228, table 3-12)
Long Term Modulus of Elasticity of Pipe Material, E =	17,920	psi				(Ref. 4, p 99 table B.1.1 at 100 yr; p100 table B.1.2 at 110° F)
Pipe Wall Area, $A' = t'$ =	0.757	in^2/in				
Hoop Thrust Stiffness Ratio, S_A =	1.07					(Ref. 4, p 227, Eqn 3-22)
Vertical Arching Factor, VAF =	0.87					(Ref. 4, p 227, Eqn 3-21)
Vertical Pressure on Top of Pipe, $wH = P_S + P_I$ =	7,756	psf				
Radial Directed Earth Pressure, P_{RD} =	6,718	psf				(Ref. 4, p 228, Eqn 3-23)
Pipe Wall Compressive Stress, S =	263	psi	=	37,845	psf	(Ref. 4, p 229, from Eqn 3-14)
Allowable Compressive Stress, S_{ALL} =	1,150	psi	=	165,600	psf	(Ref. 4, p 102, table C.1)
Factor of Safety = FS = S_{ALL}/S =	**4.4**	**> 1.0**		**Design Acceptable**		

ADVANCED GeoServices
a Montrose Environmental Group company

Project:	
P.N.: 2018-3084	**Page:** 3 of 3
By: JCA	**Date:** 07/15/20
Checked: VEJ	**Date:** 07-15-20
Subject: 8" Leachate Pipe Structural Design	

Reviewed by PGS 08/21/2021

Design for Ring Deflection:

Poisson's Ratio of Soil, μ =	$\boxed{0.15}$					*(Ref. 4, p 230, table 3-13, for coarse sand)*
Secant Modulus of Soil, E_S =	2,472	psi				*(Ref. 4, p 230, Eqn 3-26)*
Standard Dimension Ratio = SDR = SDR' =	11.3					
Long Term Modulus of Elasticity of Pipe Material, E =	17,920	psi				
Rigidity Factor, R_F =	1,791					*(Ref. 4, p 230, Eqn 3-24)*
Deformation Factor, D_F =	$\boxed{1.40}$					*(Ref. 4, p 231, Fig. 3-6)*
Soil Strain, ε_S =	2.18	%				*(Ref. 4, p 231, Eqn 3-27)*
Percent Ring Deflection, $(\Delta X/D_M)$ (100) = $(D_F)(\varepsilon_S)$ =	3.05	%				*(Ref. 4, p 231, Eqn 3-28)*
Maximum Allowable Deflection, D_{MAX} =	7.5	%				*(Ref. 4, p 218)*
Factor of Safety, FS = $D_{MAX}/(D_F)(\varepsilon_S)$ =	**2.5**	**> 1.0**	**Design Acceptable**			

Design for Constrained Wall Buckling: *(Ref. 4, using Luscher's Equations to account for possible leachate head)*

Total Height of Cover on Top of Pipe, H =	152.0	ft				
Height of Water Above Top of Pipe, H_{GW} =	$\boxed{1.0}$	ft				
Buoyancy Factor, R =	1.0					*(Ref. 4, p 222, Eqn 3-17)*
Natural Log Base Number, e =	2.71828					
Elastic Soil Support Factor, B' =	1.0					*(Ref. 4, p 222, Eqn 3-18)*
Modulus of Soil Reaction for Pipe Bedding, E' =	$\boxed{3,000}$	psi				*(Ref. 4, p 214, table 3-7)*
Dimension Ration, DR = SDR' =	11.3					
Safety Factor, N =	$\boxed{2.0}$					*(Ref. 4, p 222)*
Allowable Constrained Buckling Pressure, P_{WC} =	182	psi	=	26,144	psf	*(Ref. 4, p 221, Eqn 3-15)*
Total Vertical Pressure, P_T =	67.1	psi	=	9,666	psf	
Factor of Safety, FS = P_{WC}/P_T =	**2.7**	**> 1.0**	**Design Acceptable**			

Reference(s)
1. *Performance Pipe Manufacturer's Data*
2. *Derivation of equations to modify basic pipe information to account for perforations.*
3. *Project design information.*
4. *Plastics Pipe Instutite, "Handbook of Polyehtylene Pipe", 2nd Ed.*

PERFORMANCE PIPE
A Division of Chevron Phillips Chemical Company LP

Iron Pipe Size (IPS) and Dimension Data
DriscoPlex® Pipe for Municipal and Industrial Applications

PE4710 (PE3408)

Pressure Ratings are calculated using 0.63 design factor for HDS at 73°F as listed in PPI TR-4 for PE 4710 materials. HDPE can accomodate up to 1.5 times the pipe pressure rating for a recurring surge and up to 2.0 times the pipe pressure rating for an occasional surge. Temperature, Chemical, and Environmental use considerations may require use of additional design factors.

Pressure Rating		335 psi DR 7.0			250 psi DR 9.0			200 psi DR 11.0			160 psi DR 13.5			
Nominal Pipe Size	IPS OD (in)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Nominal Pipe Size
1 1/4"	1.660	0.237	1.158	0.46	0.184	1.270	0.37	0.151	1.340	0.31	0.123	1.399	0.26	1 1/4"
1 1/2"	1.900	0.271	1.325	0.61	0.211	1.453	0.49	0.173	1.533	0.41	0.141	1.601	0.34	1 1/2"
2"	2.375	0.339	1.656	0.95	0.264	1.815	0.77	0.216	1.917	0.64	0.176	2.002	0.53	2"
3"	3.500	0.500	2.440	2.06	0.389	2.675	1.66	0.318	2.826	1.39	0.259	2.951	1.16	3"
4"	4.500	0.643	3.137	3.40	0.500	3.440	2.75	0.409	3.633	2.31	0.333	3.794	1.92	4"
6"	6.625	0.946	4.619	7.37	0.736	5.065	5.96	0.602	5.349	5.00	0.491	5.584	4.15	6"
8"	8.625	1.232	6.013	12.50	0.958	6.594	10.11	0.784	6.963	8.47	0.639	7.270	7.04	8"
10"	10.750	1.536	7.494	19.42	1.194	8.219	15.70	0.977	8.679	13.16	0.796	9.062	10.93	10"
12"	12.750	1.821	8.889	27.31	1.417	9.746	22.08	1.159	10.293	18.51	0.944	10.749	15.38	12"
14"	14.000	2.000	9.760	32.93	1.556	10.701	26.63	1.273	11.301	22.32	1.037	11.802	18.54	14"
16"	16.000	2.286	11.154	43.01	1.778	12.231	34.78	1.455	12.915	29.15	1.185	13.488	24.22	16"
18"	18.000	2.571	12.549	54.43	2.000	13.760	44.02	1.636	14.532	36.89	1.333	15.174	30.65	18"
20"	20.000	2.857	13.943	67.20	2.222	15.289	54.34	1.818	16.146	45.54	1.481	16.860	37.84	20"
22"	22.000	3.143	15.337	81.32	2.444	16.819	65.75	2.000	17.760	55.10	1.630	18.544	45.79	22"
24"	24.000	3.429	16.731	96.77	2.667	18.346	78.25	2.182	19.374	65.58	1.778	20.231	54.49	24"
26"	26.000				2.889	19.875	91.84	2.364	20.988	76.96	1.926	21.917	63.95	26"
28"	28.000				3.111	21.405	106.51	2.545	22.605	89.26	2.074	23.603	74.17	28"
30"	30.000				3.333	22.934	122.27	2.727	24.219	102.47	2.222	25.289	85.14	30"
32"	32.000				3.556	24.462	139.12	2.909	25.833	116.58	2.370	26.976	96.87	32"
34"	34.000				3.778	25.991	157.05	3.091	27.447	131.61	2.519	28.660	109.36	34"
36"	36.000				4.000	27.520	176.07	3.273	29.061	147.55	2.667	30.346	122.60	36"
42"	42.000							3.818	33.906	200.84	3.111	35.405	166.88	42"
48"	48.000													48"
54"	54.000													54"

REFERENCE 1

This size and dimension chart is intended for reference purposes. It should not be used in place of the advice from a licensed Professional Engineer. Pipe weights are calculated in accordance with PPI TR-7. Average inside diameter is calculated using IPS OD and Minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary. When designing components to fit the pipe ID, refer to pipe dimension and tolerances in the applicable pipe manufacturing specification.

Visit www.performancepipe.com for the most current literature.

1. Purpose

Perforated pipe is used for the collection of leachate in landfills. The purpose of this analysis is to derive equations for use in accounting for the perforations in pipe stress calculations.

2. Analysis Approach and Assumptions

The perforations result in a reduced cross-sectional area of the pipe at their location(s). Based on this reduced area, modified values for thickness (t'), inside diameter (ID'), mean radius (R'), moment of inertia (I'), and standard dimension ratio (SDR') are calculated.

3. Calculations

Starting with a pipe of inside diameter, ID, and wall thickness, t, various parameters are defined as:

Outside diameter, $OD = ID + 2t$ (1)
Mean Diameter, $R = (OD - t)/2$ (2)
Moment of Inertia, $I = t^3/12$ (3)
Standard Dimension Ratio, $SDR = OD/t$ (4)
Cross-sectional Area of Pipe, $A = 2\pi Rt$ (5)

A perforation, of diameter d, has a cross-sectional area equal to dt. The total amount of the perforation area, A_P, and the reduced pipe cross-sectional area, A', are defined as

$$A_P = (\text{number of perforations, n})(dt) = ndt$$

$$A' = A - A_P$$

With a reduced pipe cross-sectional area, A', and the outside diameter, OD, staying constant, the other pipe parameters can be re-calculated. Substituting Equation (2) into Equation (5), one gets

$$A' = \frac{2\pi(OD - t')t'}{2} \quad \text{or} \quad t'^2 - ODt' + (A'/\pi) = 0$$

The quadratic solution is

$$t' = \frac{-(-OD) - [(-OD)^2 - 4(A'/\pi)]^{(0.5)}}{2} \qquad (6)$$

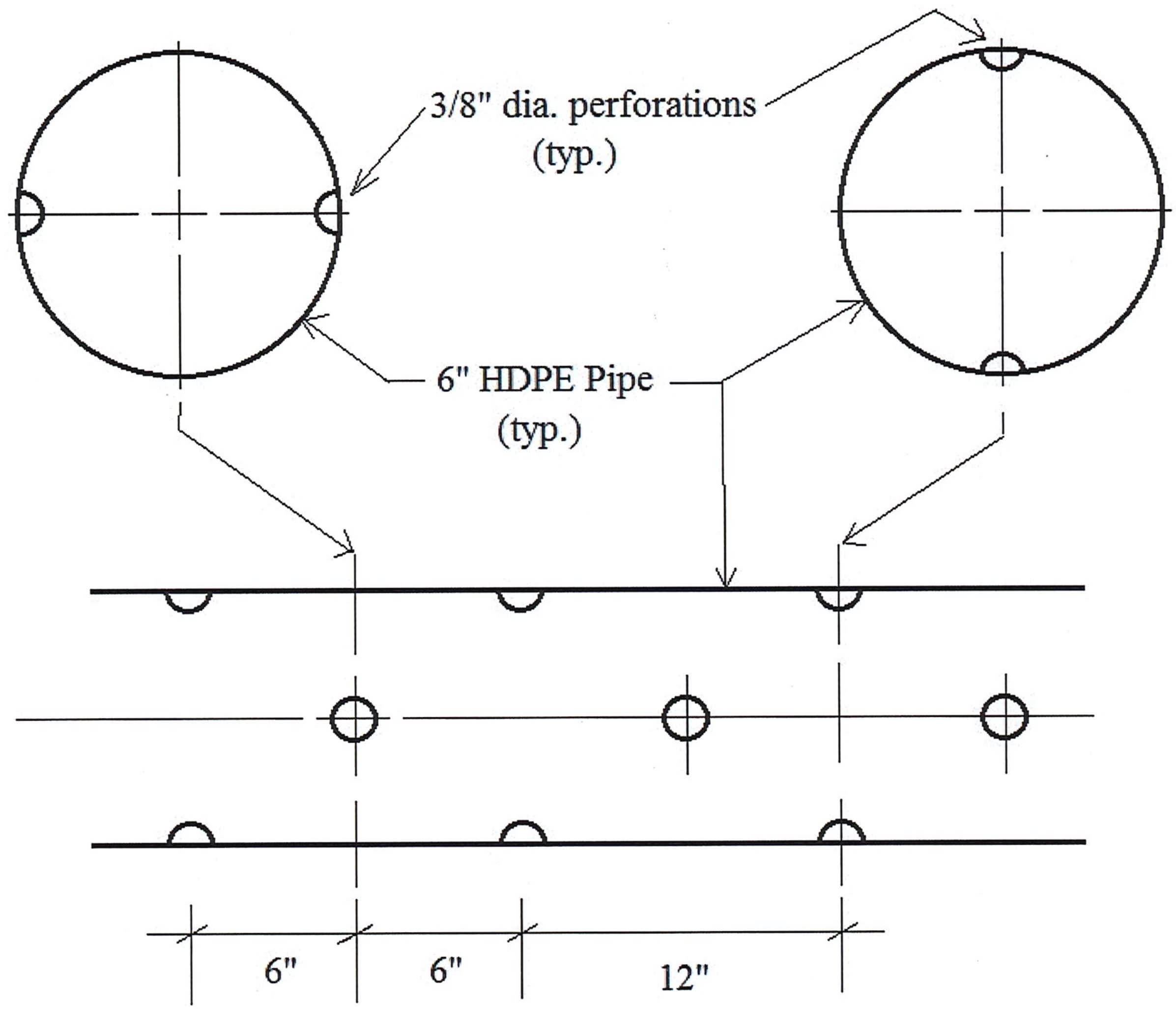
Reviewed by PGS 08/21/2021

Knowing t', the remaining modified parameters are:

Inside diameter, ID' = OD – 2t' (7)
Mean Diameter, R' = (OD – t')/2 (8)
Moment of Inertia, I' = $t'^3/12$ (9)
Standard Dimension Ratio, SDR' = OD/t' (10)

*****

Perforation Detail - Leachate Main & Lateral Collection Pipes



Plastics Pipe Institute® Handbook of Polyethylene Pipe

"The Plastics Pipe Institute® Handbook of Polyethylene Pipe" is a comprehensive guide to the use of smoothwall HDPE pipe and its applications. The handbook is available in PDF format at www.plasticpipe.org. For convenience, we have secured permission from PPI to activate hyperlinks to individual chapters. Click the links below to access the PPI website documents.

Appendix B

Apparent Elastic Modulus

B.1 – Apparent Elastic Modulus for the Condition of Either a Sustained Constant Load or a Sustained Constant Deformation

B.1.1 – Design Values for the Base Temperature of 73°F (23°C)

TABLE B.1.1
Apparent Elastic Modulus for 73°F (23°C)

Duration of Sustained Loading	Design Values For 73°F (23°C) [1,2,3]					
	PE 2XXX		PE3XXX		PE4XXX	
	psi	MPa	psi	MPa	psi	MPa
0.5hr	62,000	428	78,000	538	82,000	565
1hr	59,000	407	74,000	510	78,000	538
2hr	57,000	393	71,000	490	74,000	510
10hr	50,000	345	62,000	428	65,000	448
12hr	48,000	331	60,000	414	63,000	434
24hr	46,000	317	57,000	393	60,000	414
100hr	42,000	290	52,000	359	55,000	379
1,000hr	35,000	241	44,000	303	46,000	317
1 year	30,000	207	38,000	262	40,000	276
10 years	26,000	179	32,000	221	34,000	234
50 years	22,000	152	28,000	193	29,000	200
100 years	21,000	145	27,000	186	28,000	193

(1) Although there are various factors that determine the exact apparent modulus response of a PE, a major factor is its ratio of crystalline to amorphous content – a parameter that is reflected by a PE's density. Hence, the major headings PE2XXX, PE3XXX and, PE4XXX, which are based on PE's Standard Designation Code. The first numeral of this code denotes the PE's density category in accordance with ASTM D3350 (An explanation of this code is presented in Chapter 5).

(2) The values in this table are applicable to both the condition of sustained and constant loading (under which the resultant strain increases with increased duration of loading) and that of constant strain (under which an initially generated stress gradually relaxes with increased time).

(3) The design values in this table are based on results obtained under uni-axial loading, such as occurs in a test bar that is being subjected to a pulling load. When a PE is subjected to multi-axial stressing its strain response is inhibited, which results in a somewhat higher apparent modulus. For example, the apparent modulus of a PE pipe that is subjected to internal hydrostatic pressure – a condition that induces bi-axial stressing – is about 25% greater than that reported by this table. Thus, the Uni-axial condition represents a conservative estimate of the value that is achieved in most applications.

It should also be kept in mind that these values are for the condition of continually sustained loading. If there is an interruption or a decrease in the loading this, effectively, results in a somewhat larger modulus.

In addition, the values in this table apply to a stress intensity ranging up to about 400psi, a value that is seldom exceeded under normal service conditions.

B.1.2 – Values for Other Temperatures

The multipliers listed in Table B.1.2 when applied to the base temperature value (Table B.1.1) yield the value for another temperature.

TABLE B.1.2
Temperature Compensating Multipliers for Determination of the Apparent Modulus of Elasticity at Temperatures Other than at 73°F (23°C)
Equally Applicable to All Stress-Rated PE's (e.g., All PE2xxx's, All PE3xxx's and All PE4xxx's)

Maximum Sustained Temperature of the Pipe °F (°C)	Compensating Multiplier
-20 (-29)	2.54
-10 (-23)	2.36
0 (-18)	2.18
10 (-12)	2.00
20 (-7)	1.81
30 (-1)	1.65
40 (4)	1.49
50 (10)	1.32
60 (16)	1.18
73.4 (23)	1.00
80 (27)	0.93
90 (32)	0.82
100 (38)	0.73
110 (43)	0.64
120 (49)	0.58
130 (54)	0.50
140 (60)	0.43

select 0.64

$E = (28{,}000)(0.64) = 17{,}920$

Appendix C

Allowable Compressive Stress

Table C.1 lists allowable compressive stress values for 73°F (23°C). Values for allowable compressive stress for other temperatures may be determined by application of the same multipliers that are used for pipe pressure rating (See Table A.2).

TABLE C.1
Allowable Compressive Stress for 73°F (23°C)

<table>
<tr><td rowspan="7"></td><td colspan="6">Pe Pipe Material Designation Code (1)</td></tr>
<tr><td colspan="2">PE 2406</td><td colspan="2">PE3408</td><td colspan="2" rowspan="5">PE 4710</td></tr>
<tr><td colspan="2" rowspan="4">PE 2708</td><td colspan="2">PE 3608</td></tr>
<tr><td colspan="2">PE 3708</td></tr>
<tr><td colspan="2">PE 3710</td></tr>
<tr><td colspan="2">PE 4708</td></tr>
<tr><td>psi</td><td>MPa</td><td>psi</td><td>MPa</td><td>psi</td><td>MPa</td></tr>
<tr><td>Allowable Compressive Stress</td><td>800</td><td>5.52</td><td>1000</td><td>6.90</td><td>1150</td><td>7.93</td></tr>
</table>

(1) See Chapter 5 for an explanation of the PE Pipe Material Designation Code.

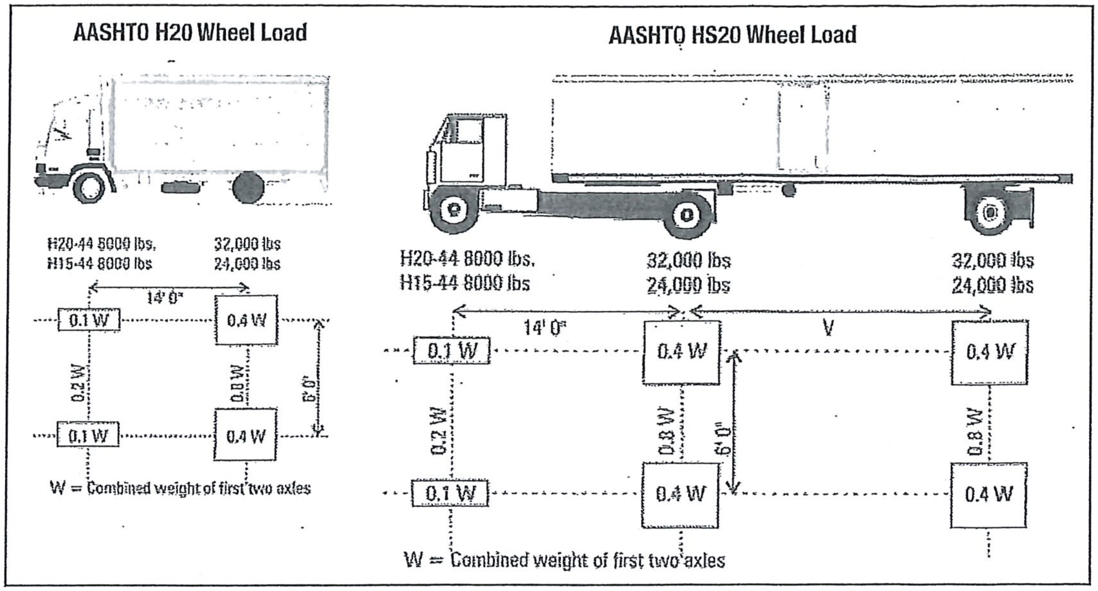


Figure 3-3 AASHTO H20 and HS20 Vehicle Loads

Boussinesq Equation

The Boussinesq Equation gives the pressure at any point in a soil mass under a concentrated surface load. The Boussinesq Equation may be used to find the pressure transmitted from a wheel load to a point that is not along the line of action of the load. Pavement effects are neglected.

(3-4)
$$P'_L = \frac{3 I_f W_w H^3}{2\pi r^5}$$

WHERE

P_L = vertical soil pressure due to live load lb/ft²

W_W = wheel load, lb

H = vertical depth to pipe crown, ft

I_f = impact factor

r = distance from the point of load application to pipe crown, ft

(3-5)
$$r = \sqrt{X^2 + H^2}$$

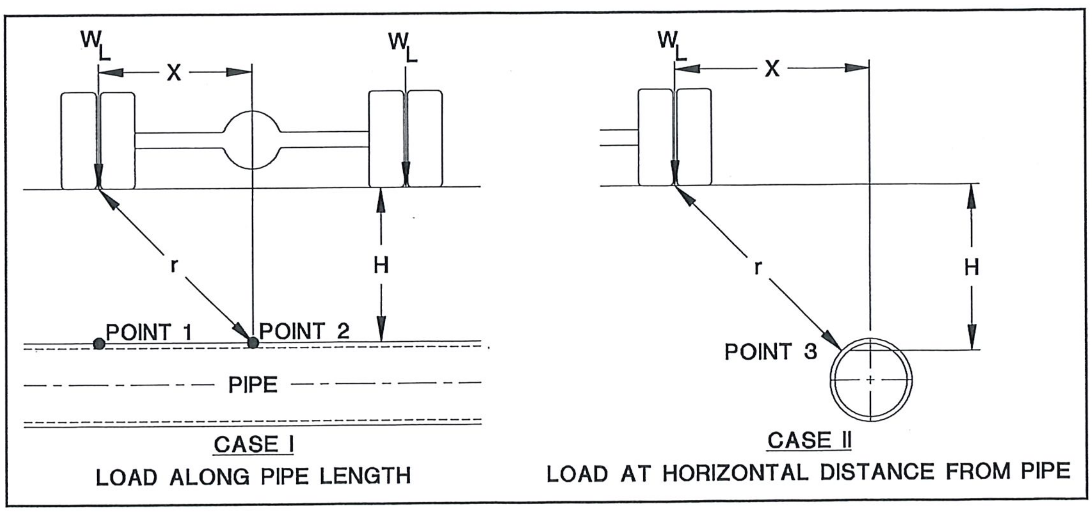


Figure 3-4 Illustration of Boussinesq Point Loading

Example Using Boussinesq Point Loading Technique

Determine the vertical soil pressure applied to a 12" pipe located 4 ft deep under a dirt road when two vehicles traveling over the pipe and in opposite lanes pass each other. Assume center lines of wheel loads are at a distance of 4 feet. Assume a wheel load of 16,000 lb.

TABLE 3-7
Values of E' for Pipe Embedment (See Howard [8])

Soil Type-pipe Embedment Material (Unified Classification System)[1]	E' for Degree of Embedment Compaction, lb/in^2			
	Dumped	Slight, <85% Proctor, <40% Relative Density	Moderate, 85%-95% Proctor, 40%-70% Relative Density	High, >95% Proctor, >70% Relative Density
Fine-grained Soils (LL > 50)[2] Soils with medium to high plasticity; CH, MH, CH-MH	No data available: consult a competent soils engineer, otherwise, use E' = 0.			
Fine-grained Soils (LL < 50) Soils with medium to no plasticity, CL, ML, ML-CL, with less than 25% coarse grained particles.	50	200	400	1000
Fine-grained Soils (LL < 50) Soils with medium to no plasticity, CL, ML, ML-CL, with more than 25% coarse grained particles; Coarse-grained Soils with Fines, GM, GC, SM, SC[3] containing more than 12% fines.	100	400	1000	2000
Coarse-grained soils with Little or No Fines GW, GP, SW, SP[3] containing less than 12% fines	200	1000	2000	3000
Crushed Rock	1000	3000	3000	3000
Accuracy in Terms of Percentage Deflection[4]	±2%	±2%	±1%	±0.5%

E'

[1] ASTM D-2487, USBR Designation E-3
[2] LL = Liquid Limit
[3] Or any borderline soil beginning with one of these symbols (i.e., GM-GC, GC-SC).
[4] For ±1% accuracy and predicted deflection of 3%, actual deflection would be between 2% and 4%.

Note: Values applicable only for fills less than 50 ft (15 m). Table does not include any safety factor. For use in predicting initial deflections only; appropriate Deflection Lag Factor must be applied for long-term deflections. If embedment falls on the borderline between two compaction categories, select lower E' value, or average the two values. Percentage Proctor based on laboratory maximum dry density from test standards using 12,500 ft-lb/cu ft (598,000 J/m^2) (ASTM D-698, AASHTO T-99, USBR Designation E-11). 1 psi = 6.9 KPa.

crown may completely reverse its curvature inward and collapse. See Figure 3-1A. A deflection limit of 7.5% provides at least a 3 to 1 safety factor against reverse curvature.

Bending strain occurs in the pipe wall as a result of ring deflection—outer-fiber tensile strain at the pipe springline and outer-fiber compressive strain at the crown and invert. While strain limits of 5% have been proposed, Jansen [12] reported that, on tests of PE pipe manufactured from pressure-rated resins and subjected to soil pressure only, "no upper limit from a practical design point of view seems to exist for the bending strain." In other words, as deflection increases, the pipe's performance limit will not be overstraining but reverse curvature collapse.

Thus, for non-pressure applications, a 7.5 percent deflection limit provides a large safety factor against instability and strain and is considered a safe design deflection. Some engineers will design profile wall pipe and other non-pressure pipe applications to a 5% deflection limit, but allow spot deflections up to 7.5% during field inspection.

The deflection limits for pressurized pipe are generally lower than for non-pressurized pipe. This is primarily due to strain considerations. Hoop strain from pressurization adds to the outer-fiber tensile strain. But the internal pressure acts to reround the pipe and, therefore, Eq. 3-10 overpredicts the actual long-term deflection for pressurized pipe. Safe allowable deflections for pressurized pipe are given in Table 3-11. Spangler and Handy [13] give equations for correcting deflection to account for rerounding.

TABLE 3-11
Safe Deflection Limits for Pressurized Pipe

DR or SDR	Safe Deflection as % of Diameter
32.5	7.5
26	7.5
21	7.5
17	6.0
13.5	6.0
11	5.0
9	4.0
7.3	3.0

* Based on Long-Term Design Deflection of Buried Pressurized Pipe given in ASTM F1962.

raised to a power. Therefore the lower the DR, the higher the resistance. Buried pipe has an added resistance due to support (or constraint) from the surrounding soil.

Non-pressurized pipes or gravity flow pipes are most likely to have a net compressive stress in the pipe wall and, therefore, the allowable buckling pressure should be calculated and compared to the total (soil and ground water) pressure. For most pressure pipe applications, the fluid pressure in the pipe exceeds the external pressure, and the net stress in the pipe wall is tensile. Buckling needs only be considered for that time the pipe is not under pressure, such as during and immediately after construction and during system shut-downs and, in cases in which a surge pressure event can produce a temporary negative internal pressure. Under these circumstances the pipe will react much stiffer to buckling as its modulus is higher under short term loading. When designing, select a modulus appropriate for the duration of the negative external pressure. For pipe that are subjected to negative pressure due to surge, consideration should be given to selecting a DR that gives the pipe sufficient unconstrained collapse strength to resist the full applied negative pressure without support for the soil. This is to insure against construction affects that result in the embedment material not developing its full design strength.

This chapter gives two equations for calculating buckling. The modified Luscher Equation is for buried pipes that are beneath the ground water level, subject to vacuum pressure, or under live load with a shallow cover. These forces act to increase even the slightest eccentricity in the pipe wall by following deformation inward. While soil pressure alone can create instability, soil is less likely to follow deformation inward, particularly if it is granular. So, dry ground buckling is only considered for deep applications and is given by the Moore-Selig Equation found in the section, "Buckling of Pipes in Deep, Dry Fills".

Luscher Equation for Constrained Buckling Below Ground Water Level

For pipes below the ground water level, operating under a full or partial vacuum, or subject to live load, Luscher's equation may be used to determine the allowable constrained buckling pressure. Equation 3-15 and 3-16 are for DR and profile pipe respectively.

(3-15)

$$P_{WC} = \frac{5.65}{N}\sqrt{RB'E'\frac{E}{12(DR-1)^3}}$$

(3-16)

$$P_{WC} = \frac{5.65}{N}\sqrt{RB'E'\frac{EI}{D_M^{\,3}}}$$

WHERE
P_{WC} = allowable constrained buckling pressure, lb/in²
N = safety factor

(3-17)
$$R = 1 - 0.33\frac{H_{GW}}{H}$$

WHERE
R = buoyancy reduction factor
H_{GW} = height of ground water above pipe, ft
H = depth of cover, ft

(3-18)
$$B' = \frac{1}{1 + 4e^{(-0.065H)}}$$

WHERE
e = natural log base number, 2.71828
E' = soil reaction modulus, psi
E = apparent modulus of elasticity, psi
DR = Dimension Ratio
I = pipe wall moment of inertia, in⁴/in ($t^3/12$, if solid wall construction)
D_M = Mean diameter ($D_I + 2z$ or $D_O - t$), in

Although buckling occurs rapidly, long-term external pressure can gradually deform the pipe to the point of instability. This behavior is considered viscoelastic and can be accounted for in Equations 3-15 and 3-16 by using the apparent modulus of elasticity value for the appropriate time and temperature of the loading. For instance, a vacuum event is resisted by the short-term value of the modulus whereas continuous ground water pressure would be resisted by the 50 year value. For modulus values see Appendix, Chapter 3.

For pipes buried with less than 4 ft or a full diameter of cover, Equations 3-15 and 3-16 may have limited applicability. In this case the designer may want to use Equations 3-39 and 3-40.

The designer should apply a safety factor commensurate with the application. A safety factor of 2.0 has been used for thermoplastic pipe.

The allowable constrained buckling pressure should be compared to the total vertical stress acting on the pipe crown from the combined load of soil, and ground water or floodwater. It is prudent to check buckling resistance against a ground water level for a 100-year-flood. In this calculation the total vertical stress is typically taken as the prism load pressure for saturated soil, plus the fluid pressure of any floodwater above the ground surface.

Determine the earth pressure coefficient:

$$K = \frac{1+\sin(30)}{1\text{-}\sin(30)} = \frac{1+0.5}{1-0.5} = 3.0$$

The live load pressure incipient to failure equals:

$$P_{WAT} = \frac{(12)120(3.0*3.0)^2}{40.04} + \frac{7387*0.171}{40.04^2(1.44)}(3000 - \frac{120(40.04)3.0}{288*0.470})$$

$$P_{WAT} = 2904 + 1584 = 4498 \ psf$$

The resulting safety factor equals:

$$N = \frac{P_{WAT}}{p_L} = \frac{4498}{1697} = 2.65$$

Installation Category #3: Deep Fill Installation

The performance limits for pipes in a deep fill are the same as for any buried pipe. They include:

1. Compressive ring thrust stress
2. Ring deflection
3. Constrained pipe wall buckling

The suggested calculation method for pipe in deep fill applications involves the introduction of design routines for each performance limit that are different than those previously given.

Compressive ring thrust is calculated using soil arching. The arching calculation may also be used for profile pipe designs in standard trench applications. Profile pipes are relatively low stiffness pipes where significant arching may occur at relatively shallow depths of cover.

At a depth of around 50 feet or so it becomes impractical to use Spangler's equation as published in this chapter because it neglects the significant load reduction due to arching and the inherent stiffening of the embedment and consequential increase in E' due to the increased lateral earth pressure applied to the embedment. This section gives an alternate deflection equation for use with PE pipes. It was first introduced by Watkins et al. (1) for metal pipes, but later Gaube extended its use to include PE pipes. (15)

Where deep fill applications are in dry soil, Luscher's equation (Eq. 3-15 or 3-16) may often be too conservative for design as it considers a radial driving force from ground water or vacuum. Moore and Selig[17] developed a constrained pipe wall buckling equation suitable for pipes in dry soils, which is given in a following section.

Considerable care should be taken in the design of deeply buried pipes whose failure may cause slope failure in earthen structures, or refuse piles or whose failure may have severe environmental or economical impact. These cases normally justify the use of methods beyond those given in this Chapter, including finite element analysis and field testing, along with considerable professional design review.

Compressive Ring Thrust and the Vertical Arching Factor

The combined horizontal and vertical earth load acting on a buried pipe creates a radially-directed compressive load acting around the pipe's circumference. When a PE pipe is subjected to ring compression, thrust stress develops around the pipe hoop, and the pipe's circumference will ever so slightly shorten. The shortening permits "thrust arching," that is, the pipe hoop thrust stiffness is less than the soil hoop thrust stiffness and, as the pipe deforms, less load follows the pipe. This occurs much like the vertical arching described by Marston.[18] Viscoelasticity enhances this effect. McGrath[19] has shown thrust arching to be the predominant form of arching with PE pipes.

Burns and Richard[6] have published equations that give the resulting stress occurring in a pipe due to arching. As discussed above, the arching is usually considered when calculating the ring compressive stress in profile pipes. For deeply buried pipes McGrath [19] has simplified the Burns and Richard's equations to derive a vertical arching factor as given by Equation 3-21.

(3-21)
$$VAF = 0.88 - 0.71\frac{S_A - 1}{S_A + 2.5}$$

WHERE

VAF = **Vertical Arching Factor**

S_A = **Hoop Thrust Stiffness Ratio**

(3-22)
$$S_A = \frac{1.43\, M_S\, r_{CENT}}{EA}$$

WHERE

r_{CENT}= **radius to centroidal axis of pipe, in**

M_s= **one-dimensional modulus of soil, psi**

E = **apparent modulus of elasticity of pipe material, psi (See Appendix, Chapter 3)**

A= **profile wall average cross-sectional area, in^2/in, or wall thickness (in) for DR pipe**

One-dimensional modulus values for soil can be obtained from soil testing, geotechnical texts, or Table 3-12 which gives typical values. The typical values in Table 3-12 were obtained by converting values from McGrath [20].

TABLE 3-12
Typical Values of M_S, One-Dimensional Modulus of Soil

Interpolate $M_S = 2610$ psi

Vertical Soil Stress¹ (psi)	Gravelly Sand/Gravels 95% Std. Proctor (psi)	Gravelly Sand/Gravels 90% Std. Proctor (psi)	Gravelly Sand/Gravels 85% Std. Proctor (psi)
10	3000	1600	550
20	3500	1800	650
40	4200	2100	800
60	5000	2500	1000
80	6000	2900	1300
100	6500	3200	1450

65.5 psi

* Adapted and extended from values given by McGrath[20]. For depths not shown in McGrath[20], the MS values were approximated using the hyperbolic soil model with appropriate values for K and n where n=0.4 and K=200, K=100, and K=45 for 95% Proctor, 90% Proctor, and 85% Proctor, respectively.

¹ Vertical Soil Stress (psi) = [soil depth (ft) x soil density (pcf)]/144

The radial directed earth pressure can be found by multiplying the prism load (pressure) by the vertical arching factor as shown in Eq. 3-23.

$$P_{RD} = (VAF)wH \tag{3-23}$$

WHERE
P_{RD} = **radial directed earth pressure, lb/ft²**
W = **unit weight of soil, pcf**
H = **depth of cover, ft**

The ring compressive stress in the pipe wall can be found by substituting P_{RD} from Equation 3-23 for P_E in Equation 3-13 for DR pipe and Equation 3-14 for profile wall pipe.

Earth Pressure Example

Determine the earth pressure acting on a 36" profile wall pipe buried 30 feet deep. The following properties are for one unique 36" profile pipe made from PE3608 material. Other 36" profile pipe may have different properties. The pipe's cross-sectional area, A, equals 0.470 inches²/inch, its radius to the centroidal axis is 18.00 inches plus 0.58 inches, and its apparent modulus is 27,000 psi. Its wall height is 2.02 in and its D_O equals 36 in +2 (2.02 in) or 40.04 in. Assume the pipe is installed in a clean granular soil compacted to 90% Standard Proctor (Ms = 1875 psi), the insitu soil is as stiff as the embedment, and the backfill weighs 120 pcf. (Where the excavation is in a stable trench, the stiffness of the insitu soil can generally be ignored in this calculation.) The following series of equations calculates the hoop compressive stress, S, in the pipe wall due to the earth pressure applied by the soil above the pipe. The earth pressure is reduced from the prism load by the vertical arching factor.

(From Equation 3-22)

$$S_A = \frac{1.43(1875\frac{lbs}{inch^2})(18.58\,inch)}{(28250\frac{lbs}{inch^2})(0.470\frac{inch^2}{inch})} = 3.93$$

(From Equation 3-21)

$$VAF = 0.88 - 0.71\frac{3.75-1}{3.75+2.5} = 0.56$$

(From Equation 3-23)

$$P_{RD} = 0.57(120\ pcf)(30\ ft) = 2016\frac{lb}{ft^2}$$

(From Equation 3-14)

$$S = \frac{P_{RD} D_O}{288 A} = \frac{2052\ psf(40.04\ in)}{288\ (0.470\ in^2\ /\ in)} = 596\ psi \le 1000\ psi$$

(Allowable compressive stress per Table C.1, Appendix to Chapter 3)

Ring Deflection of Pipes Using Watkins-Gaube Graph

R. Watkins[1] developed an extremely straight-forward approach to calculating pipe deflection in a fill that does not rely on E'. It is based on the concept that the deflection of a pipe embedded in a layer of soil is proportional to the compression or settlement of the soil layer and that the constant of proportionality is a function of the relative stiffness between the pipe and soil. Watkins used laboratory testing to establish and graph proportionality constants, called Deformation Factors, D_F, for the stiffness ranges of metal pipes. Gaube[15, 16] extended Watkins' work by testing to include PE pipes. In order to predict deflection, the designer first determines the amount of compression in the layer of soil in which the pipe is installed using conventional geotechnical equations. Then, deflection equals the soil compression multiplied by the D_F factor. This bypasses some of the inherent problems associated with using the soil reaction modulus, E', values. The designer using the Watkins-Gaube Graph (Figure 3-6) should select conservative soil modulus values to accommodate variance due to installation. Two other factors to consider when using this method is that it assumes a constant Deformation Factor independent of depth of cover and it does not address the effect of the presence of ground water on the Deformation Factor.

To use the Watkins-Gaube Graph, the designer first determines the relative stiffness between pipe and soil, which is given by the Rigidity Factor, R_F. Equation 3-24 and 3-25 are for DR pipe and for profile pipe respectively:

(3-24)
$$R_F = \frac{12\,E_S\,(DR-1)^3}{E}$$

(3-25)
$$R_F = \frac{E_S D_m^{\;3}}{EI}$$

WHERE

DR = **Dimension Ratio**

E_S = **Secant modulus of the soil, psi**

E = **Apparent modulus of elasticity of pipe material, psi**

I = **Pipe wall moment of inertia of pipe, in^4/in**

D_m = **Mean diameter (D_I + 2z or D_O – t), in**

The secant modulus of the soil may be obtained from testing or from a geotechnical engineer's evaluation. In lieu of a precise determination, the soil modulus may be related to the one-dimensional modulus, M_S, from Table 3-12 by the following equation where μ is the soil's Poisson ratio.

(3-26)
$$E_S = M_S \frac{(1+\mu)(1-2\mu)}{(1-\mu)}$$

TABLE 3-13
Typical range of Poisson's Ratio for Soil (Bowles [21])

Soil Type	Poisson's Ratio, μ
Saturated Clay	0.4-0.5
Unsaturated Clay	0.1-0.3
Sandy Clay	0.2-0.3
Silt	0.3-0.35
Sand (Dense)	0.2-0.4
Coarse Sand (Void Ratio 0.4-0.7)	0.15
Fine-grained Sand (Void Ratio 0.4-0.7)	0.25

Next, the designer determines the Deformation Factor, D_F, by entering the Watkins-Gaube Graph with the Rigidity Factor. See Fig. 3-6. The Deformation Factor is the proportionality constant between vertical deflection (compression) of the soil layer containing the pipe and the deflection of the pipe. Thus, pipe deflection can be obtained by multiplying the proportionality constant D_F times the soil settlement. If D_F is less than 1.0 in Fig. 3-6, use 1.0.

The soil layer surrounding the pipe bears the entire load of the overburden above it without arching. Therefore, settlement (compression) of the soil layer is proportional to the prism load and not the radial directed earth pressure. Soil strain, ε_S, may be determined from geotechnical analysis or from the following equation:

(3-27)

$$\varepsilon_S = \frac{wH}{144 E_S} (100)$$

Note the use of Eqn 3-27 on page 232.

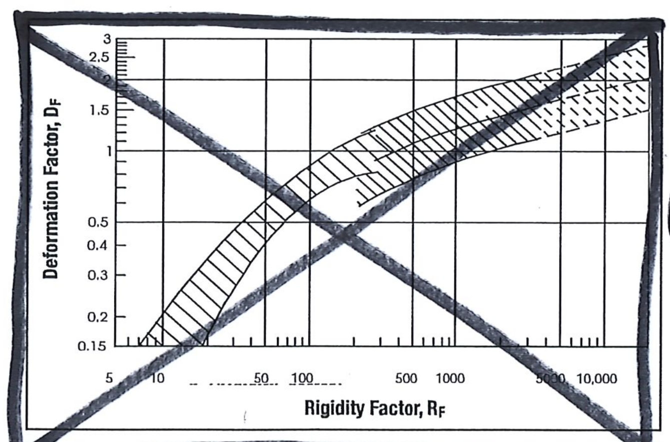
WHERE

w = unit weight of soil, pcf

H = depth of cover (height of fill above pipe crown), ft

E_S = secant modulus of the soil, psi

The designer can find the pipe deflection as a percent of the diameter by multiplying the soil strain, in percent, by the deformation factor:



SEE ATTACHED ENLARGED COPY

Figure 3-6 Watkins-Gaube Graph

(3-28)

$$\frac{\Delta X}{D_M}(100) = D_F \varepsilon_S$$

WHERE

$\Delta X/D_M$ multiplied by 100 gives percent deflection.

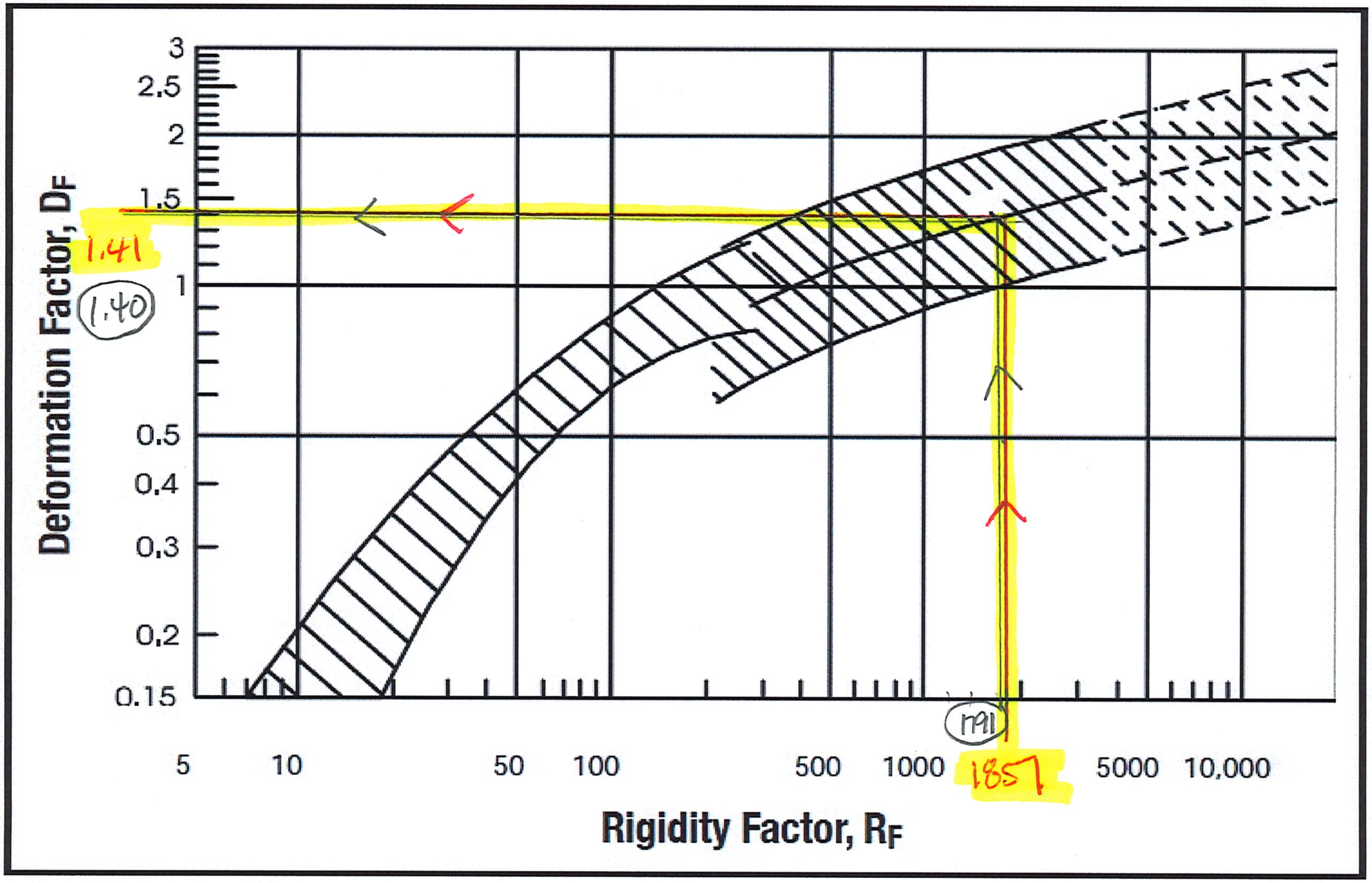


Figure 3-6 Watkins-Gaube Graph

Example of the Application of the Watkins-Gaube Calculation Technique

Find the deflection of a 6" SDR 11 pipe made from PE4710 materials under 140 ft of fill with granular embedment containing 12% or less fines, compacted at 90% of standard proctor. The fill weighs 75 pcf.

SOLUTION: First, calculate the vertical soil pressure equation, Eq. 3-1.

Eq. 3-1: $P_E = wH$

P_E **= (75lb/ft³)(140 ft)**

P_E **= 10,500 lb/ft² or 72.9 psi**

The M_S is obtained by interpolation from Table 3-12 and equals 2700. The secant modulus can be found assuming a Poisson's Ratio of 0.30.

$$E_S = \frac{2700\ psi(1+0.30)(1-2(0.30))}{(1-0.30)} = 2005\ psi$$

The rigidity factor is obtained from Equation 3-24.

$$R_F = \frac{12(2005)(11-1)^3}{29{,}000} = 830$$

Using Figure 3-6, the average value of the deformation factor is found to be 1.2. The soil strain is calculated by Equation 3-27.

$$\varepsilon_S = \frac{75pcf * 140ft}{144 * 2005\dfrac{lbs}{inch^2}} * 100 = 3.6\%$$

The deflection is found by multiplying the soil strain by the deformation factor:

$$\frac{\Delta X}{D_M}(100) = 1.2 * 3.6 = 4.4\%$$

Moore-Selig Equation for Constrained Buckling in Dry Ground

As discussed previously, a compressive thrust stress exists in buried pipe. When this thrust stress approaches a critical value, the pipe can experience a local instability or large deformation and collapse. In an earlier section of this chapter, Luscher's equation was given for constrained buckling under ground water. Moore and Selig[17] have used an alternate approach called the continuum theory to develop design equations for contrained buckling due to soil pressure (buckling of embedded pipes). The particular version of their equations given below is more appropriate for dry applications than Luscher's equation. Where ground water is present, Luscher's equation should be used.

ADVANCED GeoServices
a Montrose Environmental Group company

ATTACHMENT 10E

Peak Daily Flows from Each Cell

1. Purpose

The purpose of this analysis is to estimate the peak daily leachate volumes for each cell.

2. Analysis Approach

The HELP modeling for the project peak leachate flows based on a unit one acre. Values are provided for First Lift conditions, for floor and sideslope areas.

3. HELP Modeling Data

From the HELP modeling and analysis, the following peak daily unit leachate flow values were selected for design.

Active Landfill – Peak Daily Unit Leachate Flows				
Lift Condition	**Floor (cf/ac)**	***Floor (gal/ac)***	**Sideslope (cf/ac)**	***Sideslope (gal/ac)***
First Lift	1,300	*9,724*	1,655	*12,379*
Mid-Fill	1,011	*7,562*	1,001	*7,487*
Full-Fill	1,113	*8,325*	1,031	*7,712*

Also from, the HELP modeling and analysis, similar data for the Post-Closure Years 1 through 10 were provided. From this data, the following peak daily unit leachate values were selected for design.

Closed Landfill – Peak daily Unit Leachate Flows (Full-Fill Condition)				
Year	**Floor (cf/ac)**	***Floor (gal/ac)***	**Sideslope (cf/ac)**	***Sideslope (gal/ac)***
1	521	*3,897*	486	*3,635*
2	16	*120*	16	*120*
3	3	*22*	3	*22*
4	2	*15*	2	*15*
5	1	*7*	1	*7*
6	1	*7*	1	*7*
7	0	*0*	0	*0*
8	0	*0*	0	*0*
9	0	*0*	0	*0*
10	0	*0*	0	*0*

This data is now used with the respective acreage for each cell to calculate peak daily leachate flows from each cell. See attached Tables A and B.

Reviewed by PGS 08/28/2021

5. References

1. Project Design Information.

2. Related Project Design Calculations.

Revised by PGS 08/28/2021 for adjusted cell areas

TABLE A - PEAK DAILY UNIT LEACHATE FLOWS (GAL/AC-DAY)

Unit Flows	Active Landfill			Closed Landfill									
	First Lift Flow (gal/ac-day)	Mid-Fill Flow (gal/ac-day)	Full-Fill Flow (gal/ac-day)	Year 1 (gal/ac-day)	Year 2 (gal/ac-day)	Year 3 (gal/ac-day)	Year 4 (gal/ac-day)	Year 5 (gal/ac-day)	Year 6 (gal/ac-day)	Year 7 (gal/ac-day)	Year 8 (gal/ac-day)	Year 9 (gal/ac-day)	Year 10 (gal/ac-day)
Floor	9,724	7,562	8,325	3,897	120	22	15	7	7	0	0	0	0
Sideslope	12,379	7,487	7,712	3,635	120	22	15	7	7	0	0	0	0

TABLE B - PEAK LEACHATE FLOWS (GAL/DAY)

Cell		Size (ac)	Active Landfill			Closed Landfill									
			First Lift Flow (gal/day)	Mid-Fill Flow (gal/day)	Full-Fill Flow (gal/day)	Year 1 (gal/day)	Year 2 (gal/day)	Year 3 (gal/day)	Year 4 (gal/day)	Year 5 (gal/day)	Year 6 (gal/day)	Year 7 (gal/day)	Year 8 (gal/day)	Year 9 (gal/day)	Year 10 (gal/day)
1	*Floor:*	11.70	113,771	88,479	97,405	45,596	1,400	263	175	88	88	0	0	0	0
	Sideslope:	1.49	18,445	11,156	11,491	5,417	178	33	22	11	11	0	0	0	0
	Total:	**13.19**	**132,216**	**99,635**	**108,896**	**51,012**	**1,579**	**296**	**197**	**99**	**99**	**0**	**0**	**0**	**0**
2	*Floor:*	5.41	52,607	40,912	45,040	21,083	647	121	81	40	40	0	0	0	0
	Sideslope:	2.13	26,368	15,948	16,426	7,743	255	48	32	16	16	0	0	0	0
	Total:	**7.54**	**78,975**	**56,860**	**61,466**	**28,826**	**902**	**169**	**113**	**56**	**56**	**0**	**0**	**0**	**0**
3	*Floor:*	4.19	40,744	31,686	34,883	16,329	501	94	63	31	31	0	0	0	0
	Sideslope:	0.67	8,294	5,017	5,167	2,436	80	15	10	5	5	0	0	0	0
	Total:	**4.86**	**49,038**	**36,703**	**40,050**	**18,764**	**582**	**109**	**73**	**36**	**36**	**0**	**0**	**0**	**0**
4	*Floor:*	4.91	47,745	37,131	40,877	19,135	588	110	73	37	37	0	0	0	0
	Sideslope:	0.57	7,056	4,268	4,396	2,072	68	13	9	4	4	0	0	0	0
	Total:	**5.48**	**54,801**	**41,399**	**45,273**	**21,207**	**656**	**123**	**82**	**41**	**41**	**0**	**0**	**0**	**0**
5A	*Floor:*	3.94	38,313	29,795	32,801	15,354	472	88	59	29	29	0	0	0	0
	Sideslope:	1.72	21,293	12,878	13,264	6,253	206	39	26	13	13	0	0	0	0
	Total:	**5.66**	**59,605**	**42,674**	**46,066**	**21,607**	**677**	**127**	**85**	**42**	**42**	**0**	**0**	**0**	**0**

Revised by PGS 08/28/2021 for adjusted cell areas

TABLE B - PEAK LEACHATE FLOWS (GAL/AC) - CONT.

Cell		Size (ac)	Active Landfill			Closed Landfill									
			First Lift Flow (gal/day)	Mid-Fill Flow (gal/day)	Full-Fill Flow (gal/day)	Year 1 (cf/day)	Year 2 (cf/day)	Year 3 (cf/day)	Year 4 (cf/day)	Year 5 (cf/day)	Year 6 (cf/day)	Year 7 (cf/day)	Year 8 (cf/day)	Year 9 (cf/day)	Year 10 (cf/day)
5B	*Floor:*	2.40	23,338	18,149	19,981	9,353	287	54	36	18	18	0	0	0	0
	Sideslope:	0.97	12,008	7,263	7,481	3,526	116	22	15	7	7	0	0	0	0
	Total:	**3.37**	**35,346**	**25,412**	**27,461**	**12,879**	**403**	**76**	**50**	**25**	**25**	**0**	**0**	**0**	**0**
5C	*Floor:*	3.60	35,006	27,224	29,971	14,029	431	81	54	27	27	0	0	0	0
	Sideslope:	0.84	10,399	6,289	6,478	3,054	101	19	13	6	6	0	0	0	0
	Total:	**4.44**	**45,405**	**33,514**	**36,449**	**17,083**	**531**	**100**	**66**	**33**	**33**	**0**	**0**	**0**	**0**
5D	*Floor:*	2.36	22,949	17,847	19,648	9,197	282	53	35	18	18	0	0	0	0
	Sideslope:	0.51	6,313	3,819	3,933	1,854	61	11	8	4	4	0	0	0	0
	Total:	**2.87**	**29,262**	**21,666**	**23,581**	**11,051**	**343**	**64**	**43**	**21**	**21**	**0**	**0**	**0**	**0**
5E	*Floor:*	2.02	19,642	15,276	16,817	7,872	242	45	30	15	15	0	0	0	0
	Sideslope:	1.15	14,236	8,611	8,869	4,181	138	26	17	9	9	0	0	0	0
	Total:	**3.17**	**33,879**	**23,886**	**25,686**	**12,053**	**379**	**71**	**47**	**24**	**24**	**0**	**0**	**0**	**0**
5F	*Floor:*	1.01	9,821	7,638	8,408	3,936	121	23	15	8	8	0	0	0	0
	Sideslope:	0.57	7,056	4,268	4,396	2,072	68	13	9	4	4	0	0	0	0
	Total:	**1.58**	**16,877**	**11,906**	**12,804**	**6,008**	**189**	**35**	**24**	**12**	**12**	**0**	**0**	**0**	**0**
6	*Floor:*	2.01	19,545	15,200	16,734	7,833	241	45	30	15	15	0	0	0	0
	Sideslope:	3.17	39,243	23,735	24,447	11,524	379	71	47	24	24	0	0	0	0
	Total:	**5.18**	**58,788**	**38,935**	**41,180**	**19,357**	**620**	**116**	**77**	**39**	**39**	**0**	**0**	**0**	**0**
7	*Floor:*	2.21	21,490	16,713	18,399	8,613	264	50	33	17	17	0	0	0	0
	Sideslope:	4.47	55,336	33,469	34,472	16,250	535	100	67	33	33	0	0	0	0
	Total:	**6.68**	**76,826**	**50,182**	**52,871**	**24,862**	**799**	**150**	**100**	**50**	**50**	**0**	**0**	**0**	**0**
8	*Floor:*	4.64	45,119	35,089	38,629	18,082	555	104	69	35	35	0	0	0	0
	Sideslope:	1.39	17,207	10,408	10,720	5,053	166	31	21	10	10	0	0	0	0
	Total:	**6.03**	**62,327**	**45,497**	**49,349**	**23,135**	**722**	**135**	**90**	**45**	**45**	**0**	**0**	**0**	**0**
9	*Floor:*	2.59	25,185	19,586	21,562	10,093	310	58	39	19	19	0	0	0	0
	Sideslope:	1.30	16,093	9,734	10,025	4,726	156	29	19	10	10	0	0	0	0
	Total:	**3.89**	**41,278**	**29,320**	**31,588**	**14,819**	**466**	**87**	**58**	**29**	**29**	**0**	**0**	**0**	**0**

Revised by PGS 08/28/2021 for adjusted cell areas

TABLE B - PEAK LEACHATE FLOWS (GAL/AC) - CONT.

Cell		Size (ac)	Active Landfill First Lift Flow (gal/day)	Mid-Fill Flow (gal/day)	Full-Fill Flow (gal/day)	Closed Landfill Year 1 (cf/day)	Year 2 (cf/day)	Year 3 (cf/day)	Year 4 (cf/day)	Year 5 (cf/day)	Year 6 (cf/day)	Year 7 (cf/day)	Year 8 (cf/day)	Year 9 (cf/day)	Year 10 (cf/day)
10	*Floor:*	7.45	72,444	56,339	62,023	29,033	892	167	111	56	56	0	0	0	0
	Sideslope:	2.08	25,749	15,574	16,041	7,561	249	47	31	16	16	0	0	0	0
	Total:	**9.53**	**98,193**	**71,913**	**78,064**	**36,595**	**1,141**	**214**	**143**	**71**	**71**	**0**	**0**	**0**	**0**
11	*Floor:*	3.93	38,215	29,720	32,718	15,316	470	88	59	29	29	0	0	0	0
	Sideslope:	3.13	38,748	23,436	24,138	11,378	375	70	47	23	23	0	0	0	0
	Total:	**7.06**	**76,963**	**53,156**	**56,856**	**26,694**	**845**	**158**	**106**	**53**	**53**	**0**	**0**	**0**	**0**
12	*Floor:*	5.35	52,023	40,458	44,540	20,849	640	120	80	40	40	0	0	0	0
	Sideslope:	1.01	12,503	7,562	7,789	3,672	121	23	15	8	8	0	0	0	0
	Total:	**6.36**	**64,527**	**48,021**	**52,329**	**24,521**	**761**	**143**	**95**	**48**	**48**	**0**	**0**	**0**	**0**
13	*Floor:*	3.05	29,658	23,065	25,392	11,886	365	68	46	23	23	0	0	0	0
	Sideslope:	0.80	9,904	5,990	6,170	2,908	96	18	12	6	6	0	0	0	0
	Total:	**3.85**	**39,562**	**29,055**	**31,561**	**14,794**	**461**	**86**	**58**	**29**	**29**	**0**	**0**	**0**	**0**
14	*Floor:*	3.50	34,034	26,468	29,138	13,640	419	79	52	26	26	0	0	0	0
	Sideslope:	0.03	371	225	231	109	4	1	0	0	0	0	0	0	0
	Total:	**3.53**	**34,405**	**26,693**	**29,370**	**13,749**	**422**	**79**	**53**	**26**	**26**	**0**	**0**	**0**	**0**
15	*Floor:*	3.16	30,728	23,897	26,308	12,315	378	71	47	24	24	0	0	0	0
	Sideslope:	1.93	23,892	14,451	14,884	7,016	231	43	29	14	14	0	0	0	0
	Total:	**5.09**	**54,620**	**38,348**	**41,192**	**19,331**	**609**	**114**	**76**	**38**	**38**	**0**	**0**	**0**	**0**
16	*Floor:*	1.88	18,281	14,217	15,651	7,327	225	42	28	14	14	0	0	0	0
	Sideslope:	2.40	29,711	17,970	18,509	8,725	287	54	36	18	18	0	0	0	0
	Total:	**4.28**	**47,992**	**32,187**	**34,160**	**16,051**	**512**	**96**	**64**	**32**	**32**	**0**	**0**	**0**	**0**

ATTACHMENT 10F

Leachate Pump Sizing Calculations

1. Purpose

The purpose is to select the pumps to convey the leachate from the sump in each cell to the leachate storage areas. Pumping leachate out of the cells as it is generated reduces the head that accumulates in the liner system.

2. Analysis Approach

Pumps area sized based on the flow rate they need to convey, the head they have to overcome, and the size of the pipe. With this information and pump curves from pump manufacturers, select the pumps which will satisfy the design criteria.

2.1 Design Data: There are several sources of data.

1) Use Reference 1 for Cell IDs {column (a) on attached table} and to obtain the following information:
   a. Sump Invert Elevation {column (b) on attached table}
   b. Elevation of crest of perimeter berm at sump sideslope riser pipes {column (c) on attached table}
   c. Elevation at road at pumphouse {column (d) on attached table}
2) Use Reference 2 to determine to which leachate storage facility the leachate from each cell is discharged {column (g) on attached table}
3) Use Reference 3, obtain
   a. The elevation at the base of the receiving tank {column (e) on attached table}
   b. The elevation at the inflow pipe at the receiving tank {column (f) on attached table}
   c. The force main ID# conveying flow from cell to leachate storage facility {column (i) on attached table}
   d. The length of the force main between the cell and the leachate storage facility, by measuring the length with a scale{column (h) on attached table}
4) From Reference 4, obtain the peak daily leachate generation rates for each cell {column (j) on attached table}. Convert that rate from gallons per day (gpd) to gallons per minute (gpm) {column (k) on attached table}.

2.2 Calculate Head. Assuming a 6-inch force main will be installed, determine the static head (elevation difference between pump location and discharge location) and the dynamic head (Hazen-Williams)

1) Static head = Elevation of inflow pipe at Tank – sump invert
   (column f) – Column (b)

For Cell 1 --- Static Head = 207 – 100 = 107 feet

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Leachate Sump Pump Sizing		
	Job No. 2018-3854	Made by: VEF VEF	Date 7/14/20
	Ref. Ches Terrace	Checked by: TD	Sheet 2 of 2

Reviewed by PGS 08/28/2021

2) Use Hazen-Williams to estimate dynamic head (or friction loss in the conveyance pipe)

hf = 0.002083 x L x (100/C)^1.85 x (gpm^1.85 / d^4.8655)

where:
hf = head loss in feet of water
L = length of pipe in feet
C = friction coefficient
gpm = gallons per minute (USA gallons not imperial gallons)
d = inside diameter of the pipe in inches
C= 140 for PE pipe

For Cell 1, hf = 0.002083 x 2400 x (100/140)^(1.85) x ({91.8}^1.85)/(6^4.8655) = 1.9

3) Total head = static head + dynamic head. For Cell 1, total head = 107 + 1.9 = 108.9 ft

2.3 Pump Selection. Based on pump curves for sideslope riser pumps produced by EPG, review pump options across multiple series are available. Based on the range of peak flows and the range of head, consider the Series 9, 14, and 18 SurePump™ pumps. Plot the total head vs peak flow on the pump curves for each cell. Please reference to the attached pumps curves for Series 9 and Series 18 pumps.

3. Conclusions

Select the pump associated with the curve immediately above the plotted head vs flow rate for each pump. Since the Series 18 can handle the entire range of flow rates and heads, specific Series 18 pumps. The pump model and horsepower for each cell is listed on the attached summary table.

When these cells are constructed, based on field performance of these pumps, a different make or model may be preferable to the model specified for a variety of reason. The objective is to meet the flow rate vs head considerations. Further, as cells are close and leachate production drops, the operators may choose to downsize pumps to accommodate much reduced flow rates.

4. References

1) Drawings entitled "Top of Subgrade Grading Plan – West Section" and "Top of Subgrade Grading Plan – East Section," prepared by Advanced GeoServices Corp dated July 2020.
2) Drawings entitled "Leachate Collection System Grading Plan and Layout – West Section" and "Leachate Collection System Grading Plan and Layout – East Section," prepared by Advanced GeoServices Corp dated July 2020.
3) Drawing entitled "Leachate Storage Tank Details (Sheet 1 of 2)," prepared by Advanced GeoServices Corp dated July 2020.
4) Calculation entitled "Peak Daily Leachate Generation Rates," prepared by Advanced GeoServices Corp dated July 2020.
5) EPG Companies, Series 9, 14, and 18 SurePump™ pump curves.

July 2020
Rev Aug 2021

Project 2018-3854

Leachate Sump Pump SIzing Summary Table
Chesapeake Terrace Rubble Landfill, Odenton, Maryland

Cell or Sub-cell ID	Sump Invert Elevation (ft)	Elevation of Crest of Perimeter Berm (ft)	Perimeter Road at Sump (ft)	Elevation of Tank at Base (ft)	Elevation of Inflow Pipe at Tank (ft)	Leachate Storage Area	Length of Force Main (ft)	Force Main ID#	Peak Leachate Generation (gpd)	Peak Leachate Generation (gpm)	Static Head (ft)	Dynamic Head (ft)	Total Head (ft)	Selected Pump
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)
1	103.0	130	127	164	207	2	2400	2	132,340.0	91.9	104.0	1.9	105.9	Model 18-4 HP 5.0
2	88.0	118	102	92	135	1	780	3	78,506.0	54.5	47.0	0.2	47.2	Model 18-2 HP 3.0
3	100.0	110	82	92	135	1	1620	3	49,506.0	34.4	35.0	0.2	35.2	Model 18-1 HP 1.5
4	102.5	114	82	164	135	1	2000	3	55,075.0	38.2	32.5	0.3	32.8	Model 18-1 HP 1.5
5A	115.0	156	156	164	207	2	2200	1	56,844.0	39.5	92.0	0.4	92.4	Model 18-2 HP 3.0
5B	118.5	148	148	164	207	2	3000	1	34,389.0	23.9	88.5	0.2	88.7	Model 18-2 HP 3.0
5C	120.0	142	142	164	207	2	3345	1	45,405.0	31.5	87.0	0.4	87.4	Model 18-2 HP 3.0
5D	121.5	134	132	164	207	2	3800	1	30,855.0	21.4	85.5	0.2	85.7	Model 18-2 HP 3.0
5E	121.5	134	122	164	207	2	4100	1	33,507.0	23.3	85.5	0.3	85.8	Model 18-2 HP 3.0
5F	120.0	134	120	164	207	2	4500	1	28,340.0	19.7	87.0	0.2	87.2	Model 18-3 HP 5.0
6	109.0	174	174	164	207	2	1500	1	58,788.0	40.8	98.0	0.3	98.3	Model 18-3 HP 5.0
7	102.0	172	172	164	207	2	300	1	76,826.0	53.4	105.0	0.1	105.1	Model 18-3 HP 5.0
8	108.0	155	155	164	207	2	750	2	62,327.0	43.3	99.0	0.1	99.1	Model 18-3 HP 5.0
9	111.2	150	150	164	207	2	1100	2	42,348.0	29.4	95.8	0.1	95.9	Model 18-2 HP 3.0
10	103.0	140	140	164	207	2	1800	2	98,193.0	68.2	104.0	0.8	104.8	Model 18-3 HP 5.0
11	73.0	88	88	92	135	1	660	5	76,963.0	53.4	62.0	0.2	62.2	Model 18-2 HP 3.0
12	73.5	91	84	92	135	1	1425	5	67,806.0	47.1	61.5	0.3	61.8	Model 18-2 HP 3.0
13	77.0	88	84	92	135	1	2280	5	35,186.0	24.4	58.0	0.2	58.2	Model 18-1 HP 1.5
14	79.0	91	91	92	135	1	2880	5	42,609.0	29.6	56.0	0.3	56.3	Model 18-1 HP 1.5
15	82.0	102	102	92	135	1	3500	5	50,748.0	35.2	53.0	0.5	53.5	Model 18-2 HP 3.0
16	80.0	140	138	92	135	1	1250	4	50,131.0	34.8	55.0	0.2	55.2	Model 18-1 HP 1.5

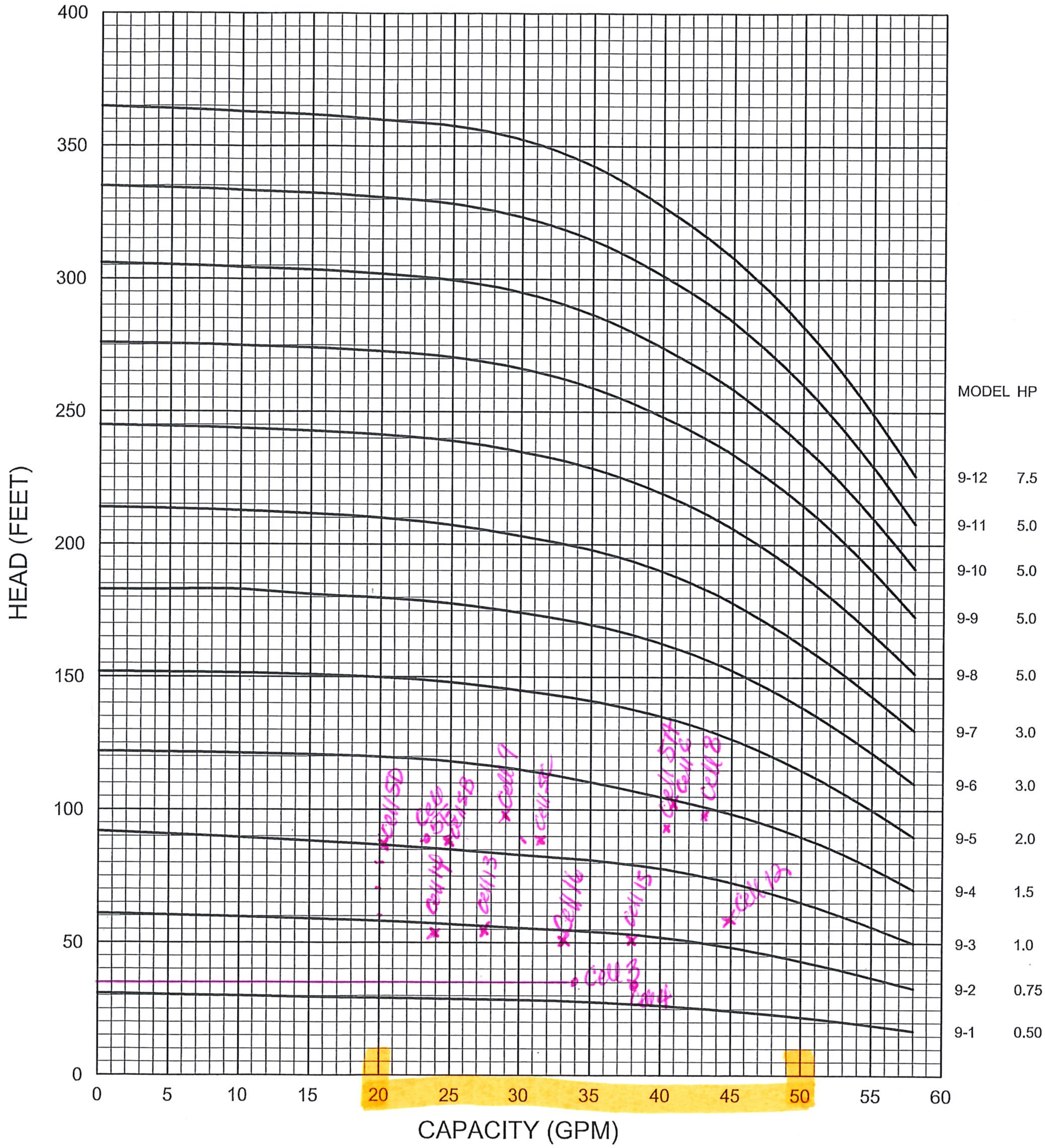
Revised for new Peak Leachate Generation by PGS 08/28/2021

0523

Series 9 SurePump™

Flow Range 20 - 50 GPM

60 Hz



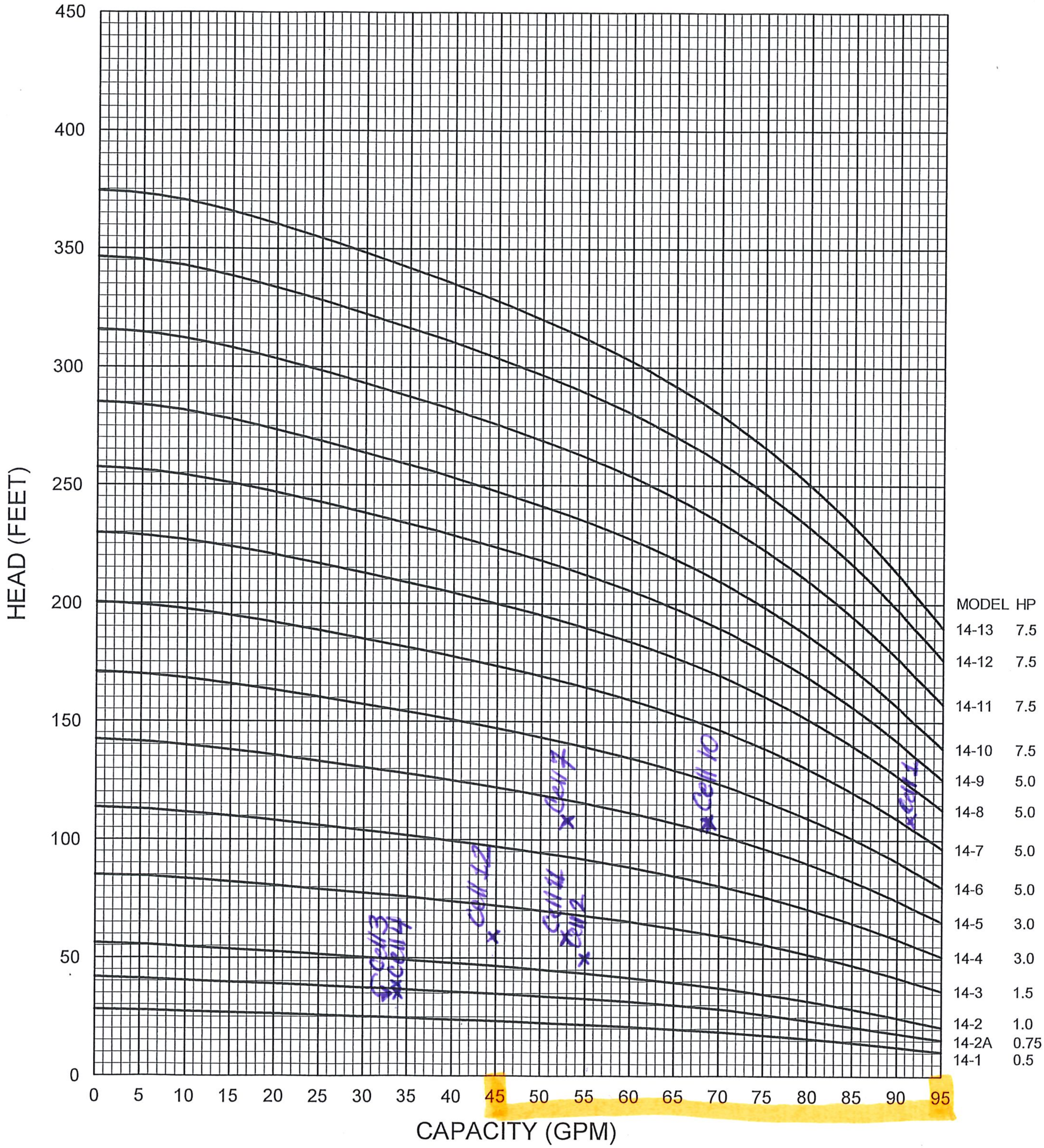
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

0817

Series 14 SurePump™

Flow Range 45 - 95 GPM

60 Hz



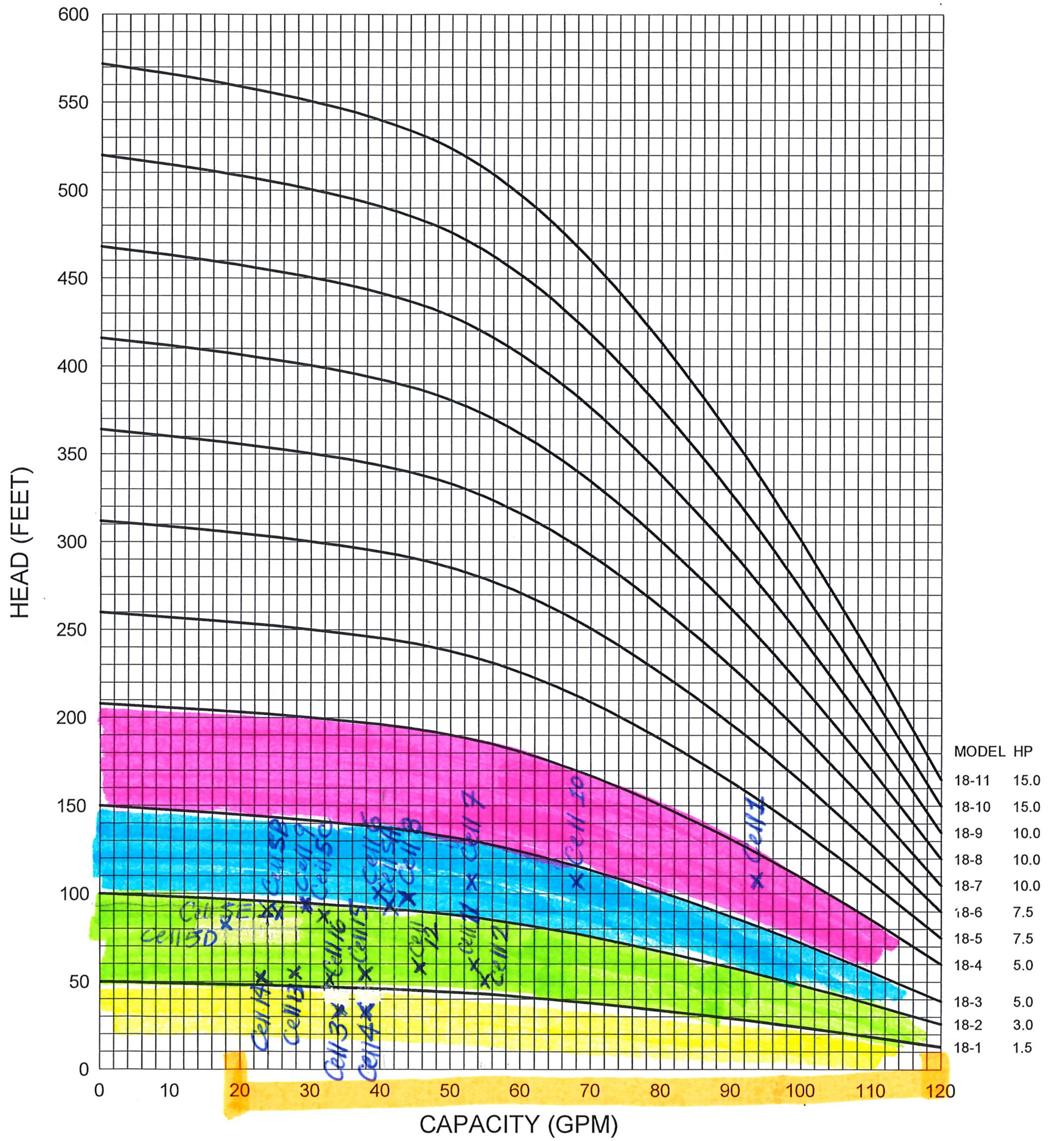
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

0817

Series 18 SurePump™

Flow Range 20-120 GPM

60 Hz



SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

ATTACHMENT 10G

Leachate Generation over Landfill Life

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Leachate Volume Estimates		
	Job No. 2018-3854	Made by: JCA	Date 07/17/20
	Ref.	Checked by: VEF	Sheet 1 of 4

Reviewed by PGS 08/28/2021

1. Purpose

The purpose of this analysis is to estimate the peak daily leachate volumes from the facility.

2. Analysis Approach

The HELP modeling for the project peak leachate flows based on a unit one acre. Values were provided for First Lift, Mid-Fill, Full-Fill, and Closed conditions, as well as for floor and sideslope areas. This data was used with the respective acreage for each cell to calculate peak daily leachate flows from each cell. The calculated flows are then used to develop a timeline to estimate the total peak daily flow from the facility.

3. Development of Leachate Timeline

1. Since the life of each cell is relatively brief (most a few months, some for two (2) years) planning for cell construction will require that multiple cells be "grouped together".

2. From the HELP modeling, each cell has peak daily flows for the First Lift, Mid-Fill, and Full-Fill conditions.

3. From the cell life estimates, each cell has an estimated life, and collectively they provide twelve (12) years of landfilling. For each cell, Mid-Fill is associated with Mid-Life, and Full-Fill is associated with maximum waste grades. Since each cell has a different life, each cell group will have a different total life.

4. The first cell is brought into service, and experiences the "First Lift" daily peak flow.

5. At mid-life in the first cell, the first cell experiences the "Mid-Life" peak daily flow. At the same time, the second cell in the group is brought into service, and experiences its "First Lift" peak daily flow.

6. At the Mid-Life of the second cell, it experiences its Mid-Life peak daily flow. At the same time, the third cell is brought into service with its "First Lift" peak daily flow.

7. At Mid-Life, the third cell experiences its "Mid-Fill" peak daily flow.

8. All of the cells in the group are presumed to experience their respective Full-Fill peak daily flows at the end of the total life for the group.

9. Between any of the calculated peak daily flows, between First Lift and Mid-Fill flows, and between Mid-Fill and Full-Fill flows, flow values were linearly interpolated.

10. A closure construction period of 10 months was assumed. Between the calculated flows for Full-Fill and Post-Closure Year 1, peak daily flows for each month were interpolated.

11. Flows during post-closure months between calculated values were interpolated.

12. This arrangement is continued for each cell, each cell group, and through a minimum of 10 years after the last cell is closed. The HELP model output shows that leachate continues for several years after closure, but eventually ceases.

As an example of how this approach is applied, consider the following:

Step 1: The first cell group includes Cells 11, 16, and 12, in that order.

Step 4: Cell 11 is brought into service, and it has an estimated life of 8 months. In Month 1, the flow is the First Lift peak daily flow.

Step 5: At Month 4, the flow from Cell 11 is the Mid-Fill peak daily flow. Cell 16 is brought into service with its First Lift peak daily flow. Cell 16 has an estimated life of 5 months.

Step 6: At month 6, the flow from Cell 11 continues. The flow from Cell 16 is at its Mid-Fill peak daily flow. Cell 12 is brought into service with its First Lift peak daily flow. Cell 12 has an estimated life of 5 months.

Step 7: At month 8, the flows from Cells 11 and 16 continue. The flow from Cell 12 is at its Mid-Fill peak daily flow.

Step 8: In month 18, all three cells experience their respective Full-Fill peak daily flows. Cell 13 is brought into service with its First Lift peak daily flow. Cell 13 is the first cell planned in the next group of cells to be constructed.

Step 10: During the subsequent 10 months after Cells 11, 16, and 12 have been completely filled, closure construction takes place. Leachate flow from these three cells continue. Filling occurs in the next group of cells with their leachate flows.

Step 11: Once closure of Cells 11, 16, and 12 is complete, the leachate flow begins to taper off. By Post-Closure Year 7, modeling indicates flow will have ceased. Concurrently, filling and leachate flow continues from the next group of cells.

During the timeline, monthly flows are summed to estimate the total peak daily leachate flow from the facility. At some point, the facility will experience a maximum total flow that will be a combination of peak daily flows from cells under different fill conditions – active filling, closure construction, and post-closure.

The attached Tables A provides a summary of peak daily flow each month for the 12-year life of the facility, and 10 years into post-closure. Groups of cells are arranged by the storage facility that will receive the leachate. The calculated flows are shown in **bold** font, and interpolated values are shown in regular font between those values. Black font is associated with the active landfilling years. Red font is associated with the closure construction time period. Green font is associated with the Post-Closure years.

For each month, the flows are summed to estimate the total flow from the facility. For the East leachate storage facility, the estimated peak daily volume is 254,933 gallons. For the West leachate storage facility, the estimated peak daily volume is 245,579 gallons.

8. References

1. Project Design Information.

2. Related Project Design Calculations.

Note by PGS08/28/2021: Calculations prepared to quantify peak daily leachate flows to leachate tanks over the operating life of the facility.

- The worst case flows to East tanks occurs when cells 11, 16 and 17 are fully capped, Cells 13,14 and 15 are being capped and cells 2, 3 and 4 are beginning operation.
- The worst case flows to West tanks occurs when Cells 1, 5E and 5F are about to start capping and Cell 10 is beginning operation.

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell

		Year 1												Year 2						
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7
Cell 11	8	**76,963**	69,027	61,091	**53,156**	53,420	53,684	53,948	54,212	54,476	54,740	55,004	55,268	55,532	55,796	56,060	56,324	56,588	**56,856**	53,840
Cell 16	5				**47,992**	40,089	**32,187**	32,351	32,515	32,679	32,843	33,007	33,171	33,335	33,499	33,663	33,827	33,991	**34,160**	32,349
Cell 12	5						**64,527**	56,274	**48,021**	48,452	48,883	49,314	49,745	50,176	50,607	51,038	51,469	51,900	**52,329**	48,753
Cell 13	3																		**39,562**	**29,005**
Cell 14	3																			**34,405**
Cell 15	5																			
Cell 2	8																			
Cell 3	5																			
Cell 4	4																			
Total Peak Daily Flow (gal)		**76,963**	**69,027**	**61,091**	**101,148**	**93,509**	**150,398**	**142,573**	**134,748**	**135,607**	**136,466**	**137,325**	**138,184**	**139,043**	**139,902**	**140,761**	**141,620**	**142,479**	**182,907**	**198,352**

Cell 1	27
Cell 5E	3
Cell 5F	
Cell 10	15
Cell 9	6
Cell 5D	2
Cell 5C	4
Cell 5B	4
Cell 8	9
Cell 5A	8
Cell 7	12
Cell 6	10
Total Peak Daily Flow (gal)	

LEACHATE TIMELINE

pg 2/13

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

											Year 3										
8	*9*	*10*	*11*	*12*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*1*	*2*	*3*	*4*	*5*
50,824	47,808	44,792	41,776	38,760	35,744	32,728	29,712	**26,694**	24,540	22,386	20,232	18,078	15,924	13,770	11,616	9,462	7,308	5,154	3,000	**845**	788
30,538	28,727	26,916	25,105	23,294	21,483	19,672	17,861	**16,051**	14,756	13,461	12,166	10,871	9,576	8,281	6,986	5,691	4,396	3,101	1,806	**512**	477
45,177	41,601	38,025	34,449	30,873	27,297	23,721	20,145	**16,568**	15,229	13,890	12,551	11,212	9,873	8,534	7,195	5,856	4,517	3,178	1,839	**500**	470
29,289	29,573	29,857	30,141	30,425	30,709	30,993	31,277	**31,561**	29,300	27,039	24,778	22,517	20,256	17,995	15,734	13,473	11,212	**8,947**	8,240	7,533	6,826
26,693	27,028	27,363	27,698	28,033	28,368	28,703	29,038	**29,370**	27,490	25,610	23,730	21,850	19,970	18,090	16,210	14,330	12,450	**10,574**	9,728	8,882	8,036
54,620	46,484	**38,348**	38,822	39,296	39,770	40,244	40,718	**41,192**	39,006	36,820	34,634	32,448	30,262	28,076	25,890	23,704	21,518	**19,331**	17,771	16,211	14,651
								78,975	71,603	64,231	**56,860**	57,214	57,568	57,922	58,276	58,630	58,984	59,338	59,692	60,046	60,400
											49,038	42,870	**36,703**	37,007	37,311	37,615	37,919	38,223	38,527	38,831	39,135
													54,801	48,100	**41,399**	41,829	42,259	42,689	43,119	43,549	43,979
237,141	**221,221**	**205,301**	**197,991**	**190,681**	**183,371**	**176,061**	**168,751**	**240,411**	**221,924**	**203,437**	**233,989**	**217,060**	**$\boxed{254,933}$**	**237,775**	**220,617**	**210,590**	**200,563**	**190,535**	**183,722**	**176,909**	**174,762**

LEACHATE TIMELINE

pg 3/13

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

Year 4							**Year 5**														
6	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
731	674	617	560	503	446	389	332	275	218	**158**	154	150	146	142	138	134	130	126	122	118	114
442	407	372	337	302	267	232	197	162	127	**96**	93	90	87	84	81	78	75	72	69	66	63
440	410	380	350	320	290	260	230	200	170	**143**	139	135	131	127	123	119	115	111	107	103	99
6,119	5,412	4,705	3,998	3,291	2,584	1,877	1,170	**461**	430	399	368	337	306	275	244	213	182	151	120	**86**	84
7,190	6,344	5,498	4,652	3,806	2,960	2,114	1,268	**423**	394	365	336	307	278	249	220	191	162	133	104	**79**	77
13,091	11,531	9,971	8,411	6,851	5,291	3,731	2,171	**609**	568	527	486	445	404	363	322	281	240	199	158	**114**	111
60,754	61,108	**61,466**	58,202	54,938	51,674	48,410	45,146	41,882	38,618	35,354	32,090	**28,826**	28,666	28,506	28,346	28,186	28,026	27,866	27,706	27,546	27,386
39,439	39,743	**40,050**	37,921	35,792	33,663	31,534	29,405	27,276	25,147	23,018	20,889	**18,764**	17,249	15,734	14,219	12,704	11,189	9,674	8,159	6,644	5,129
44,409	44,839	**45,273**	42,866	40,459	38,052	35,645	33,238	30,831	28,424	26,017	23,610	**21,207**	19,495	17,783	16,071	14,359	12,647	10,935	9,223	7,511	5,799
172,615	**170,468**	**168,332**	**157,297**	**146,262**	**135,227**	**124,192**	**113,157**	**102,119**	**94,096**	**86,077**	**78,165**	**70,261**	**66,762**	**63,263**	**59,764**	**56,265**	**52,766**	**49,267**	**45,768**	**42,267**	**38,862**
		132,216	129,710	127,204	124,698	122,192	119,686	117,180	114,674	112,168	109,662	107,156	104,650	102,144	**99,635**	100,214	100,793	101,372	101,951	102,530	103,109
															33,879	28,882	**23,886**	24,014	24,142	24,270	24,398
															16,877	14,391	**11,906**	11,970	12,034	12,098	12,162
		132,216	129,710	127,204	124,698	122,192	119,686	117,180	114,674	112,168	109,662	107,156	104,650	102,144	150,391	143,487	136,585	137,356	138,127	138,898	139,669

LEACHATE TIMELINE
Pg 4/13

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

Year 6									Year 7												
4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1
106	102	98	94	90	86	82	78	74	70	66	62	**53**	53	53	53	53	53	53	53	53	53
64	61	58	55	52	49	46	43	40	37	34	31	**32**	32	32	32	32	32	32	32	32	32
95	91	87	83	79	75	71	67	63	59	55	51	**48**	48	48	48	48	48	48	48	48	48
82	80	78	76	74	72	70	68	66	64	**57**	55	53	51	49	47	45	43	41	39	37	35
75	73	71	69	67	65	63	61	59	57	**53**	51	49	47	45	43	41	39	37	35	33	31
108	105	102	99	96	93	90	87	84	81	**76**	73	70	67	64	61	58	55	52	49	46	43
27,226	27,066	**902**	841	780	719	658	597	536	475	414	353	292	231	**169**	164	159	154	149	144	139	134
3,614	2,099	**582**	543	504	465	426	387	348	309	270	231	192	153	**109**	106	103	100	97	94	91	88
4,087	2,375	**656**	612	568	524	480	436	392	348	304	260	216	172	**123**	120	117	114	111	108	105	102
35,457	**32,052**	**2,634**	**2,472**	**2,310**	**2,148**	**1,986**	**1,824**	**1,662**	**1,500**	**1,329**	**1,167**	**1,005**	**854**	**692**	**674**	**656**	**638**	**620**	**602**	**584**	**566**
103,688	104,267	104,846	105,425	106,004	106,583	107,162	107,741	108,320	**108,896**	103,108	97,320	91,532	85,744	79,956	74,168	68,380	62,592	56,804	**51,012**	46,893	42,774
24,526	24,654	24,782	24,910	25,038	25,166	25,294	25,422	25,550	**25,686**	24,368	23,050	21,732	20,414	19,096	17,778	16,460	15,142	13,824	**12,053**	11,080	10,107
12,226	12,290	12,354	12,418	12,482	12,546	12,610	12,674	12,738	**12,804**	12,124	11,444	10,764	10,084	9,404	8,724	8,044	7,364	6,684	**6,008**	5,523	5,038
									98,193	94,439	90,685	86,931	83,177	79,423	75,669	**71,913**	72,386	72,859	73,332	73,805	74,278
																41,278	35,299	**29,320**	29,526	29,732	29,938
140,440	141,211	141,982	142,753	143,524	144,295	145,066	145,837	146,608	$\boxed{245,579}$	234,039	222,499	210,959	199,419	187,879	176,339	206,075	192,783	179,491	171,931	167,033	162,135

LEACHATE TIMELINE

pg 5/13

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

Year 8											Year 9										
2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
53	53	53	40	27	14	0															
32	32	32	24	16	8	0															
48	48	48	36	24	12	0															
28	28	28	28	28	28	28	28	28	28	28	28	28	28	21	14	7	0				
26	26	26	26	26	26	26	26	26	26	26	26	26	26	19	12	5	0				
38	38	38	38	38	38	38	38	38	38	38	38	38	38	29	20	11	0				
129	124	119	114	113	108	103	98	93	88	83	78	73	68	63	58	56	56	56	56	56	56
85	82	79	76	73	70	67	64	61	58	55	52	49	46	43	40	36	36	36	36	36	36
99	96	93	90	82	79	76	73	70	67	64	61	58	55	52	49	41	41	41	41	41	41
538	**527**	**516**	**472**	**427**	**383**	**338**	**327**	**316**	**305**	**294**	**283**	**272**	**261**	**227**	**193**	**156**	**133**	**133**	**133**	**133**	**133**
38,655	34,536	30,417	26,298	22,179	18,060	13,941	9,822	5,703	1,579	1,472	1,365	1,258	1,151	1,044	937	830	723	616	509	402	296
9,134	8,161	7,188	6,215	5,242	4,269	3,296	2,323	1,350	379	353	327	301	275	249	223	197	171	145	119	93	71
4,553	4,068	3,583	3,098	2,613	2,128	1,643	1,158	673	189	176	163	150	137	124	111	98	85	72	59	46	35
74,751	75,224	75,697	76,170	76,643	77,116	77,589	78,064	73,917	69,770	65,623	61,476	57,329	53,182	49,035	44,888	40,741	36,595	33,641	30,687	27,733	24,779
30,144	30,350	30,556	30,762	30,968	31,174	31,380	31,588	29,911	28,234	26,557	24,880	23,203	21,526	19,849	18,172	16,495	14,819	13,623	12,427	11,231	10,035
							29,262	21,666	21,879	22,092	22,305	22,518	22,731	22,944	23,157	23,370	23,581	22,328	21,075	19,822	18,569
								45,405	39,459	33,514	33,933	34,352	34,771	35,190	35,609	36,028	36,449	34,512	32,575	30,638	28,701
										35,346	30,379	25,412	25,822	26,232	26,642	27,052	27,461	26,003	24,545	23,087	21,629
																	62,327	58,120	53,913	49,706	45,497
																					59,605
157,237	152,339	147,441	142,543	137,645	132,747	127,849	152,217	178,625	161,489	185,133	174,828	164,523	159,595	154,667	149,739	144,811	202,211	189,060	175,909	162,758	209,217

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

	Year 10												Year 11								
12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9
56	56	56	56	56	56	56	42	28	14	0											
36	36	36	36	36	36	36	30	24	18	0											
41	41	41	41	41	41	41	31	21	11	0											
133	133	133	133	133	133	133	103	73	43	0											
288	280	272	264	256	248	240	232	224	216	208	197	189	181	173	165	157	149	141	133	125	117
69	67	65	63	61	59	57	55	53	51	49	47	45	43	41	39	37	35	33	31	29	27
34	33	32	31	30	29	28	27	26	25	24	24	23	22	21	20	19	18	17	16	15	14
21,825	18,871	15,917	12,963	10,009	7,055	4,101	1,141	1,064	987	910	833	756	679	602	525	448	371	294	214	208	202
8,839	7,643	6,447	5,251	4,055	2,859	1,663	466	435	404	373	342	311	280	249	218	187	156	125	87	85	83
17,316	16,063	14,810	13,557	12,304	11,051	10,164	9,277	8,390	7,503	6,616	5,729	4,842	3,955	3,068	2,181	1,294	403	375	347	319	291
26,764	24,827	22,890	20,953	19,016	17,083	15,704	14,325	12,946	11,567	10,188	8,809	7,430	6,051	4,672	3,293	1,914	531	495	459	423	387
20,171	18,713	17,255	15,797	14,339	12,879	11,826	10,773	9,720	8,667	7,614	6,561	5,508	4,455	3,402	2,349	1,296	243	229	215	201	187
45,818	46,139	46,460	46,781	47,102	47,423	47,744	48,065	48,386	48,707	49,028	49,349	46,728	44,107	41,486	38,865	36,244	33,623	31,002	28,381	25,760	23,135
53,961	48,317	42,674	43,051	43,428	43,805	44,182	44,559	44,936	45,313	45,690	46,066	43,620	41,174	38,728	36,282	33,836	31,390	28,944	26,498	24,052	21,607
											76,826	71,497	66,168	60,839	55,510	50,182	50,350	50,518	50,686	50,854	51,022
																58,788	52,170	45,552	38,935	39,108	39,281
195,085	180,953	166,822	158,711	150,600	142,491	135,709	128,920	126,180	123,440	120,700	194,783	180,949	167,115	153,281	139,447	184,402	169,439	157,725	146,002	141,179	136,353

LEACHATE TIMELINE
pg 7/13

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

			Year 12												***Year 13***						
10	***11***	***12***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***1***	***2***	***3***	***4***	***5***	***6***	***7***
109	**99**	99	99	99	99	99	99	99	99	99	99	99	**99**	74	49	24	**0**				
25	**24**	24	24	24	24	24	24	24	24	24	24	24	**24**	18	12	6	**0**				
13	**12**	12	12	12	12	12	12	12	12	12	12	12	**12**	9	6	3	**0**				
196	190	184	178	172	166	160	154	148	**143**	137	131	125	119	113	107	101	95	89	83	77	**71**
81	79	77	75	73	71	69	67	65	**58**	56	54	52	50	48	46	44	42	40	38	36	**29**
263	235	207	179	151	123	95	**64**	62	60	58	56	54	52	50	48	46	44	42	**43**	41	39
351	315	279	243	207	171	135	**100**	97	94	91	88	85	82	79	76	73	70	67	**66**	63	60
173	159	145	131	117	103	89	**76**	74	72	70	68	66	64	62	60	58	56	54	**50**	48	46
21,267	19,399	17,531	15,663	13,795	11,927	10,059	8,191	6,323	4,455	2,587	**722**	673	624	575	526	477	428	379	330	281	232
19,863	18,119	16,375	14,631	12,887	11,143	9,399	7,655	5,911	4,167	2,423	**677**	631	585	539	493	447	401	355	309	263	217
51,190	51,358	51,526	51,694	51,862	52,030	52,198	52,366	52,534	52,702	**52,871**	50,070	47,269	44,468	41,667	38,866	36,065	33,264	30,463	27,662	**24,862**	22,857
39,454	39,627	39,800	39,973	40,146	40,319	40,492	40,665	40,838	41,011	**41,180**	38,998	36,816	34,634	32,452	30,270	28,088	25,906	23,724	21,542	**19,357**	17,796
132,985	129,616	126,259	122,902	119,545	116,188	112,831	109,473	106,187	102,897	99,608	90,999	85,906	80,813	75,686	70,559	65,432	60,306	55,213	50,123	45,028	41,347

LEACHATE TIMELINE
pg 8/13

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

					Year 14																
8	***9***	***10***	***11***	***12***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***1***	***2***	***3***	***4***	***5***
71	71	71	71	71	71	71	71	71	71	71	**71**	53	35	17	**0**						
29	29	29	29	29	29	29	29	29	29	29	**29**	22	15	8	**0**						
37	35	33	31	29	27	25	23	21	**21**	21	21	21	21	21	21	21	21	21	21	21	**21**
57	54	51	48	45	42	39	36	33	**33**	33	33	33	33	33	33	33	33	33	33	33	**33**
44	42	40	38	36	34	32	30	28	**25**	25	25	25	25	25	25	25	25	25	25	25	**25**
183	**135**	131	127	123	119	115	111	107	103	99	95	91	**90**	86	82	78	74	70	66	62	58
171	**127**	124	121	118	115	112	109	106	103	100	97	94	**85**	81	77	73	69	65	61	57	53
20,852	18,847	16,842	14,837	12,832	10,827	8,822	6,817	4,812	2,807	**799**	745	691	637	583	529	475	421	367	313	259	205
16,235	14,674	13,113	11,552	9,991	8,430	6,869	5,308	3,747	2,186	**620**	578	536	494	452	410	368	326	284	242	200	158
37,679	34,014	30,434	26,854	23,274	19,694	16,114	12,534	8,954	5,378	1,797	1,694	1,566	1,435	1,306	1,177	1,073	969	865	761	657	553

LEACHATE TIMELINE
pg 9/13

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

Year 15							Year 16														
6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
16	11	6	**0**																		
25	17	9	**0**																		
19	13	7	**0**																		
54	50	46	**45**	45	45	45	45	45	45	45	45	45	45	45	**45**	34	23	12	**0**		
49	45	43	**42**	42	42	42	42	42	42	42	42	42	42	42	**42**	32	22	12	**0**		
150	112	109	106	103	100	97	94	91	88	85	82	**100**	96	92	88	84	80	76	72	68	64
116	113	110	107	104	101	98	95	92	89	86	83	**77**	74	71	68	65	62	59	56	53	50
429	361	330	300	294	288	282	276	270	264	258	252	264	257	250	243	215	187	159	128	121	114

LEACHATE TIMELINE
Pg 10/13

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

Year 17									Year 18												
4	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*1*
60	56	**50**	50	50	50	50	50	50	50	50	50	50	50	**50**	38	26	14	**0**	0	0	0
47	44	**39**	39	39	39	39	39	39	39	39	39	39	39	**39**	29	19	9	**0**	0	0	0
107	100	89	89	89	89	89	89	89	89	89	89	89	89	89	67	45	23	0	0	0	0

LEACHATE TIMELINE
pg 11/13

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

Year 19											Year 20										
2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LEACHATE TIMELINE
pg 12/13

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

	Year 21												Year 22								
12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LEACHATE TIMELINE
pg 13/13

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

10	**11**	**12**
0	0	0
0	0	0
0	0	0

ADVANCED GeoServices
a Montrose Environmental Group company

ATTACHMENT 10H

Leachate Storage Facility Secondary Containment

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Leachate Tanks Secondary Containment		
	Job No. 2018-3854	Made by: VEF VEF	Date 7/8/20
	Ref. Ches Terrace	Checked by: TD TD	Sheet 1 of 2

Reviewed by PGS 08/29/2021

1. Purpose

The purpose of these calculations is to determine the minimum dimensions of the secondary containment areas associated with the leachate storage areas.

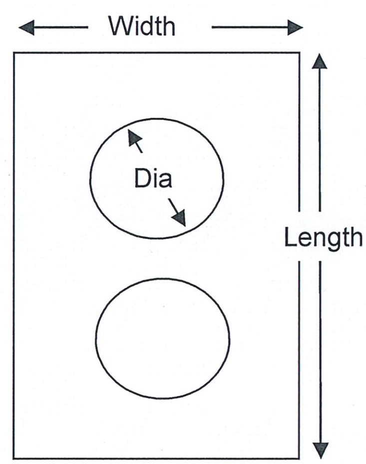
2. Analysis Approach

While 40 CFR 112.8(c)(2) is specifically applicable to containment for petroleum and non-petroleum oils, the purpose of the regulation is to prevent pollution. As such, we consider it relevant and appropriate for determining minimum secondary containment storage for the leachate tanks. 40CFR112.8 requires above-ground-tank secondary containment storage to contain the volume of the largest tank plus sufficient freeboard for precipitation.

2.1 Design Data: This is a function of tank size and the geometry of the secondary containment dimensions.

TABLE 1 – Design Data	
Parameter	**Value**
Tank Storage	500,000 gallons
Number of tank per storage area	Two
Diameter of tanks	45 feet
Length of Containment Area	140 feet*
Length available for secondary containment	138 feet
Width of Containment Area	80 feet*
Width available for secondary containment	78 feet

* assume concrete wall thickness of 1 foot for each wall



2.2 Calculation: The three liner systems were simulated for a five year, under first lift conditions, with the following results:

Volume = Area x D, where

Volume = 500,000 gallons x (1 c.f./7.48 gallons)
= 66844.9 c.f.

Area = (LxW) – π x(Dia/2)^2
= (140 x 80) - π x(45/2)^2
= 11,200 – 1589.6 s.f.
= 9610.4 s.f.

Depth = d (desired value)

Substituting, 66,844.9 c.f. = 9,610 s.f. x d

Solving for d: d = 66,844.9/9610 = 6.96 ft

This assumes the entire space is open and available for storage, despite piping, stairs, and other access mechanisms, which occupy the same space. The precipitation depth that is usually applied in this application is the rainfall associated with a 25-year, 24 hour storm event – or 5.9 inches of rain per NOAA. Due to the nature of this facility, we recommend using the rainfall associated with a 100-year, 24 hour storm event – or 8.5 inches of rain per NOAA.

This provides a minimum required depth of 6.96 ft plus 8.5 inches for rainfall = 7.7 feet This does not provide any freeboard however. Adding a foot of freeboard, an adjusted minimum depths of 8.7 feet is required.

4. Conclusions

Based on the foregoing, a leachate secondary containment area measuring 140 ft x 80 ft x 9 feet deep is recommended.

discussion of conformance with the applicable requirements and other effective discharge prevention and containment procedures listed in this part or any applicable more stringent State rules, regulations, and guidelines.

Subpart B—Requirements for Petroleum Oils and Non-Petroleum Oils, Except Animal Fats and Oils and Greases, and Fish and Marine Mammal Oils; and Vegetable Oils (Including Oils from Seeds, Nuts, Fruits, and Kernels)

SOURCE: 67 FR 47146, July 17, 2002, unless otherwise noted.

§ 112.8 Spill Prevention, Control, and Countermeasure Plan requirements for onshore facilities (excluding production facilities).

If you are the owner or operator of an onshore facility (excluding a production facility), you must:

(a) Meet the general requirements for the Plan listed under § 112.7, and the specific discharge prevention and containment procedures listed in this section.

(b) *Facility drainage.* (1) Restrain drainage from diked storage areas by valves to prevent a discharge into the drainage system or facility effluent treatment system, except where facility systems are designed to control such discharge. You may empty diked areas by pumps or ejectors; however, you must manually activate these pumps or ejectors and must inspect the condition of the accumulation before starting, to ensure no oil will be discharged.

(2) Use valves of manual, open-and-closed design, for the drainage of diked areas. You may not use flapper-type drain valves to drain diked areas. If your facility drainage drains directly into a watercourse and not into an onsite wastewater treatment plant, you must inspect and may drain uncontaminated retained stormwater, as provided in paragraphs (c)(3)(ii), (iii), and (iv) of this section.

(3) Design facility drainage systems from undiked areas with a potential for a discharge (such as where piping is located outside containment walls or where tank truck discharges may occur outside the loading area) to flow into ponds, lagoons, or catchment basins designed to retain oil or return it to the facility. You must not locate catchment basins in areas subject to periodic flooding.

(4) If facility drainage is not engineered as in paragraph (b)(3) of this section, equip the final discharge of all ditches inside the facility with a diversion system that would, in the event of an uncontrolled discharge, retain oil in the facility.

(5) Where drainage waters are treated in more than one treatment unit and such treatment is continuous, and pump transfer is needed, provide two "lift" pumps and permanently install at least one of the pumps. Whatever techniques you use, you must engineer facility drainage systems to prevent a discharge as described in § 112.1(b) in case there is an equipment failure or human error at the facility.

(c) *Bulk storage containers.* (1) Not use a container for the storage of oil unless its material and construction are compatible with the material stored and conditions of storage such as pressure and temperature.

(2) Construct all bulk storage container installations so that you provide a secondary means of containment for the entire capacity of the largest single container and sufficient freeboard to contain precipitation. You must ensure that diked areas are sufficiently impervious to contain discharged oil. Dikes, containment curbs, and pits are commonly employed for this purpose. You may also use an alternative system consisting of a drainage trench enclosure that must be arranged so that any discharge will terminate and be safely confined in a facility catchment basin or holding pond.

(3) Not allow drainage of uncontaminated rainwater from the diked area into a storm drain or discharge of an effluent into an open watercourse, lake, or pond, bypassing the facility treatment system unless you:

(i) Normally keep the bypass valve sealed closed.

(ii) Inspect the retained rainwater to ensure that its presence will not cause a discharge as described in § 112.1(b).

(iii) Open the bypass valve and reseal it following drainage under responsible supervision; and

(iv) Keep adequate records of such events, for example, any records required under permits issued in accordance with §§ 122.41(j)(2) and 122.41(m)(3) of this chapter.

(4) Protect any completely buried metallic storage tank installed on or after January 10, 1974 from corrosion by coatings or cathodic protection compatible with local soil conditions. You must regularly leak test such completely buried metallic storage tanks.

(5) Not use partially buried or bunkered metallic tanks for the storage of oil, unless you protect the buried section of the tank from corrosion. You must protect partially buried and bunkered tanks from corrosion by coatings or cathodic protection compatible with local soil conditions.

(6) Test each aboveground container for integrity on a regular schedule, and whenever you make material repairs. The frequency of and type of testing must take into account container size and design (such as floating roof, skid-mounted, elevated, or partially buried). You must combine visual inspection with another testing technique such as hydrostatic testing, radiographic testing, ultrasonic testing, acoustic emissions testing, or another system of non-destructive shell testing. You must keep comparison records and you must also inspect the container's supports and foundations. In addition, you must frequently inspect the outside of the container for signs of deterioration, discharges, or accumulation of oil inside diked areas. Records of inspections and tests kept under usual and customary business practices will suffice for purposes of this paragraph.

(7) Control leakage through defective internal heating coils by monitoring the steam return and exhaust lines for contamination from internal heating coils that discharge into an open watercourse, or pass the steam return or exhaust lines through a settling tank, skimmer, or other separation or retention system.

(8) Engineer or update each container installation in accordance with good engineering practice to avoid discharges. You must provide at least one of the following devices:

(i) High liquid level alarms with an audible or visual signal at a constantly attended operation or surveillance station. In smaller facilities an audible air vent may suffice.

(ii) High liquid level pump cutoff devices set to stop flow at a predetermined container content level.

(iii) Direct audible or code signal communication between the container gauger and the pumping station.

(iv) A fast response system for determining the liquid level of each bulk storage container such as digital computers, telepulse, or direct vision gauges. If you use this alternative, a person must be present to monitor gauges and the overall filling of bulk storage containers.

(v) You must regularly test liquid level sensing devices to ensure proper operation.

(9) Observe effluent treatment facilities frequently enough to detect possible system upsets that could cause a discharge as described in § 112.1(b).

(10) Promptly correct visible discharges which result in a loss of oil from the container, including but not limited to seams, gaskets, piping, pumps, valves, rivets, and bolts. You must promptly remove any accumulations of oil in diked areas.

(11) Position or locate mobile or portable oil storage containers to prevent a discharge as described in § 112.1(b). You must furnish a secondary means of containment, such as a dike or catchment basin, sufficient to contain the capacity of the largest single compartment or container with sufficient freeboard to contain precipitation.

(d) *Facility transfer operations, pumping, and facility process.* (1) Provide buried piping that is installed or replaced on or after August 16, 2002, with a protective wrapping and coating. You must also cathodically protect such buried piping installations or otherwise satisfy the corrosion protection standards for piping in part 280 of this chapter or a State program approved under part 281 of this chapter. If a section of buried line is exposed for any reason, you must carefully inspect it for deterioration. If you find corrosion damage, you must undertake additional examination and corrective action as indicated by the magnitude of the damage.

(2) Cap or blank-flange the terminal connection at the transfer point and mark it as to origin when piping is not in service or is in standby service for an extended time.

(3) Properly design pipe supports to minimize abrasion and corrosion and allow for expansion and contraction.

(4) Regularly inspect all aboveground valves, piping, and appurtenances. During the inspection you must assess the general condition of items, such as flange joints, expansion joints, valve glands and bodies, catch pans, pipeline supports, locking of valves, and metal surfaces. You must also conduct integrity and leak testing of buried piping at the time of installation, modification, construction, relocation, or replacement.

(5) Warn all vehicles entering the facility to be sure that no vehicle will endanger aboveground piping or other oil transfer operations.

§ 112.9 Spill Prevention, Control, and Countermeasure Plan requirements for onshore oil production facilities.

If you are the owner or operator of an onshore production facility, you must:

(a) Meet the general requirements for the Plan listed under § 112.7, and the specific discharge prevention and containment procedures listed under this section.

(b) *Oil production facility drainage.* (1) At tank batteries and separation and treating areas where there is a reasonable possibility of a discharge as described in § 112.1(b), close and seal at all times drains of dikes or drains of equivalent measures required under § 112.7(c)(1), except when draining uncontaminated rainwater. Prior to drainage, you must inspect the diked area and take action as provided in § 112.8(c)(3)(ii), (iii), and (iv). You must remove accumulated oil on the rainwater and return it to storage or dispose of it in accordance with legally approved methods.

(2) Inspect at regularly scheduled intervals field drainage systems (such as drainage ditches or road ditches), and oil traps, sumps, or skimmers, for an accumulation of oil that may have resulted from any small discharge. You must promptly remove any accumulations of oil.

(c) *Oil production facility bulk storage containers.* (1) Not use a container for the storage of oil unless its material and construction are compatible with the material stored and the conditions of storage.

(2) Provide all tank battery, separation, and treating facility installations with a secondary means of containment for the entire capacity of the largest single container and sufficient freeboard to contain precipitation. You must safely confine drainage from undiked areas in a catchment basin or holding pond.

(3) Periodically and upon a regular schedule visually inspect each container of oil for deterioration and maintenance needs, including the foundation and support of each container that is on or above the surface of the ground.

(4) Engineer or update new and old tank battery installations in accordance with good engineering practice to prevent discharges. You must provide at least one of the following:

(i) Container capacity adequate to assure that a container will not overfill if a pumper/gauger is delayed in making regularly scheduled rounds.

(ii) Overflow equalizing lines between containers so that a full container can overflow to an adjacent container.

(iii) Vacuum protection adequate to prevent container collapse during a pipeline run or other transfer of oil from the container.

(iv) High level sensors to generate and transmit an alarm signal to the computer where the facility is subject to a computer production control system.

(d) *Facility transfer operations, oil production facility.* (1) Periodically and upon a regular schedule inspect all aboveground valves and piping associated with transfer operations for the general condition of flange joints, valve glands and bodies, drip pans, pipe supports, pumping well polish rod stuffing boxes, bleeder and gauge valves, and other such items.

(2) Inspect saltwater (oil field brine) disposal facilities often, particularly

ATTACHMENT 10I

Sideslope Riser & Force Main Loading Calculations

CHEASAPEAKE TERRACE RUBBLE LANDFILL
FORCE MAIN PIPE SELECTION
[for Century Engineering]

JCO
10-25-05

Design Criteria:
- 5 Separate Forcemains
- 16 Pumps/ Cells
- Use 6" HDPE SDR 11 Pipe
- Assume all pumps running/ full flow
- Use 2" or 3" pipe inside riser
- Top of riser for Pumps 1 & 16 located above top of tank

- Pump manufacturer's "Cell Pump List" for 16 cells and the following data were furnished by Century:

[Pump #]	[Static Head, ft.]	[Design Flow, GPM]	[Pipe Length, ft.]	[Pipe Size, in.]
1	28.5	50 {44 Actual}	1048	6
2	18.5	50 {29 " }	1135	6
3	48.5	100 {65 " }	2231	6
4	48.0	100 {73 " }	3058	6
5	119	100 {109 " }	688	6
6	118.5	50 {44 " }	1088	6
7	119.5	100 {94 " }	1306	6
8	117	50 {51 " }	1977	6
9	117	50 {44 " }	2909	6
10	117	100 {80 " }	3431	6
11	48.5	50 {51 " }	706	6
12	45.0	50 {44 " }	1587	6
13	45.5	50 {29 " }	2316	6
14	43.5	50 {36 " }	2962	6
15	42.0	50 {36 " }	3556	6
16	56.5	50 {29 " }	1305	6

Friction loss will be calculated using the following equation:
The Hazen-Williams formula
Ff = .2083 x [Q]1.85/ [d]4.8655 x [100/ C]1.85

Where: Ff = friction loss, ft./ 100 ft.
Q = flow, GPM
d = pipe I.D., in.
C = flow coefficient, use 150 for HDPE pipe
Therefore, Ff = .2083 x [Q]1.85/ [d]4.8655 x .47

6" SDR 11/ I.D. = 5.35 in.
3" SDR 11/ I.D. = 2.83 in.
2" SDR 11/ I.D. = 1.92 in.

[Forcemain #1]

{Pump #1}
- 6" Pipe @ 520 l.f. w/ 50 GPM, Ff = .2
- 6" Pipe @ 528 l.f. w/ 300 GPM, Ff = 5.6
- 2" Pipe @ 64 l.f. w/ 50 GPM, Ff = 3.6

Total TDH = 28.5 + .2 + 5.6 + 3.6 = 37.9

{Pump #2}
- 6" Pipe @ 609 l.f. w/ 250 GPM, Ff = 4.7
- 6" Pipe @ 526 l.f. w/ 300 GPM, Ff = 5.6
- 2" Pipe @ 20 l.f. w/ 50 GPM, Ff = 1.1

Total TDH = 18.5 + 4.7 + 5.6 + 1.1 = 29.9

{Pump #3}
- 6" Pipe @ 1096 l.f. w/ 200 GPM, Ff = 5.6
- 6" Pipe @ 609 l.f. w/ 250 GPM, Ff = 4.7
- 6" Pipe @ 526 l.f. w/ 300 GPM, Ff = 5.6
- 2" Pipe @ 42 l.f. w/ 50 GPM, Ff = 8.6

Total TDH = 48.5 + 5.6 + 4.7 + 5.6 + 8.6 = 73.0

{Pump #4}
- 6" Pipe @ 827 l.f. w/ 100 GPM, Ff = 1.2
- 6" Pipe @ 1096 l.f. w/ 200 GPM, Ff = 5.6
- 6" Pipe @ 512 l.f. w/ 250 GPM, Ff = 4.7
- 6" Pipe @ 526 l.f. w/ 300 GPM, Ff = 5.6
- 2" Pipe @ 94 l.f. w/ 100 GPM, Ff = 19.3

Total TDH = 48 + 1.2 + 5.6 + 4.7 + 5.6 + 19.3 = 84.4

[Forcemain #2]

{Pump #5}
- 6" Pipe @ 688 l.f. w/ 250 GPM, Ff = 5.3
- 3" Pipe @ 187 l.f. w/ 100 GPM, Ff = 5.8

Total TDH = 119 + 5.3 + 5.8 = 130.1

{Pump #6}
- 6" Pipe @ 400 l.f. w/ 150 GPM, Ff = 1.2
- 6" Pipe @ 688 l.f. w/ 250 GPM, Ff = 5.3
- 2" Pipe @ 175 l.f. w/ 50 GPM, Ff = 10.0

Total TDH = 118.5 + 1.2 + 5.3 + 10.0 = 135.0

{Pump #7}
- 6" Pipe @ 218 l.f. w/ 100 GPM, Ff = .3
- 6" Pipe @ 400 l.f. w/ 150 GPM, Ff = 1.2
- 6" Pipe @ 688 l.f. w/ 250 GPM, Ff = 5.3
- 3" Pipe @ 168 l.f. w/ 100 GPM, Ff = 5.2

Total TDH = 119.5 + .3 + 1.2 + 5.3 + 5.2 = 131.5

[Forcemain #3]

{Pump #8}
- 6" Pipe @ 1977 l.f. w/ 200 GPM, Ff = 10.0
- 2" Pipe @ 180 l.f. w/ 50 GPM, Ff = 10.3

Total TDH = 117 + 10.0 + 10.3 = 137.3

{Pump #9}
- 6" Pipe @ 932 l.f. w/ 150 GPM, Ff = 2.8
- 6" Pipe @ 1977 l.f .w/ 200 GPM, Ff = 10.0
- 2" Pipe @ 158 l.f. w/ 50 GPM, Ff = 9.0

Total TDH = 117 + 2.8 + 10.0 + 9.0 = 138.8

{Pump #10}
- 6" Pipe @ 522 l.f. w/ 100 GPM, Ff = .7
- 6" Pipe @ 932 l.f. w/ 150 GPM, Ff = 2.8
- 6" Pipe @ 1977 l.f. w/ 200 GPM, Ff = 10.0
- 3" Pipe @ 130 l.f. w/ 100 GPM, Ff = 4.0

Total TDH = 117 + .7 + 2.8 + 10.0 + 4.0 = 134.5

[Forcemain #4]

{Pump #11}

- 6" Pipe @ 706 l.f. w/ 250 GPM, Ff = 5.4
- 2" Pipe @ 22 l.f. w/ 50 GPM, Ff = 1.3

Total TDH = 40.5 + 5.4 + 1.3 = 47.2

{Pump #12}
- 6" Pipe @ 881 l.f. w/ 200 GPM, Ff = 4.4
- 6" Pipe @ 706 l.f. w/ 250 GPM, Ff = 5.4
- 2" Pipe @ 22 l.f. w/ 50 GPM, Ff = 1.3

Total TDH = 45 + 4.4 + 5.4 + 1.3 = 56.1

{Pump #13}
- 6" Pipe @ 729 l.f. w/ 150 GPM, Ff = 2.2
- 6" Pipe @ 881 l.f. w/ 200 GPM, Ff = 4.4
- 6" Pipe @ 706 l.f. w/ 250 GPM, Ff = 5.4
- 2" Pipe @ 21 l.f. w/ 50 GPM, Ff = 1.2

Total TDH = 45.5 + 2.2 + 4.4 + 5.4 + 1.2 = 58.7

{Pump #14}
- 6" Pipe @ 646 l.f. w/ 100 GPM, Ff = .9
- 6" Pipe @ 729 l.f. w/ 150 GPM, Ff = 2.2
- 6" Pipe @ 881 l.f. w/ 200 GPM, Ff = 4.4
- 6" Pipe @ 706 l.f. w/ 250 GPM, Ff = 5.4
- 2" Pipe @ 37 l.f. w/ 50 GPM, Ff = 2.1

Total TDH = 43.5 + 9 + 2.2 + 4.4 + 5.4 + 2.1 = 58.5

{Pump #15}
- 6" Pipe @ 594 l.f. w/ 50 GPM, Ff = .2
- 6" Pipe @ 646 l.f. w/ 100 GPM, Ff = .9
- 6" Pipe @ 729 l.f. w/ 150 GPM, Ff = 2.2
- 6" Pipe @ 881 l.f. w/ 200 GPM, Ff = 4.4
- 6" Pipe @ 706 l.f. w/ 250 GPM, Ff = 5.4
- 2" Pipe @ 57 l.f w/ 50 GPM, Ff = 3.2

Total TDH = 42 + .2 + .9 + 2.2 + 4.4 + 5.4 + 3.2 = 58.3

[Forcemain #5]

{Pump #16}
- 6" Pipe @ 1305 l.f. w/ 50 GPM, Ff = .5
- 2" Pipe @ 126 l.f. w/ 50 GPM, Ff = 7.2

Total TDH = 56.5 + .5 + 7.2 = 64.2

Summary and Conclusion:

1. All flow calculations for TDH made using the Hazen-Williams formula.
2. The flow coefficient used was 150 for HDPE.

Based on above calculations and data from the pump manufacturer's "Cell Pump List", 6" HDPE will function properly for site's 5 forcemain systems.

ATTACHMENT 10J

Environmental Recovery Corp. Leachate Disposal Letter

ERC Acceptance Parameters

Liquid for WWT
- PH must be >2.01 and <12.49
- Flash Point must be >100°F
- Water - PCB's must be <3 ppb (case-by-case)
- Oil – PCB's must be <2 ppm
- Liquid <10% Solids

Pit Solidification
- PH must be >2.01 and <12.49
- Flash Point must be >140°F
- Water - with PCB's <35 ppm
- Oil - with PCB's >1 ppm
- Oxidizers will be rejected
- Waste cannot be reactive

Anything that ends in "OL" i.e. Glycol, Alcohol, are water soluble organics and won't treat due to raising the Biological Oxygen Demand (BOD) causing it to go to the Pit for Solidification. ERC limit is 300 ppm.

Glycol Limits
Non-Hazardous Treatable Water 0% - <10% Glycol – Treatable
Non-Hazardous Treatable Water 0% - >10% to <19% Glycol – Treatable
Non-Hazardous Treatable Water >19% Glycol – Pit Solidification

ERC can accept DOT shipping name
ERC cannot accept EPA regulated waste
ERC can accept Hazardous Material
ERC cannot process Hazardous Waste

Direct all questions to the Lab Manager

7/26/2021

Proposal ID#: 003476 Quote ID# Q004407

Michael Baudinet
Montrose Environmental
1 Park Plaza unit 1000
Irvine CA 92614

Dear Michael,

Thank you for allowing Environmental Recovery Corporation (ERC) to provide this proposal, and thereby allowing us the opportunity to form a partnership with you and your organization. We look forward to sharing our knowledge of the industry to better serve your disposal and recycling sustainability goals.

Scope: Recycling/Processing/Disposal of Non-Hazardous (NH) Bulk Liquid Residual Waste by ERC – Disposal only- Leachate from Odenton, MD

Bulk Liquid Waste

Waste Water Treatment (WWT) NH Liquids **$0.21 / Gallon**

- All waste water loads containing oil will be subject to a $0/gallon surcharge based on the number of gallons of oil, ERC will notify the customer of the additional charges via change order.
- All loads are subject to a 1000-gallon minimum charge
- If the TX levels exceed 3,000PPM ERC will offer alternative processing options and will notify the customer of the additional charges via change order.
- All waste water loads containing 10% to 19% water soluble organics will be subject to a $0.35/ gallon surcharge, ERC will notify the customer of the additional charges via change order.
- If the PCB levels exceed 3 ppb customer will be notified of alternative processing options and price

Single Stream Treatment (SST) NH Liquids **$0.70 / Gallon**

- All loads are subject to a 1000-gallon minimum charge
- Liquid waste streams that are incompatible with our bulk WWT system may be a candidate for our SST, customized, treatment system for recycling
- If the PCB levels exceed 3 ppb customer will be notified of alternative processing options and price

Solidification (PIT) NH Liquid to Landfill **$0.80 / Gallon**

- All PIT loads will be redirected to our Lancaster, PA facility for service, based on availability. If you choose to pump off the waste at our Baltimore, MD facility it will be subject to a $0.15 per gallon transportation transfer charge.
- All loads are subject to a 300-gallon minimum charge
- The per gallon rate is based on the waste received weighing < 10lbs/gallon
- All PIT loads are subject to a scale fee of $15.00/load

Lab Fee **$78.00 / Load**

If a liquid bulk waste stream is received and determined to be "un-treatable" by the ERC PA Certified Laboratory bench test, a change order will be issued to your company contact outlining new pricing for the proper processing according to the Laboratory results. Your company contact will be required to approve the new pricing for processing prior to offloading. The customer will incur all additional charges that apply.

Materials profiled, manifested, and received at ERC as Non-Hazardous Waste and determined to be Hazardous will be rejected.

If the waste is determined to contain PCB's through the ERC PA Certified Laboratory, ERC reserves the right to apply surcharges accordingly and, in some cases, reject the load in its entirety. If the PCB content is <50ppm and is from a source that is <50ppm may be able to process the waste for landfill. If the waste is determined to contain >50 ppm ERC will reject the load, and, in all cases, the customer/generator will incur the Laboratory Fees.

Weekend Opening Fee **$510.00 / 1st 3 Hours**

- Must be prescheduled and is based on availability
- $155.00/hour will be billed in ¼ hour increments after first 3 hours

A signed copy of this Proposal and completed Waste Profile must be receive by ERC prior to accepting waste to be processed at our facility.

By signing below, you are agreeing to do business under the ERC Terms and Conditions. If you have not already signed and returned the ERC Terms and Conditions, you must do so prior to ERC providing proposed services.

Pricing referenced in this proposal is guaranteed for a period of thirty (30) days from date of the proposal indicated above.

We are truly grateful for the opportunity to present you with this proposal and look forward to working to provide total solutions in the quest to meet your sustainability goals. Please feel free to contact me with additional questions -or- service needs.

Sincerely,

Michelle Birmingham
Account Executive
443-517-7490
mbirmingham@ercofmd.com

GROWING to serve a more sustainable WORLD

Montrose Environmental

Proposal ID#: 003476 Quote ID# Q004407

Signature - Michelle Birmingham

Signature - Baudinet, Michael

Date

Date

SECTION 11

LANDFILL GAS MANAGEMENT PLAN

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

LIST OF TABLES

LIST OF ATTACHMENTS

11.0 LANDFILL GAS MANAGEMENT PLAN

11.1 General

This *Landfill Gas Management (LFG) Plan (LFGMP)* has been developed for the proposed Chesapeake Terrace Rubble Landfill to identify the landfill gas control and monitoring procedures and activities to be performed during the operation, closure, and post-closure periods of the landfill. The purpose of this LFGMP is to ensure that decomposition gases generated by the landfill are controlled to protect public health, safety, and the environment.

11.1.1 Nature and Composition of Landfill Decomposition Gases

Following placement of rubble fill in a disposal area, aerobic and anaerobic processes immediately begin degrading the waste. The degradation processes produce heat, water, and decomposition gases. A significant component of the decomposition gas is methane, which can account for approximately 40% of the decomposition gas that is generated. The remainder of decomposition gas is generally composed of carbon dioxide, hydrogen sulfide, carbon monoxide, nitrogen oxides, and trace amounts, typically less than 1% by volume, of contaminants known as "non-methane organic compounds" or NMOCs.

The methane component of landfill decomposition gas is generally the component of concern due to the relatively low explosive limit. In the pure form, methane is lighter than air, is clear and odorless. The lower explosive limit (LEL) for methane is 5% methane by volume and the upper explosive limit (UEL) is 15% by volume. Concentrations below 5% by volume will not ignite. Concentrations above 15% can ignite, but will not explode (NIOSH, 1997). The hydrogen sulfide component of rubble landfill decomposition gases may also be of concern due to the toxicity and odor.

11.1.2 Methane Compliance Limits

Pursuant to 26.04.07.21(5) of the Code of Maryland Regulations (COMAR), the compliance limits for methane gas are as follows:

- The Compliance Level for methane in facility structures, excluding gas control and recovery system components, is 25% of the LEL for methane, or 1.25% methane by volume; and,
- The Compliance Level for methane at the facility property boundary is 100% of the LEL for methane, or 5.0% methane by volume.

While this COMAR citation is for “municipal landfill”, LFG can be an issue at rubble landfills depending upon the mixture of rubble waste disposed at any facility. This LFG system has been designed to provide active extraction, collection, and removal. If, during the course of operating the landfill, less waste that would contribute to higher levels of methane is placed, National Waste Managers (NWM) may pursue a permit modifications to downgrade the LFG Management System to a passive system instead of the active system describe herein.

11.2 Landfill Gas Generation Potential

The proposed Chesapeake Terrace Rubble Landfill is a rubble, or construction and demolition debris, landfill located in Anne Arundel County, Maryland, approximately 3 miles northwest of Crofton on State Route 424. The landfill is separated into two areas, designated as the West Section and the East Section. In general, the landfill is bounded on the west by the Patuxent Research Refuge, to the north and east by Patuxent Road, and to the south by Conway Road, across which is agricultural land and residential development.

The proposed Chesapeake Terrace Rubble Landfill will accept construction and demolition (C&D) debris waste (e.g., soil, concrete, brick, wood, metal, green waste – Refer to Section 2). Approximately 114.4 acres of the property on which the landfill is sited are proposed for waste disposal activities. The permitted waste disposal area is divided into two separate footprints, the West Section comprising approximately 83.8 acres and the East Section comprising approximately 30.6 acres. NWM expects the Landfill to provide approximately 12 years of life for construction demolition debris (C&D) disposal.

The amount and rate of landfill gas production within a landfill is dependent on several factors including:

- The amount of waste in-place;
- Waste composition;
- Waste moisture content and pH;
- Waste temperature;
- Quantity and quality of nutrients in the waste; and,
- Composition and effectiveness of the cover and cap materials.

The typical municipal waste stream is high in cellulose content (food waste, office paper), will produce large amounts of landfill gas in a short period of time due to their rapid degradation. A rubble, or C&D landfill accepting the materials described above has a waste stream consisting of components with high lignin content that will produce lower volumes of landfill gas over a longer period of time.

The landfill gas generation rates have been predicted using the Landfill Gas Emissions Model (LandGEM) version 3.02 produced by the United States Environmental Protection Agency (USEPA). The model inputs include the anticipated refuse placement rates, a gas generation rate (k), a gas generation potential (L_o), and concentration of NMOCs (C_{NMOC}). The anticipated refuse placement rates are assumed to be 1,602 tons per day with 260 working days per year. The model was analyzed with the AP-42 default parameters as follows:

- $k = 0.04\ yr^{-1}$
- $L_o = 100\ m^3/Mg$
- C_{NMOC} = 600 parts per million (by volume) as hexane

It is assumed that the methane concentration is 40%. The results of the model are provided in Attachment 11A. The peak landfill gas generation occurs in 2036 (based on a start of filling in 2024), which coincides with the final closure cap construction period, and is 2,430 standard cubic feet per minute (SCFM) of landfill gas. The blowers and piping will be sized based on this maximum production rate corrected for collection efficiency of 75%, providing a conservative size for the majority of significant landfill gas production period.

11.3 Landfill Gas Monitoring System

Pursuant to COMAR 26.04.07.21(5), the LFG monitoring system for this facility has been designed to ensure the detection of decomposition gases prior to migration beyond the facility property boundary, into facility structures, or other structures located within the property boundary. To monitor this facility, a perimeter system of subsurface gas probes is proposed. The perimeter system (described in the following section) has been designed based on the subsurface conditions, surrounding property usage, the location of surface water bodies, the depth of the groundwater table, and in consideration of potential preferential flow pathways in the vadose zone, both natural and man-made. The perimeter system shall be in place prior to placement of waste in the landfill to ensure that landfill gas does not exceed the lower explosive limit (LEL) at the landfill property boundary or 25 percent of the LEL in facility structures.

11.3.1 Perimeter System

Pursuant to COMAR 26.04.07.21(5), solid waste disposal facilities are required to maintain a gas monitoring network capable of detecting the presence of decomposition gas in the vadose zone at the facility property boundary. The perimeter system proposed herein is designed to detect the presence of decomposition gases adjacent to the facility and within the facility property boundary. Gas probe spacing is at a maximum of 400 feet on center. The spacing of the gas probes is based on Maryland Department of the Environment (MDE) requirements. This landfill gas monitoring network consists of forty (40) gas probes to provide the necessary monitoring components for routinely determining compliance with COMAR 26.04.07.21(5) regulation. The gas monitoring probe plan is found on Drawing 85.

11.3.1.1 Perimeter Probe Construction

Boreholes for the proposed gas probes will be advanced using a mechanical drill rig equipped with 4.25-inch inside diameter hollow stem augers. During advancement of the soil borings, soil samples will be collected and logged in the field. Field descriptions will be transcribed to soil boring logs for future reference as needed. Boreholes will be advanced to the water table or the underlying low permeability clay confining layer, where present, to ensure that the entire vadose zone is monitored for the landfill decomposition gases.

The screened portions of the probes will be constructed from 1-inch inside diameter schedule 40 PVC casing slotted with two rows of 1/4-inch wide by 3-inch tall slots, 6 inches on-center, staggered, and offset 90 degrees. Following placement of the probe casing and screen, the annular space in the borehole will be backfilled to 3 feet below grade with washed pea gravel (minimum sieve size of 3/8-inch). Following placement of the gravel pack, a minimum 1-foot thick hydrated bentonite seal will be placed.

The remaining annular space in the borehole will be filled with concrete during placement of the locking well head and protective surface pad. The gas probes will be equipped with a 5/16-inch or similar size acetyl or polypropylene male quick-connect fitting with a built-in shut-off valve to facilitate instantaneous gas pressure readings during monitoring. Following placement of the protective casing, each probe will be affixed with a high visibility label identifying the probe number. Following construction of the probes, a surveyor licensed in the State of Maryland will locate the probes and obtain elevation data for the top of the PVC casings. Gas monitoring probe construction details are found on Drawing 88.

Soil boring and probe construction logs will be completed for the gas probes and retained with the facility's records. Soil boring logs will identify the method of drilling, subsurface soils and moisture conditions encountered during advancement of the soil borings, and total depth of the borings. Probe construction logs will identify materials used for construction of the probes, depth of the probe, top of the screen, and survey information.

11.3.2 Facility Structures

Pursuant to COMAR 26.04.07.21(5)(a), facility operators are required to include facility structures, exclusive of gas control or recovery system components, that are located on the waste mass or within 1,000 feet proximity to the waste mass. Based on these criteria, the monitored structures will include the equipment maintenance building(s), cell pump houses, Leachate Storage Facility control buildings, wheel wash building (if a closed building – or capable of being closed), and scale house(s).

11.3.3 LFG Monitoring Probe and Facility Structure Monitoring Procedures

The following sections outline the recommended procedures for performing required probe and facility structure monitoring for methane gas.

11.3.3.1 Monitoring Equipment

The GEM-500 or GEM-2000, or the latest version thereof, is the preferred monitoring device for monitoring probes and facility structures. Alternatively, a digital or analog manometer combined with a vacuum pump equipped monitoring device designed to measure methane gas concentrations (e.g., Industrial Scientific Gas Monitoring Meter) can be used for probe and facility structure monitoring.

In addition to the monitoring device(s), the following equipment and documents should be readily available during monitoring events.

- A copy of the facility's Landfill Gas Management Plan, and the project specific Health and Safety Plan. All documents should be reviewed by sampling personnel prior to leaving the office;
- Copy of the Standard Operating Guidance and the Operation Manual(s) for the equipment being used during monitoring;
- Blank copies of a Landfill Gas Monitoring Log. A sample Landfill Gas Monitoring Log is provided as Attachment 11DI;
- Calibration gas;
- Barometer (if available);
- Personal protection equipment (site specific);
- Field book;
- Waterproof pen;
- Calculator; and,
- Necessary keys (site specific).

11.3.3.2 Equipment Calibration

Gas monitoring equipment should be calibrated prior to each day's use in the field. Generally, one calibration per day is sufficient. In some instances where highly variable concentrations are being observed, it may be necessary to re-calibrate the monitoring device during the work day to ensure that instrument drift is minimal. Instrument drift can be checked with a calibration gas of known concentration. If more than a 3% differential is observed between the instrument reading and the gas standard during an instrument drift check, the unit should be recalibrated.

Calibration should be performed in accordance with the instrument manufacturer's recommendations using an approved gas standard. Generally, when monitoring probes, it is best to calibrate the unit with a standard composed of 15% or less methane. Calibration activities should be documented on a calibration log form or on the landfill gas monitoring log for future reference.

11.3.3.3 Field Observations

After calibrating the monitoring instrument, record the weather conditions at the site, including the barometric pressure and ambient temperature. The temperature and barometric pressure should be logged at the beginning and ending of each field day. Site specific barometric pressure readings are preferred. In the event that a barometer is not available, barometric pressure readings from a nearby weather station can be used.

Required monitoring measurements and observations should be recorded, in duplicate, on a monitoring log and in a field book, as a backup record keeping procedure. If the monitoring is performed with a device that electronically saves the monitoring measurements, the monitoring results should be recorded in a field book or on a field log after logging the data in the event that the monitoring device's memory is corrupted prior to downloading the information.

11.3.3.4 Reading Gas Levels at Probes and Facility Structures

Prior to monitoring the methane concentration in a probe or a facility structure, it is necessary to gauge the static pressure in the probe using a manometer. Ideally, the manometer, which must be "zeroed" prior to each usage, should measure pressure in inches of water. For monitoring probes, after zeroing the manometer, connect the quick connect fitting to the probe fitting and record the pressure on the monitoring log, noting if the pressure is negative or positive. For facility structures, place the monitoring device central to the facility or in the low point of the structure and take a reading with the quick connect fitting open to the atmosphere. In addition to quarterly monitoring of facility structures, a continuous methane monitoring device will be installed to alert occupants when 25% of the LEL is met or exceeded.

If the probe pressure is positive, connect the gas monitoring device to the probe using the quick-connect fitting, activate the vacuum pump, and record the steady-state concentrations of methane and any other gases of interest.

If the probe pressure is negative or zero, connect the gas monitoring device to the probe using the quick-connect fitting, activate the vacuum pump, and purge two casing volumes of air from the probe. After purging of the probe is complete, record the highest observed methane concentration, steady-state methane concentration and any other gases of interest.

Prior to mobilizing to the next probe, record the time of monitoring.

11.3.3.5 Monitoring Wrap-up

After required monitoring has been completed, a completed copy of the monitoring results should be placed in the facility's operating record.

If any exceedances of the methane compliance level are noted in a facility probe, the facility operator should be notified of the exceedances prior to leaving the site. If methane is detected above the 25% LEL limit in a facility structure, the facility operator should be notified as soon as possible.

11.3.4 Monitoring Parameters

Pursuant to COMAR, perimeter gas probes shall be monitored for methane and pressure, and facility structures shall be monitored for methane. The monitoring parameters for this facility are as follows:

- Instantaneous pressure (perimeter probes only);
- Percent methane;
- Percent oxygen; and,
- Percent carbon dioxide.

An example landfill gas probe monitoring log is presented in Attachment 11D.

11.3.5 Monitoring Frequency

In accordance with USEPA requirements, facility structures and perimeter probes that are part of the facility's landfill gas monitoring network shall be monitored on a quarterly (approximately every 3 months) basis. Monitoring results along with the probe location drawing will be forwarded to MDE on a semi-annual basis. Quarterly gas monitoring will continue throughout the life of the facility and will continue, at a minimum, until the 5-year post-closure period has ended. The permittee may petition MDE for a reduction in sampling frequency after the 5-year post closure period, if a reduction is supported by the data.

In the event that the methane compliance level is exceeded, the monitoring frequency will increase to monthly until three consecutive months have passed without a methane compliance level exceedance, at which time the monitoring frequency will revert to quarterly.

11.4 Monitoring Results Evaluation and Response

Requirements for record keeping, and in the event of a methane compliance level exceedance, for notifications and mitigation are presented in the following sections.

11.4.1 Record Keeping Requirements

LFG monitoring results shall be maintained by the facility operator for the life of the facility and the post-closure care period. At a minimum, these records shall identify the following:

- Date and time of monitoring;
- Concentration of methane (maximum and steady state), oxygen, and carbon dioxide recorded in each gas probe and facility structure;
- Probe pressure, atmospheric temperature, and barometric pressure;
- A description of the weather conditions during the monitoring event;
- Name(s) of the personnel performing the monitoring activities;
- Description of the monitoring device used to perform the monitoring;
- Description of the procedures used to perform the monitoring activities; and,
- A number system to correlate monitoring results to specific locations.

11.4.2 Notification Requirements

If the compliance level for methane (25% of the LEL in facility structures and 100% of the LEL at the facility boundary) is exceeded based on steady state results, the facility operator shall perform the following activities:

- Take immediate steps, as necessary, to protect human health and safety. Depending on the location of the elevated methane gas concentration, immediate remedial action may consist of evacuation of impacted structures, venting of subsurface utility conduits or crawl spaces, or other measures deemed protective of human health and safety based on the risk level identified in association with the detected methane concentrations;
- Notify the MDE in writing within 24 hours, identifying the compliance level exceedance. The notification shall identify the location(s) of the exceedance(s) and activities that have been completed or are planned to mitigate the compliance level exceedance(s);
- Implement monthly monitoring of the affected probes until such time as three consecutive months have passed during which the methane gas concentration in the affected probes has been less than the methane compliance limit. In the event an on-site or off-site structure designed for human occupation is determined to be impacted, monitoring of the structure once the initial methane gas has been dispersed will be implemented with one, or more, real-time continuous ambient gas monitoring devices, as determined by the site engineer. The monitoring devices shall be equipped with a visual or audible alarm system that is designed to activate at 10% of the LEL for methane (0.5 percent by volume).

- In the event that a subsurface conduit, excluding conduits associated with the facility's leachate collection and LFG collection systems, has been impacted, monitoring of the ambient headspace within the conduit shall be conducted monthly, with more frequent monitoring performed as required by the site engineer in the event that access is required to the conduit by utility, contract, or site workers. Monitoring of the conduit will be conducted until three consecutive monthly readings with no exceedances of the methane regulatory limit have been recorded; and,
- Within 60 days of identifying the compliance level exceedance(s), implement a remediation plan for the methane gas releases and submit it to the MDE for approval and amendment of the facility's permit. The plan shall describe the nature and extent of the problem and the proposed remedy.

11.4.3 Landfill Gas Remediation Plan Requirements

Pursuant to industry standards, the *Landfill Gas Remediation Plan* shall identify the nature and extent of the landfill gas impacts and describe the proposed remedial action for mitigating the impacts. Gas control systems proposed in a *Landfill Gas Remediation Plan* shall be designed to:

- Prevent methane accumulation in on-site structures;
- Prevent methane compliance level exceedances at the facility boundary;
- Provide for the collection, treatment, and destruction/disposal of decomposition gases and condensate; and,
- Comply with Clean Air Act requirements, as applicable.

11.5 Gas Control System

Pursuant to COMAR 26.04.07.03B(9), an active LFG extraction system including ninety-nine (99) active gas wells is proposed to be constructed in the landfill rubble waste mass for the purpose of collecting and controlling landfill gas. As shown on Drawings 86 and 87, the landfill is separated into a West Section and an East Section that contain rubble cells 1 through 10 and 11 through 16 respectively. Blowers and flare will be located in the flare paddock, located as shown on the drawings. The blowers (including knock-out tank and filter), control panels and flare, will be pre-manufactured skid or modular units. Details of the system design are presented on Drawings 86 through 88, as described in the following sections.

11.5.1 Gas Well Construction Specifications

All landfill gas extraction (LFGE) well borehole locations will be surveyed prior to construction for accurate placement and calculation of drilling depths. Boreholes for construction of the gas wells will be advanced using a 36-inch-diameter borehole. The boreholes will extend from the landfill surface to 10 feet above the low permeability components (i.e., geomembrane) of the liner system. A preliminary table of the gas well construction is provided as Table 11-1.

LFGE wells will be constructed from 6-inch diameter SDR-11 high density polyethylene (HDPE) pipe and will be screened from 10 feet below the landfill surface to 1 foot above the bottom of the borehole. If wells are constructed in a closed area, the casings will be extend through the 40-mil closure system geomembrane and sealed with a manufactured or field fabricated geomembrane boot. The annular space around the well screen will be backfilled with 1" to 3" washed gravel to approximately 9 feet below the landfill surface. The remaining annular space will be backfilled on top of a geo-fabric donut with a bentonite seal 2 feet thick and clean backfill to grade. The wells' casings will be extended to a minimum of 4 feet above the landfill surface, and will then be tied into the header/lateral system using a well head equipped with sample ports and a control valve as depicted on Drawing 88.

Following completion of the gas wells, the gas wells will be surveyed and a well construction log for each gas well (identifying the method of borehole advancement, subsurface materials, excavated waste temperatures, and well construction details) will be prepared by the Quality Assurance Contractor for gas well construction.

11.5.2 Construction Schedule

The construction of gas wells will follow filling operations of areas brought to or near design grades. The owner, at his/her discretion, may expand the gas system as they find necessary provided the rubble waste is of sufficient thickness for gas well installation.

11.6 Blowers and Related Equipment

The centrifugal blower system acts as the driving force to transfer the landfill gas from the interior of the landfill through the piping network and into the flare system for subsequent combustion. The blower system will be equipped with two parallel blowers that may be operated independently to provide backup should the operating blower fail or operated together to provide increased capacity.

11.6.1 Blower Sizing

The breakdown of peak gas generation amount and year between the East and West Sections based on separate LandGEM modeling are 721 SCFM in 2027 for the East Section and 2,102 SCSM in 2037 for the West Section. When modeled together the peak generation rate is 2,430 SCFM in 2036. We have sized the Flare Paddock to accommodate separate modular or skid mounted gas recovery and destruction systems. Detailed design will be prepared by the landfill gas system manufacturer. The decision to utilize a combined system or separate systems (one for the East Section and one for the West Section) will be based on recommendations from the manufacturer. Assuming that a single combined system will be the preferred configuration, the blower will be specified to transfer 2,430 SCFM of landfill gas from the extraction wells to the flare unit for combustion. The modular/skid mounted unit(s) will include a pre-installed backup blower equal in size to the primary blower. The required size of the blower is determined by the total head loss (measured in inches of water column) generated from the friction encountered to remove and transfer the landfill gas through the piping network and into the flare unit. Microsoft Excel spreadsheet implementing Darcy-Weisbach equation for head loss was created to calculate the total head loss to determine the required vacuum. EPANET was used to model the piping network to understand the volume of LFG flow in each lateral and header as an input parameter in the Darcy-Weisbach equation. The model output is provided in Attachment 11B. The blower shall be sized to provide a vacuum of approximately 50 inches of water column at 87° F.

11.6.2 Blower Construction

The blowers shall be centrifugal type blowers. The advantages and specific design features of this type of blower are listed below:

- Constant efficiency; little wearing of internal parts; ample clearance throughout the blower.
- Since the centrifugal blowers all have outboard mounted bearings, no chance exists for lubricant to contaminate the air stream.
- Variable volume at constant speed - power varies directly with air volume requirement. No special bleed off devices are needed.
- Relatively constant pressure at constant speed.
- Centrifugal blowers produce unusually low noise; silencers are usually not required.
- Relatively lightweight; no special foundation is required.

- Centrifugal blowers produce a smooth non-pulsating air flow when operating at any point beyond the surge limit.
- Since horsepower is in direct proportion to the volumetric demand, an ammeter can be calibrated in CFM to indicate air flow when required.

11.7 Flare System

The flare system for the gas collection control system shall be an enclosed flare unit that meets the requirements of the Code of Federal Regulations, Title 40, Chapter 1, Section 60.18, 40 CFR 60.18. The flare shall guarantee over 98% destruction efficiency of NMOCs, and ensure a maximum exit velocity of 100 ft/sec. The flare is to be equipped with thermocouples mounted near the exit to monitor the flue LFG temperature and detect the presence of a flame. A flame arrestor will be installed in the landfill gas stream leading into the flare to prevent the flame from traveling upstream. The unit will be equipped with a fail-closed valve, which is actuated when a flame is not detected. Other features for the flare include:

- A temperature recorder;
- A flow meter and recorder; and,
- Propane pilot ignition system.

11.8 Landfill Gas System Operation

Operation of the LFGE system will consist primarily of regulating and adjusting the amount of vacuum available at each extraction well through the use of valves. This adjustment of vacuum, and therefore flow rate, is referred to as "balancing" or "tuning" the LFG system. A balanced system is one in which each well is adjusted to extract the maximum amount of LFG possible without causing excessive amounts of air to be pulled through the landfill cover and into the extraction system. Some of the tests performed to balance and ensure the efficient operation of the landfill gas system are:

- Flow rate into the flare;
- Percentage methane into the flare;
- Landfill gas temperature at the moisture separator;
- Percentage methane at each well;
- Vacuum at each well;
- Landfill gas temperature at each well; and,
- Flow rate at each well.

The proposed LFG system for the landfill will operated continuously, 24 hours a day, 365 days a year. A qualified operator will monitor the system operation as well as perform the testing, sampling, and adjustment as detailed on an item by item basis.

11.8.1 Wells

Because methane production in the landfill is dependent upon many factors, the amount of vacuum required to extract the LFG will vary by well and by time during the landfill life cycle. Generally, the vacuum is adjusted to maintain a level at or just below zero (i.e., from -1.0" wc to 0" wc).

In order to achieve and maintain a well-balanced system, vacuum, gas concentration, and LFG temperature are measured monthly at each well. In addition to these monthly tests, flow rates are to be periodically measured to help establish the correlation between vacuum and flow rate at each individual well.

Because LFG is generated at a mixture of approximately 40% methane, methane concentrations of less than 25% may be indicative of excessive air intrusion through the landfill cover.

Conversely, high methane concentrations indicate that more landfill gas is being generated than is being extracted by the well. Therefore, methane concentration is the primary test used to determine if the flow rate should be increased or decreased. Oxygen levels shall be maintained below 3% and wellhead temperatures maintained below 130°F.

Vacuum is measured to establish its relationship with gas concentration and extraction rate at each well. Records are kept of these relationships to aid in determining the optimal flow rate to maximize landfill gas extraction and minimize air intrusion at each well. Instantaneous vacuum readings are to be used to correctly adjust the wellhead valve to the desired vacuum. Abnormal vacuum readings are indicative of and will be used to locate pipe blockages or restrictions caused by pipe failure or water blockage.

Temperature of the LFG will be measured and recorded quarterly at each extraction well to help detect the onset of air intrusion and the corresponding possibility of spontaneous combustion within the landfill. Although temperatures will vary for each LFGE well, they should remain reasonably stable at a particular well. A sharp increase in landfill gas temperature accompanied by a decrease in methane concentration is indicative of combustion within the landfill.

11.8.2 Piping and Condensate Management

Due to the extremely corrosive conditions of the landfill environment, all underground laterals and headers are to be constructed of SDR-11 HDPE or SDR-17 HDPE pipe, or equivalent, piping. HDPE is resistant to the corrosive nature of the LFG and its associated condensate. Also, because of its' flexibility and durability, HDPE is well-suited to withstand the stresses imposed by differential settlement within the landfill.

Valves are located in the header pipe to isolate areas of the system when maintenance, repairs, or new construction is required. This allows the other portions of the system to continue to operate as normal, thereby minimizing system downtime.

The gas collection piping system will utilize condensate sumps to manage liquids accumulating in the gas collection system header pipe within the waste disposal areas. The condensate sumps will be configured as shown on Detail 4 on Drawing 88. Detail 4 on Drawing 88. The sumps will be located at the low spots of the landfill gas piping system. The 3-inch line will have a "J" trap at the connection with the header pipe and an isolation valve down slope of the J Trap. The sump will terminate at the ground surface with a bolted cover/flange connection with waterproof gasket. The bolted flange will be set into a concrete pad.

11.8.3 Blowers and Flare Equipment

A moisture separator (knock out chamber) is an expansion chamber located just upstream of the blowers. As LFG flows through the moisture separator, the decrease in pressure and the subsequent cooling of the LFG allows any remaining water vapor to condense. A liquid level switch on the moisture separator indicates when the liquid must be drained. The drained liquid will be transferred using a pump from the knock out chamber into polyethylene drum or tote (with secondary containment), transported to the leachate tanker loading area and transferred by pump into the leachate storage tanks for handling with the site leachate.

Operation of the blowers will be in accordance with the manufacturers recommended procedures and is to be controlled by switches on the flare control panel and valves located next to each blower unit. The redundant capacity of the blowers will allow the system to continue operating in the event of a mechanical problem in one of the blowers.

11.8.4 Flare System Operation

The system start-up will begin with a timed air purge cycle to remove any hydrocarbons from the flare enclosure. After the purge cycle is completed, the pilot flame is lit by an electrical spark.

Upon proving the pilot flame with the thermocouple, the LFG fail-closed valve is opened and the LFG blower is started, allowing the LFG to flow into the flare enclosure. This allows the use of landfill gas for system warm-up.

After the LFG fail-closed valve has been opened, the pilot gas will then shut off to limit the propane usage. If a flame is still detected on the main burner, the system will continue operation; however, if a flame is not detected, the system will shut down due to flame failure.

The system temperature will be monitored by a thermocouple. If the thermocouple detects a temperature outside a specified operating range, the system will shut itself off. When the blower shuts off, the fail-closed valve is automatically closed to prevent the release of landfill gas from the system. Under normal operating conditions, the system may be set up to attempt to restart automatically. In the event of a failure, the flare will be equipped with a remedial action (i.e., auto-dialer) that will notify the Owners specified officer, to respond within 24 hours of flare failure.

11.9 Maintenance

11.9.1 Wells

All wells are to be inspected quarterly during normal testing as follows:

- Proper operation of valves;
- Leaks in exposed piping, valves, and fittings;
- Settling around wells; and,
- Water buildup in the piping.

11.9.2 Laterals and Headers

Laterals and headers will be inspected yearly by the Owner. There are several issues that can affect the flow of LFG through the piping system. Typical issues are leaks, breaks, and water blockage. If any issues are discovered through testing, sight, or sound, they are to be repaired as soon as possible.

11.9.3 Condensate Drain

The condensate drainsshall be inspected semi-annually. The cover is to be removed, the inside of the inspected for standing liquid, integrity of the cover gasket and dirt buildup. Signs of leakage or damage identified during the inspections shall be repaired as soon as possible.

11.9.4 Blower Maintenance

Two blowers are to be installed to create a redundant capacity in the event that one should fail. Some of the important maintenance items are:

- Lubrication of bearings and motors;
- Inspection of bearing wear;
- Proper valve operation;
- Check for leaks in piping connections and valves;
- Check for vibrations and loose connections;
- Check electrical connections on blower motors and control panel; and,
- Other periodic maintenance recommended by manufacturer.

11.9.5 Flare

The maintenance required for the flare will normally be limited to checking and repairing any items that fail to function properly. The pilot fuel is to be checked monthly to ensure that an adequate supply is always available. If compressed gas is used to actuate the fail-closed valve, the gas valve and the tank pressure will also be checked monthly.

11.10 References

EPA (United States Environmental Protection Agency), 1991. *Air Emissions from Municipal Solid Waste Landfills - Background Information for Proposed Standards and Guidelines*. EPA/450/3-90/011A. March 1991, 544 pages.

EPA, 2005. *Landfill Gas Emissions Model (LandGEM) Version 3.02 User's Guide*. EPA-600/R05/047. May.

NIOSH (National Institute for Occupational Safety and Health), 1997. *NIOSH Pocket Guide to Chemical Hazards*. United States Department of Health and Human Services, 440 pages.

COMAR (Relative Sections)

a Montrose Environmental Group company

TABLES

TABLE 11-1
Landfill Gas Extraction Wells
Chesapeake Terrace Rubble Landfill
Anne Arundel County, Maryland

Well ID		Elevation for Top of Closure Cap (ft MSL)	Elevation for Top of Leachate Collection Layer (ft MSL)	Waste Thickness (feet)	Top of Screen (ft MSL)	Elevation for Bottom of Screen (ft MSL)	Length of Screen (feet)	Screen Length to Waste Depth (%)
EW-	1	161	116	41	151	124	27	65.9
EW-	2	160	109	47	150	117	33	70.2
EW-	3	156	101	51	146	109	37	72.5
EW-	4	190	118	68	180	126	54	79.4
EW-	5	188	115	69	178	123	55	79.7
EW-	6	150	96	50	140	104	36	72.0
EW-	7	184	105	75	174	113	61	81.3
EW-	8	140	101	35	130	109	21	60.0
EW-	9	135	107	24	125	115	10	41.7
EW-	10	130	106	20	120	114	6	30.0
EW-	11	137	110	23	127	118	9	39.1
EW-	12	144	113	27	134	121	13	48.1
EW-	13	181	109	68	171	117	54	79.4
EW-	14	168	112	52	158	120	38	73.1
EW-	15	158	112	42	148	120	28	66.7
EW-	16	192	114	74	182	122	60	81.1
EW-	17	190	117	69	180	125	55	79.7
EW-	18	180	119	57	170	127	43	75.4
EW-	19	150	119	27	140	127	13	48.1
EW-	20	197	128	65	187	136	51	78.5
EW-	21	185	127	54	175	135	40	74.1
EW-	22	151	122	25	141	130	11	44.0
EW-	23	187	138	45	177	146	31	68.9
EW-	24	154	126	24	144	134	10	41.7
EW-	25	155	130	21	145	138	7	33.3
EW-	26	196	127	65	186	135	51	78.5
EW-	27	189	140	45	179	148	31	68.9
EW-	28	158	128	26	148	136	12	46.2
EW-	29	190	143	43	180	151	29	67.4
EW-	30	163	129	30	153	137	16	53.3
EW-	31	197	135	58	187	143	44	75.9
EW-	32	165	137	24	155	145	10	41.7
EW-	33	203	133	66	193	141	52	78.8
EW-	34	170	126	40	160	134	26	65.0
EW-	35	212	138	70	202	146	56	80.0
EW-	36	175	127	44	165	135	30	68.2
EW-	37	215	131	80	205	139	66	82.5
EW-	38	178	128	46	168	136	32	69.6

TABLE 11-1
Landfill Gas Extraction Wells
Chesapeake Terrace Rubble Landfill
Anne Arundel County, Maryland

Well ID		Elevation for Top of Closure Cap (ft MSL)	Elevation for Top of Leachate Collection Layer (ft MSL)	Waste Thickness (feet)	Top of Screen (ft MSL)	Elevation for Bottom of Screen (ft MSL)	Length of Screen (feet)	Screen Length to Waste Depth (%)
EW-	39	217	126	87	207	134	73	83.9
EW-	40	180	126	50	170	134	36	72.0
EW-	41	217	130	83	207	138	69	83.1
EW-	42	184	123	57	174	131	43	75.4
EW-	43	194	120	70	184	128	56	80.0
EW-	44	205	121	80	195	129	66	82.5
EW-	45	222	124	94	212	132	80	85.1
EW-	46	224	125	95	214	133	81	85.3
EW-	47	210	132	74	200	140	60	81.1
EW-	48	224	119	101	214	127	87	86.1
EW-	49	218	117	97	208	125	83	85.6
EW-	50	212	129	79	202	137	65	82.3
EW-	51	220	114	102	210	122	88	86.3
EW-	52	187	114	69	177	122	55	79.7
EW-	53	202	131	67	192	139	53	79.1
EW-	54	192	110	78	182	118	64	82.1
EW-	55	188	120	64	178	128	50	78.1
EW-	56	217	124	89	207	132	75	84.3
EW-	57	223	134	85	213	142	71	83.5
EW-	58	182	126	52	172	134	38	73.1
EW-	59	217	132	81	207	140	67	82.7
EW-	60	182	119	59	172	127	45	76.3
EW-	61	211	123	84	201	131	70	83.3
EW-	62	210	139	67	200	147	53	79.1
EW-	63	181	123	54	171	131	40	74.1
EW-	64	206	133	69	196	141	55	79.7
EW-	65	201	124	73	191	132	59	80.8
EW-	66	206	130	72	196	138	58	80.6
EW-	67	175	112	59	165	120	45	76.3
EW-	68	192	115	73	182	123	59	80.8
EW-	69	198	123	71	188	131	57	80.3
EW-	70	198	131	63	188	139	49	77.8
EW-	71	166	119	43	156	127	29	67.4
EW-	72	189	123	62	179	131	48	77.4
EW-	73	195	124	67	185	132	53	79.1
EW-	74	197	129	64	187	137	50	78.1
EW-	75	196	121	71	186	129	57	80.3
EW-	76	126	87	35	116	95	21	60.0

TABLE 11-1
Landfill Gas Extraction Wells
Chesapeake Terrace Rubble Landfill
Anne Arundel County, Maryland

Well ID		Elevation for Top of Closure Cap (ft MSL)	Elevation for Top of Leachate Collection Layer (ft MSL)	Waste Thickness (feet)	Top of Screen (ft MSL)	Elevation for Bottom of Screen (ft MSL)	Length of Screen (feet)	Screen Length to Waste Depth (%)
EW-	77	152	89	59	142	97	45	76.3
EW-	78	126	80	42	116	88	28	66.7
EW-	79	159	93	62	149	101	48	77.4
EW-	80	132	91	37	122	99	23	62.2
EW-	81	162	102	56	152	110	42	75.0
EW-	82	168	92	72	158	100	58	80.6
EW-	83	181	101	76	171	109	62	81.6
EW-	84	155	99	52	145	107	38	73.1
EW-	85	140	90	46	130	98	32	69.6
EW-	86	132	92	36	122	100	22	61.1
EW-	87	170	92	74	160	100	60	81.1
EW-	88	170	98	68	160	106	54	79.4
EW-	89	125	86	35	115	94	21	60.0
EW-	90	174	93	77	164	101	63	81.8
EW-	91	122	81	37	112	89	23	62.2
EW-	92	121	88	29	111	96	15	51.7
EW-	93	179	99	76	169	107	62	81.6
EW-	94	132	90	38	122	98	24	63.2
EW-	95	174	92	78	164	100	64	82.1
EW-	96	130	88	38	120	96	24	63.2
EW-	97	124	90	30	114	98	16	53.3
EW-	98	124	86	34	114	94	20	58.8
EW-	99	167	96	67	157	104	53	79.1

Notes:

1) Elevations for the top of the final cover and the top of the leachate collection layer were taken from Drawings 32 & 33 and 17 & 18.
2) The final cover system thickness is assumed to be 4 feet.
3) The waste thickness is based upon the difference between the top of final cover and the top of the leachate collection layer minus another 4-feet for the final cover thickness.
4) The wells where the ratio of the screen length compared to the waste thickness is less than sixty percent are shaded yellow. These wells have a ratio less than 60% because these wells are located in areas along the edge of the cells, where achieving the ratio is difficult while also maintaining a minimum distance from the cell floor to protect the liner system and a distance from the top of the final cover to prevent air intrusion into the well.

a Montrose Environmental Group company

ATTACHMENT 11A

USEPA LandGEM Model Results

ADVANCED GeoServices a Montrose Environmental Group company	Subject: LandGEM Model		
	Job No. 2018-3854	Made by: TD TD	Date 07-13-20
	Ref. Chesapeake Terrace Rubble Fill	Checked by: VEF VEF	Sheet 1 of 2

Revised by PGS 08/29/2021

Objective:

To provide the input parameters for the LandGEM Model for the design of the landfill gas extraction system and calculate the maximum landfill gas production rate at the Chesapeake Terrace Rubble Fill.

References:

1. Landfill Gas Emission Model, V. 3.02, USEPA, May 2005.

Calculation:

Model Parameters:

The methane generation rates (k), potential methane generation capacity (L_o), nonmethane organic compounds concentration (C_{NMOC}), and methane constant were assumed to be the AP-42 default values provided in the LandGEM model.

$k = 0.04$ year^{-1}
$L_o = 100$ m^3/Mg
$C_{NMOC} = 600$ ppmv as hexane
Methane Content = 40%

Waste Type	% by Weight
Textiles, rubber, leather, sludge	6
Plastics	2
Glass	3
Cardboard Green Wastes	20
Wood	30
Poorly degradable (soil, concrete, brick)	39
	100

Paper and green waste appear to be the drivers in the methane output. Therefore, AP-42 values appear to be satisfactory.

Waste Design Capacity:

For this site, the model was ran with the following input data:

Operable life: 12 years
Tonnage Rate: ~~2,686~~ 1602 tons per day

Revised by PGS 08/29/2021

Assuming 286 working days (5.5 days/week) per year, the following in-place tonnage is calculated

$$\frac{\cancel{2,686}\ 1602\ tons}{day}\left(\frac{\cancel{286}\ 260\ day}{year}\right)(12\ year) = \cancel{9,200,000}\ 4,998,000\ tons$$

Landfill open year = 2024
Landfill closed year = 2036

$$\text{Yearly rate} = \frac{\cancel{9,200,000}\ 4,998,000\ tons}{12\ yr} = \cancel{767,000}\ 416,500\ \frac{tons}{yr}$$

Note: The resulting values were rounded to the nearest whole number.

Conclusion:

Based on the inputs described herein, the maximum total landfill gas production occurs in year 2036 and is ~~4,472~~ 2,430 scfm. This can be found on page “Report 7” in the attached model results.

Summary Report

Landfill Name or Identifier: Chesapeake Terrace Rubble Fill

Date: Monday, August 30, 2021

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} k L_o \left(\frac{M_i}{10} \right) e^{-k t_{ij}}$$

Where,

Q_{CH4} = annual methane generation in the year of the calculation *(m^3/year)*
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate *(year^{-1})*
L_o = potential methane generation capacity *(m^3/Mg)*

M_i = mass of waste accepted in the ith year *(Mg)*
t_{ij} = age of the jth section of waste mass M_i accepted in the ith year *(decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**2024**	
Landfill Closure Year (with 80-year limit)	**2036**	
Actual Closure Year (without limit)	***2036***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**5,000,000**	*short tons*

MODEL PARAMETERS

Methane Generation Rate, k	**0.040**	*year $^{-1}$*
Potential Methane Generation Capacity, L_o	**100**	*m^3/Mg*
NMOC Concentration	**600**	*ppmv as hexane*
Methane Content	**40**	*% by volume*

GASES / POLLUTANTS SELECTED

Gas / Pollutant #1:	**Total landfill gas**
Gas / Pollutant #2:	**Methane**
Gas / Pollutant #3:	**Carbon dioxide**
Gas / Pollutant #4:	**NMOC**

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2024	378,655	416,520	0	0
2025	378,655	416,520	378,655	416,520
2026	378,655	416,520	757,309	833,040
2027	378,655	416,520	1,135,964	1,249,560
2028	378,655	416,520	1,514,618	1,666,080
2029	378,655	416,520	1,893,273	2,082,600
2030	378,655	416,520	2,271,927	2,499,120
2031	378,655	416,520	2,650,582	2,915,640
2032	378,655	416,520	3,029,236	3,332,160
2033	378,655	416,520	3,407,891	3,748,680
2034	378,655	416,520	3,786,545	4,165,200
2035	378,655	416,520	4,165,200	4,581,720
2036	1,600	1,760	4,543,855	4,998,240
2037	0	0	4,545,455	5,000,000
2038	0	0	4,545,455	5,000,000
2039	0	0	4,545,455	5,000,000
2040	0	0	4,545,455	5,000,000
2041	0	0	4,545,455	5,000,000
2042	0	0	4,545,455	5,000,000
2043	0	0	4,545,455	5,000,000
2044	0	0	4,545,455	5,000,000
2045	0	0	4,545,455	5,000,000
2046	0	0	4,545,455	5,000,000
2047	0	0	4,545,455	5,000,000
2048	0	0	4,545,455	5,000,000
2049	0	0	4,545,455	5,000,000
2050	0	0	4,545,455	5,000,000
2051	0	0	4,545,455	5,000,000
2052	0	0	4,545,455	5,000,000
2053	0	0	4,545,455	5,000,000
2054	0	0	4,545,455	5,000,000
2055	0	0	4,545,455	5,000,000
2056	0	0	4,545,455	5,000,000
2057	0	0	4,545,455	5,000,000
2058	0	0	4,545,455	5,000,000
2059	0	0	4,545,455	5,000,000
2060	0	0	4,545,455	5,000,000
2061	0	0	4,545,455	5,000,000
2062	0	0	4,545,455	5,000,000
2063	0	0	4,545,455	5,000,000

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2064	0	0	4,545,455	5,000,000
2065	0	0	4,545,455	5,000,000
2066	0	0	4,545,455	5,000,000
2067	0	0	4,545,455	5,000,000
2068	0	0	4,545,455	5,000,000
2069	0	0	4,545,455	5,000,000
2070	0	0	4,545,455	5,000,000
2071	0	0	4,545,455	5,000,000
2072	0	0	4,545,455	5,000,000
2073	0	0	4,545,455	5,000,000
2074	0	0	4,545,455	5,000,000
2075	0	0	4,545,455	5,000,000
2076	0	0	4,545,455	5,000,000
2077	0	0	4,545,455	5,000,000
2078	0	0	4,545,455	5,000,000
2079	0	0	4,545,455	5,000,000
2080	0	0	4,545,455	5,000,000
2081	0	0	4,545,455	5,000,000
2082	0	0	4,545,455	5,000,000
2083	0	0	4,545,455	5,000,000
2084	0	0	4,545,455	5,000,000
2085	0	0	4,545,455	5,000,000
2086	0	0	4,545,455	5,000,000
2087	0	0	4,545,455	5,000,000
2088	0	0	4,545,455	5,000,000
2089	0	0	4,545,455	5,000,000
2090	0	0	4,545,455	5,000,000
2091	0	0	4,545,455	5,000,000
2092	0	0	4,545,455	5,000,000
2093	0	0	4,545,455	5,000,000
2094	0	0	4,545,455	5,000,000
2095	0	0	4,545,455	5,000,000
2096	0	0	4,545,455	5,000,000
2097	0	0	4,545,455	5,000,000
2098	0	0	4,545,455	5,000,000
2099	0	0	4,545,455	5,000,000
2100	0	0	4,545,455	5,000,000
2101	0	0	4,545,455	5,000,000
2102	0	0	4,545,455	5,000,000
2103	0	0	4,545,455	5,000,000

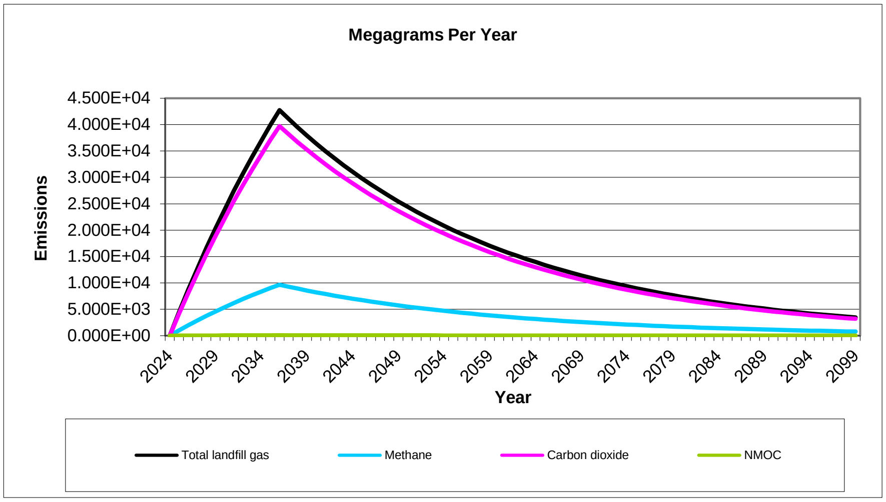
Pollutant Parameters

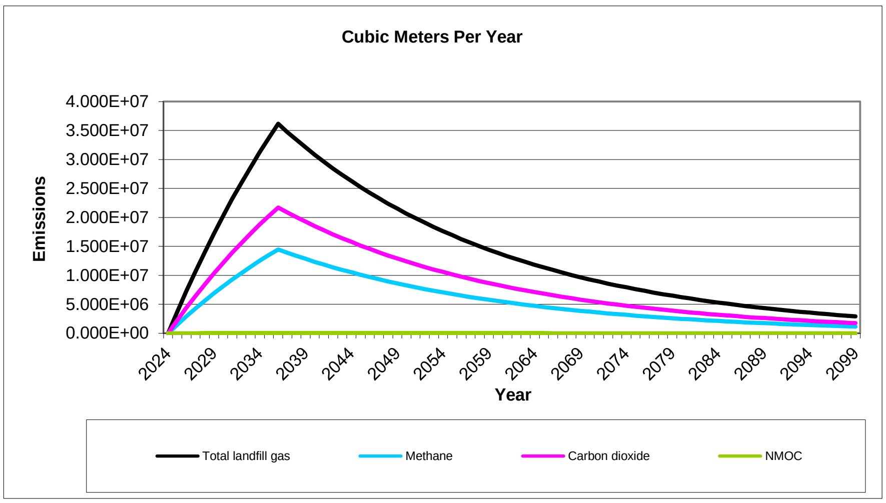
		Gas / Pollutant Default Parameters:		User-specified Pollutant Parameters:	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

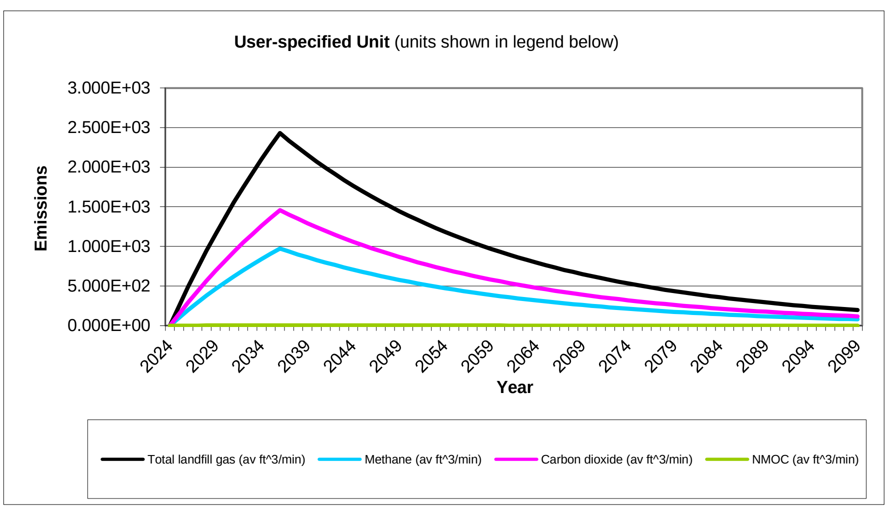
Pollutant Parameters (Continued)

	Gas / Pollutant Default Parameters:			User-specified Pollutant Parameters:	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

Graphs


Megagrams Per Year
4.500E+04
4.000E+04
3.500E+04
3.000E+04
2.500E+04
2.000E+04
1.500E+04
1.000E+04
5.000E+03
0.000E+00
Emissions
2024 2029 2034 2039 2044 2049 2054 2059 2064 2069 2074 2079 2084 2089 2094 2099
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
4.000E+07
3.500E+07
3.000E+07
2.500E+07
2.000E+07
1.500E+07
1.000E+07
5.000E+06
0.000E+00
Emissions
2024 2029 2034 2039 2044 2049 2054 2059 2064 2069 2074 2079 2084 2089 2094 2099
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
3.000E+03
2.500E+03
2.000E+03
1.500E+03
1.000E+03
5.000E+02
0.000E+00
Emissions
2024 2029 2034 2039 2044 2049 2054 2059 2064 2069 2074 2079 2084 2089 2094 2099
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2024	0	0	0	0	0	0
2025	4.397E+03	3.719E+06	2.499E+02	9.925E+02	1.488E+06	9.996E+01
2026	8.621E+03	7.293E+06	4.900E+02	1.946E+03	2.917E+06	1.960E+02
2027	1.268E+04	1.073E+07	7.207E+02	2.862E+03	4.290E+06	2.883E+02
2028	1.658E+04	1.402E+07	9.423E+02	3.743E+03	5.610E+06	3.769E+02
2029	2.033E+04	1.719E+07	1.155E+03	4.588E+03	6.878E+06	4.621E+02
2030	2.392E+04	2.024E+07	1.360E+03	5.401E+03	8.096E+06	5.439E+02
2031	2.738E+04	2.316E+07	1.556E+03	6.182E+03	9.266E+06	6.226E+02
2032	3.071E+04	2.598E+07	1.745E+03	6.932E+03	1.039E+07	6.981E+02
2033	3.390E+04	2.868E+07	1.927E+03	7.653E+03	1.147E+07	7.707E+02
2034	3.697E+04	3.127E+07	2.101E+03	8.345E+03	1.251E+07	8.404E+02
2035	3.991E+04	3.376E+07	2.269E+03	9.010E+03	1.351E+07	9.074E+02
2036	4.274E+04	3.616E+07	2.430E+03	9.650E+03	1.446E+07	9.718E+02
2037	4.109E+04	3.476E+07	2.335E+03	9.275E+03	1.390E+07	9.341E+02
2038	3.948E+04	3.339E+07	2.244E+03	8.912E+03	1.336E+07	8.975E+02
2039	3.793E+04	3.209E+07	2.156E+03	8.562E+03	1.283E+07	8.623E+02
2040	3.644E+04	3.083E+07	2.071E+03	8.226E+03	1.233E+07	8.285E+02
2041	3.501E+04	2.962E+07	1.990E+03	7.904E+03	1.185E+07	7.960E+02
2042	3.364E+04	2.846E+07	1.912E+03	7.594E+03	1.138E+07	7.648E+02
2043	3.232E+04	2.734E+07	1.837E+03	7.296E+03	1.094E+07	7.348E+02
2044	3.105E+04	2.627E+07	1.765E+03	7.010E+03	1.051E+07	7.060E+02
2045	2.984E+04	2.524E+07	1.696E+03	6.735E+03	1.010E+07	6.783E+02
2046	2.867E+04	2.425E+07	1.629E+03	6.471E+03	9.700E+06	6.517E+02
2047	2.754E+04	2.330E+07	1.565E+03	6.217E+03	9.319E+06	6.262E+02
2048	2.646E+04	2.239E+07	1.504E+03	5.974E+03	8.954E+06	6.016E+02
2049	2.542E+04	2.151E+07	1.445E+03	5.739E+03	8.603E+06	5.780E+02
2050	2.443E+04	2.066E+07	1.388E+03	5.514E+03	8.266E+06	5.554E+02
2051	2.347E+04	1.985E+07	1.334E+03	5.298E+03	7.942E+06	5.336E+02
2052	2.255E+04	1.908E+07	1.282E+03	5.090E+03	7.630E+06	5.127E+02
2053	2.166E+04	1.833E+07	1.231E+03	4.891E+03	7.331E+06	4.926E+02
2054	2.082E+04	1.761E+07	1.183E+03	4.699E+03	7.043E+06	4.733E+02
2055	2.000E+04	1.692E+07	1.137E+03	4.515E+03	6.767E+06	4.547E+02
2056	1.922E+04	1.625E+07	1.092E+03	4.338E+03	6.502E+06	4.369E+02
2057	1.846E+04	1.562E+07	1.049E+03	4.168E+03	6.247E+06	4.197E+02
2058	1.774E+04	1.501E+07	1.008E+03	4.004E+03	6.002E+06	4.033E+02
2059	1.704E+04	1.442E+07	9.687E+02	3.847E+03	5.767E+06	3.875E+02
2060	1.637E+04	1.385E+07	9.307E+02	3.696E+03	5.541E+06	3.723E+02
2061	1.573E+04	1.331E+07	8.942E+02	3.551E+03	5.323E+06	3.577E+02
2062	1.512E+04	1.279E+07	8.591E+02	3.412E+03	5.115E+06	3.437E+02
2063	1.452E+04	1.229E+07	8.254E+02	3.278E+03	4.914E+06	3.302E+02
2064	1.395E+04	1.180E+07	7.931E+02	3.150E+03	4.721E+06	3.172E+02
2065	1.341E+04	1.134E+07	7.620E+02	3.026E+03	4.536E+06	3.048E+02
2066	1.288E+04	1.090E+07	7.321E+02	2.908E+03	4.358E+06	2.928E+02
2067	1.238E+04	1.047E+07	7.034E+02	2.794E+03	4.187E+06	2.814E+02
2068	1.189E+04	1.006E+07	6.758E+02	2.684E+03	4.023E+06	2.703E+02
2069	1.142E+04	9.664E+06	6.493E+02	2.579E+03	3.866E+06	2.597E+02
2070	1.098E+04	9.285E+06	6.239E+02	2.478E+03	3.714E+06	2.495E+02
2071	1.055E+04	8.921E+06	5.994E+02	2.381E+03	3.568E+06	2.398E+02
2072	1.013E+04	8.571E+06	5.759E+02	2.287E+03	3.428E+06	2.304E+02
2073	9.735E+03	8.235E+06	5.533E+02	2.198E+03	3.294E+06	2.213E+02

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2074	9.353E+03	7.912E+06	5.316E+02	2.111E+03	3.165E+06	2.126E+02
2075	8.986E+03	7.602E+06	5.108E+02	2.029E+03	3.041E+06	2.043E+02
2076	8.634E+03	7.304E+06	4.907E+02	1.949E+03	2.922E+06	1.963E+02
2077	8.295E+03	7.017E+06	4.715E+02	1.873E+03	2.807E+06	1.886E+02
2078	7.970E+03	6.742E+06	4.530E+02	1.799E+03	2.697E+06	1.812E+02
2079	7.658E+03	6.478E+06	4.352E+02	1.729E+03	2.591E+06	1.741E+02
2080	7.357E+03	6.224E+06	4.182E+02	1.661E+03	2.490E+06	1.673E+02
2081	7.069E+03	5.980E+06	4.018E+02	1.596E+03	2.392E+06	1.607E+02
2082	6.792E+03	5.745E+06	3.860E+02	1.533E+03	2.298E+06	1.544E+02
2083	6.525E+03	5.520E+06	3.709E+02	1.473E+03	2.208E+06	1.484E+02
2084	6.269E+03	5.304E+06	3.564E+02	1.415E+03	2.121E+06	1.425E+02
2085	6.024E+03	5.096E+06	3.424E+02	1.360E+03	2.038E+06	1.370E+02
2086	5.787E+03	4.896E+06	3.290E+02	1.307E+03	1.958E+06	1.316E+02
2087	5.561E+03	4.704E+06	3.161E+02	1.255E+03	1.882E+06	1.264E+02
2088	5.343E+03	4.519E+06	3.037E+02	1.206E+03	1.808E+06	1.215E+02
2089	5.133E+03	4.342E+06	2.918E+02	1.159E+03	1.737E+06	1.167E+02
2090	4.932E+03	4.172E+06	2.803E+02	1.113E+03	1.669E+06	1.121E+02
2091	4.738E+03	4.008E+06	2.693E+02	1.070E+03	1.603E+06	1.077E+02
2092	4.553E+03	3.851E+06	2.588E+02	1.028E+03	1.540E+06	1.035E+02
2093	4.374E+03	3.700E+06	2.486E+02	9.874E+02	1.480E+06	9.945E+01
2094	4.203E+03	3.555E+06	2.389E+02	9.487E+02	1.422E+06	9.555E+01
2095	4.038E+03	3.416E+06	2.295E+02	9.115E+02	1.366E+06	9.180E+01
2096	3.879E+03	3.282E+06	2.205E+02	8.758E+02	1.313E+06	8.820E+01
2097	3.727E+03	3.153E+06	2.119E+02	8.414E+02	1.261E+06	8.474E+01
2098	3.581E+03	3.029E+06	2.036E+02	8.084E+02	1.212E+06	8.142E+01
2099	3.441E+03	2.911E+06	1.956E+02	7.767E+02	1.164E+06	7.823E+01
2100	3.306E+03	2.797E+06	1.879E+02	7.463E+02	1.119E+06	7.516E+01
2101	3.176E+03	2.687E+06	1.805E+02	7.170E+02	1.075E+06	7.221E+01
2102	3.052E+03	2.582E+06	1.735E+02	6.889E+02	1.033E+06	6.938E+01
2103	2.932E+03	2.480E+06	1.667E+02	6.619E+02	9.921E+05	6.666E+01
2104	2.817E+03	2.383E+06	1.601E+02	6.359E+02	9.532E+05	6.405E+01
2105	2.707E+03	2.290E+06	1.538E+02	6.110E+02	9.159E+05	6.154E+01
2106	2.600E+03	2.200E+06	1.478E+02	5.871E+02	8.799E+05	5.912E+01
2107	2.499E+03	2.114E+06	1.420E+02	5.640E+02	8.454E+05	5.681E+01
2108	2.401E+03	2.031E+06	1.364E+02	5.419E+02	8.123E+05	5.458E+01
2109	2.306E+03	1.951E+06	1.311E+02	5.207E+02	7.804E+05	5.244E+01
2110	2.216E+03	1.875E+06	1.260E+02	5.003E+02	7.498E+05	5.038E+01
2111	2.129E+03	1.801E+06	1.210E+02	4.806E+02	7.204E+05	4.841E+01
2112	2.046E+03	1.730E+06	1.163E+02	4.618E+02	6.922E+05	4.651E+01
2113	1.965E+03	1.663E+06	1.117E+02	4.437E+02	6.650E+05	4.468E+01
2114	1.888E+03	1.597E+06	1.073E+02	4.263E+02	6.390E+05	4.293E+01
2115	1.814E+03	1.535E+06	1.031E+02	4.096E+02	6.139E+05	4.125E+01
2116	1.743E+03	1.475E+06	9.908E+01	3.935E+02	5.898E+05	3.963E+01
2117	1.675E+03	1.417E+06	9.519E+01	3.781E+02	5.667E+05	3.808E+01
2118	1.609E+03	1.361E+06	9.146E+01	3.633E+02	5.445E+05	3.658E+01
2119	1.546E+03	1.308E+06	8.788E+01	3.490E+02	5.231E+05	3.515E+01
2120	1.485E+03	1.257E+06	8.443E+01	3.353E+02	5.026E+05	3.377E+01
2121	1.427E+03	1.207E+06	8.112E+01	3.222E+02	4.829E+05	3.245E+01
2122	1.371E+03	1.160E+06	7.794E+01	3.095E+02	4.640E+05	3.118E+01
2123	1.317E+03	1.114E+06	7.488E+01	2.974E+02	4.458E+05	2.995E+01
2124	1.266E+03	1.071E+06	7.195E+01	2.857E+02	4.283E+05	2.878E+01

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2125	1.216E+03	1.029E+06	6.913E+01	2.745E+02	4.115E+05	2.765E+01
2126	1.168E+03	9.885E+05	6.641E+01	2.638E+02	3.954E+05	2.657E+01
2127	1.123E+03	9.497E+05	6.381E+01	2.534E+02	3.799E+05	2.552E+01
2128	1.079E+03	9.125E+05	6.131E+01	2.435E+02	3.650E+05	2.452E+01
2129	1.036E+03	8.767E+05	5.890E+01	2.340E+02	3.507E+05	2.356E+01
2130	9.957E+02	8.423E+05	5.659E+01	2.248E+02	3.369E+05	2.264E+01
2131	9.567E+02	8.093E+05	5.438E+01	2.160E+02	3.237E+05	2.175E+01
2132	9.191E+02	7.776E+05	5.224E+01	2.075E+02	3.110E+05	2.090E+01
2133	8.831E+02	7.471E+05	5.020E+01	1.994E+02	2.988E+05	2.008E+01
2134	8.485E+02	7.178E+05	4.823E+01	1.915E+02	2.871E+05	1.929E+01
2135	8.152E+02	6.896E+05	4.634E+01	1.840E+02	2.759E+05	1.853E+01
2136	7.832E+02	6.626E+05	4.452E+01	1.768E+02	2.650E+05	1.781E+01
2137	7.525E+02	6.366E+05	4.277E+01	1.699E+02	2.546E+05	1.711E+01
2138	7.230E+02	6.116E+05	4.110E+01	1.632E+02	2.447E+05	1.644E+01
2139	6.947E+02	5.877E+05	3.948E+01	1.568E+02	2.351E+05	1.579E+01
2140	6.674E+02	5.646E+05	3.794E+01	1.507E+02	2.258E+05	1.517E+01
2141	6.413E+02	5.425E+05	3.645E+01	1.448E+02	2.170E+05	1.458E+01
2142	6.161E+02	5.212E+05	3.502E+01	1.391E+02	2.085E+05	1.401E+01
2143	5.920E+02	5.008E+05	3.365E+01	1.336E+02	2.003E+05	1.346E+01
2144	5.688E+02	4.811E+05	3.233E+01	1.284E+02	1.925E+05	1.293E+01
2145	5.465E+02	4.623E+05	3.106E+01	1.234E+02	1.849E+05	1.242E+01
2146	5.250E+02	4.441E+05	2.984E+01	1.185E+02	1.777E+05	1.194E+01
2147	5.044E+02	4.267E+05	2.867E+01	1.139E+02	1.707E+05	1.147E+01
2148	4.847E+02	4.100E+05	2.755E+01	1.094E+02	1.640E+05	1.102E+01
2149	4.657E+02	3.939E+05	2.647E+01	1.051E+02	1.576E+05	1.059E+01
2150	4.474E+02	3.785E+05	2.543E+01	1.010E+02	1.514E+05	1.017E+01
2151	4.299E+02	3.636E+05	2.443E+01	9.704E+01	1.455E+05	9.773E+00
2152	4.130E+02	3.494E+05	2.347E+01	9.323E+01	1.398E+05	9.390E+00
2153	3.968E+02	3.357E+05	2.255E+01	8.958E+01	1.343E+05	9.022E+00
2154	3.812E+02	3.225E+05	2.167E+01	8.607E+01	1.290E+05	8.668E+00
2155	3.663E+02	3.099E+05	2.082E+01	8.269E+01	1.239E+05	8.328E+00
2156	3.519E+02	2.977E+05	2.000E+01	7.945E+01	1.191E+05	8.001E+00
2157	3.381E+02	2.860E+05	1.922E+01	7.633E+01	1.144E+05	7.688E+00
2158	3.249E+02	2.748E+05	1.847E+01	7.334E+01	1.099E+05	7.386E+00
2159	3.121E+02	2.641E+05	1.774E+01	7.046E+01	1.056E+05	7.097E+00
2160	2.999E+02	2.537E+05	1.705E+01	6.770E+01	1.015E+05	6.818E+00
2161	2.881E+02	2.438E+05	1.638E+01	6.505E+01	9.750E+04	6.551E+00
2162	2.768E+02	2.342E+05	1.574E+01	6.250E+01	9.368E+04	6.294E+00
2163	2.660E+02	2.250E+05	1.512E+01	6.005E+01	9.000E+04	6.047E+00
2164	2.556E+02	2.162E+05	1.453E+01	5.769E+01	8.648E+04	5.810E+00

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2024	0	0	0	0	0	0
2025	4.085E+03	2.232E+06	1.499E+02	7.999E+00	2.232E+03	1.499E-01
2026	8.010E+03	4.376E+06	2.940E+02	1.568E+01	4.376E+03	2.940E-01
2027	1.178E+04	6.436E+06	4.324E+02	2.307E+01	6.436E+03	4.324E-01
2028	1.540E+04	8.415E+06	5.654E+02	3.016E+01	8.415E+03	5.654E-01
2029	1.888E+04	1.032E+07	6.932E+02	3.698E+01	1.032E+04	6.932E-01
2030	2.223E+04	1.214E+07	8.159E+02	4.353E+01	1.214E+04	8.159E-01
2031	2.544E+04	1.390E+07	9.339E+02	4.982E+01	1.390E+04	9.339E-01
2032	2.853E+04	1.559E+07	1.047E+03	5.587E+01	1.559E+04	1.047E+00
2033	3.150E+04	1.721E+07	1.156E+03	6.167E+01	1.721E+04	1.156E+00
2034	3.435E+04	1.876E+07	1.261E+03	6.725E+01	1.876E+04	1.261E+00
2035	3.708E+04	2.026E+07	1.361E+03	7.262E+01	2.026E+04	1.361E+00
2036	3.971E+04	2.170E+07	1.458E+03	7.777E+01	2.170E+04	1.458E+00
2037	3.817E+04	2.085E+07	1.401E+03	7.475E+01	2.085E+04	1.401E+00
2038	3.668E+04	2.004E+07	1.346E+03	7.182E+01	2.004E+04	1.346E+00
2039	3.524E+04	1.925E+07	1.293E+03	6.900E+01	1.925E+04	1.293E+00
2040	3.386E+04	1.850E+07	1.243E+03	6.630E+01	1.850E+04	1.243E+00
2041	3.253E+04	1.777E+07	1.194E+03	6.370E+01	1.777E+04	1.194E+00
2042	3.125E+04	1.707E+07	1.147E+03	6.120E+01	1.707E+04	1.147E+00
2043	3.003E+04	1.640E+07	1.102E+03	5.880E+01	1.640E+04	1.102E+00
2044	2.885E+04	1.576E+07	1.059E+03	5.650E+01	1.576E+04	1.059E+00
2045	2.772E+04	1.514E+07	1.017E+03	5.428E+01	1.514E+04	1.017E+00
2046	2.663E+04	1.455E+07	9.776E+02	5.215E+01	1.455E+04	9.776E-01
2047	2.559E+04	1.398E+07	9.393E+02	5.011E+01	1.398E+04	9.393E-01
2048	2.459E+04	1.343E+07	9.024E+02	4.814E+01	1.343E+04	9.024E-01
2049	2.362E+04	1.290E+07	8.670E+02	4.626E+01	1.290E+04	8.670E-01
2050	2.270E+04	1.240E+07	8.330E+02	4.444E+01	1.240E+04	8.330E-01
2051	2.181E+04	1.191E+07	8.004E+02	4.270E+01	1.191E+04	8.004E-01
2052	2.095E+04	1.145E+07	7.690E+02	4.102E+01	1.145E+04	7.690E-01
2053	2.013E+04	1.100E+07	7.388E+02	3.942E+01	1.100E+04	7.388E-01
2054	1.934E+04	1.057E+07	7.099E+02	3.787E+01	1.057E+04	7.099E-01
2055	1.858E+04	1.015E+07	6.820E+02	3.639E+01	1.015E+04	6.820E-01
2056	1.785E+04	9.753E+06	6.553E+02	3.496E+01	9.753E+03	6.553E-01
2057	1.715E+04	9.371E+06	6.296E+02	3.359E+01	9.371E+03	6.296E-01
2058	1.648E+04	9.003E+06	6.049E+02	3.227E+01	9.003E+03	6.049E-01
2059	1.583E+04	8.650E+06	5.812E+02	3.101E+01	8.650E+03	5.812E-01
2060	1.521E+04	8.311E+06	5.584E+02	2.979E+01	8.311E+03	5.584E-01
2061	1.462E+04	7.985E+06	5.365E+02	2.862E+01	7.985E+03	5.365E-01
2062	1.404E+04	7.672E+06	5.155E+02	2.750E+01	7.672E+03	5.155E-01
2063	1.349E+04	7.371E+06	4.953E+02	2.642E+01	7.371E+03	4.953E-01
2064	1.296E+04	7.082E+06	4.758E+02	2.539E+01	7.082E+03	4.758E-01
2065	1.246E+04	6.804E+06	4.572E+02	2.439E+01	6.804E+03	4.572E-01
2066	1.197E+04	6.538E+06	4.393E+02	2.343E+01	6.538E+03	4.393E-01
2067	1.150E+04	6.281E+06	4.220E+02	2.251E+01	6.281E+03	4.220E-01
2068	1.105E+04	6.035E+06	4.055E+02	2.163E+01	6.035E+03	4.055E-01
2069	1.061E+04	5.798E+06	3.896E+02	2.078E+01	5.798E+03	3.896E-01
2070	1.020E+04	5.571E+06	3.743E+02	1.997E+01	5.571E+03	3.743E-01
2071	9.798E+03	5.353E+06	3.596E+02	1.919E+01	5.353E+03	3.596E-01
2072	9.414E+03	5.143E+06	3.455E+02	1.843E+01	5.143E+03	3.455E-01
2073	9.045E+03	4.941E+06	3.320E+02	1.771E+01	4.941E+03	3.320E-01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2074	8.690E+03	4.747E+06	3.190E+02	1.702E+01	4.747E+03	3.190E-01
2075	8.349E+03	4.561E+06	3.065E+02	1.635E+01	4.561E+03	3.065E-01
2076	8.022E+03	4.382E+06	2.944E+02	1.571E+01	4.382E+03	2.944E-01
2077	7.707E+03	4.210E+06	2.829E+02	1.509E+01	4.210E+03	2.829E-01
2078	7.405E+03	4.045E+06	2.718E+02	1.450E+01	4.045E+03	2.718E-01
2079	7.115E+03	3.887E+06	2.611E+02	1.393E+01	3.887E+03	2.611E-01
2080	6.836E+03	3.734E+06	2.509E+02	1.339E+01	3.734E+03	2.509E-01
2081	6.568E+03	3.588E+06	2.411E+02	1.286E+01	3.588E+03	2.411E-01
2082	6.310E+03	3.447E+06	2.316E+02	1.236E+01	3.447E+03	2.316E-01
2083	6.063E+03	3.312E+06	2.225E+02	1.187E+01	3.312E+03	2.225E-01
2084	5.825E+03	3.182E+06	2.138E+02	1.141E+01	3.182E+03	2.138E-01
2085	5.597E+03	3.057E+06	2.054E+02	1.096E+01	3.057E+03	2.054E-01
2086	5.377E+03	2.938E+06	1.974E+02	1.053E+01	2.938E+03	1.974E-01
2087	5.166E+03	2.822E+06	1.896E+02	1.012E+01	2.822E+03	1.896E-01
2088	4.964E+03	2.712E+06	1.822E+02	9.720E+00	2.712E+03	1.822E-01
2089	4.769E+03	2.605E+06	1.751E+02	9.339E+00	2.605E+03	1.751E-01
2090	4.582E+03	2.503E+06	1.682E+02	8.973E+00	2.503E+03	1.682E-01
2091	4.402E+03	2.405E+06	1.616E+02	8.621E+00	2.405E+03	1.616E-01
2092	4.230E+03	2.311E+06	1.553E+02	8.283E+00	2.311E+03	1.553E-01
2093	4.064E+03	2.220E+06	1.492E+02	7.958E+00	2.220E+03	1.492E-01
2094	3.905E+03	2.133E+06	1.433E+02	7.646E+00	2.133E+03	1.433E-01
2095	3.752E+03	2.049E+06	1.377E+02	7.346E+00	2.049E+03	1.377E-01
2096	3.604E+03	1.969E+06	1.323E+02	7.058E+00	1.969E+03	1.323E-01
2097	3.463E+03	1.892E+06	1.271E+02	6.781E+00	1.892E+03	1.271E-01
2098	3.327E+03	1.818E+06	1.221E+02	6.515E+00	1.818E+03	1.221E-01
2099	3.197E+03	1.746E+06	1.173E+02	6.260E+00	1.746E+03	1.173E-01
2100	3.071E+03	1.678E+06	1.127E+02	6.015E+00	1.678E+03	1.127E-01
2101	2.951E+03	1.612E+06	1.083E+02	5.779E+00	1.612E+03	1.083E-01
2102	2.835E+03	1.549E+06	1.041E+02	5.552E+00	1.549E+03	1.041E-01
2103	2.724E+03	1.488E+06	9.999E+01	5.334E+00	1.488E+03	9.999E-02
2104	2.617E+03	1.430E+06	9.607E+01	5.125E+00	1.430E+03	9.607E-02
2105	2.515E+03	1.374E+06	9.230E+01	4.924E+00	1.374E+03	9.230E-02
2106	2.416E+03	1.320E+06	8.869E+01	4.731E+00	1.320E+03	8.869E-02
2107	2.321E+03	1.268E+06	8.521E+01	4.546E+00	1.268E+03	8.521E-02
2108	2.230E+03	1.218E+06	8.187E+01	4.367E+00	1.218E+03	8.187E-02
2109	2.143E+03	1.171E+06	7.866E+01	4.196E+00	1.171E+03	7.866E-02
2110	2.059E+03	1.125E+06	7.557E+01	4.032E+00	1.125E+03	7.557E-02
2111	1.978E+03	1.081E+06	7.261E+01	3.874E+00	1.081E+03	7.261E-02
2112	1.901E+03	1.038E+06	6.976E+01	3.722E+00	1.038E+03	6.976E-02
2113	1.826E+03	9.976E+05	6.703E+01	3.576E+00	9.976E+02	6.703E-02
2114	1.754E+03	9.585E+05	6.440E+01	3.436E+00	9.585E+02	6.440E-02
2115	1.686E+03	9.209E+05	6.187E+01	3.301E+00	9.209E+02	6.187E-02
2116	1.620E+03	8.848E+05	5.945E+01	3.171E+00	8.848E+02	5.945E-02
2117	1.556E+03	8.501E+05	5.712E+01	3.047E+00	8.501E+02	5.712E-02
2118	1.495E+03	8.167E+05	5.488E+01	2.928E+00	8.167E+02	5.488E-02
2119	1.436E+03	7.847E+05	5.273E+01	2.813E+00	7.847E+02	5.273E-02
2120	1.380E+03	7.539E+05	5.066E+01	2.703E+00	7.539E+02	5.066E-02
2121	1.326E+03	7.244E+05	4.867E+01	2.597E+00	7.244E+02	4.867E-02
2122	1.274E+03	6.960E+05	4.676E+01	2.495E+00	6.960E+02	4.676E-02
2123	1.224E+03	6.687E+05	4.493E+01	2.397E+00	6.687E+02	4.493E-02
2124	1.176E+03	6.425E+05	4.317E+01	2.303E+00	6.425E+02	4.317E-02

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2125	1.130E+03	6.173E+05	4.148E+01	2.213E+00	6.173E+02	4.148E-02
2126	1.086E+03	5.931E+05	3.985E+01	2.126E+00	5.931E+02	3.985E-02
2127	1.043E+03	5.698E+05	3.829E+01	2.043E+00	5.698E+02	3.829E-02
2128	1.002E+03	5.475E+05	3.679E+01	1.962E+00	5.475E+02	3.679E-02
2129	9.629E+02	5.260E+05	3.534E+01	1.885E+00	5.260E+02	3.534E-02
2130	9.251E+02	5.054E+05	3.396E+01	1.812E+00	5.054E+02	3.396E-02
2131	8.888E+02	4.856E+05	3.263E+01	1.741E+00	4.856E+02	3.263E-02
2132	8.540E+02	4.665E+05	3.135E+01	1.672E+00	4.665E+02	3.135E-02
2133	8.205E+02	4.482E+05	3.012E+01	1.607E+00	4.482E+02	3.012E-02
2134	7.883E+02	4.307E+05	2.894E+01	1.544E+00	4.307E+02	2.894E-02
2135	7.574E+02	4.138E+05	2.780E+01	1.483E+00	4.138E+02	2.780E-02
2136	7.277E+02	3.976E+05	2.671E+01	1.425E+00	3.976E+02	2.671E-02
2137	6.992E+02	3.820E+05	2.566E+01	1.369E+00	3.820E+02	2.566E-02
2138	6.718E+02	3.670E+05	2.466E+01	1.315E+00	3.670E+02	2.466E-02
2139	6.454E+02	3.526E+05	2.369E+01	1.264E+00	3.526E+02	2.369E-02
2140	6.201E+02	3.388E+05	2.276E+01	1.214E+00	3.388E+02	2.276E-02
2141	5.958E+02	3.255E+05	2.187E+01	1.167E+00	3.255E+02	2.187E-02
2142	5.724E+02	3.127E+05	2.101E+01	1.121E+00	3.127E+02	2.101E-02
2143	5.500E+02	3.005E+05	2.019E+01	1.077E+00	3.005E+02	2.019E-02
2144	5.284E+02	2.887E+05	1.940E+01	1.035E+00	2.887E+02	1.940E-02
2145	5.077E+02	2.774E+05	1.864E+01	9.942E-01	2.774E+02	1.864E-02
2146	4.878E+02	2.665E+05	1.791E+01	9.552E-01	2.665E+02	1.791E-02
2147	4.687E+02	2.560E+05	1.720E+01	9.178E-01	2.560E+02	1.720E-02
2148	4.503E+02	2.460E+05	1.653E+01	8.818E-01	2.460E+02	1.653E-02
2149	4.326E+02	2.364E+05	1.588E+01	8.472E-01	2.364E+02	1.588E-02
2150	4.157E+02	2.271E+05	1.526E+01	8.140E-01	2.271E+02	1.526E-02
2151	3.994E+02	2.182E+05	1.466E+01	7.821E-01	2.182E+02	1.466E-02
2152	3.837E+02	2.096E+05	1.408E+01	7.514E-01	2.096E+02	1.408E-02
2153	3.687E+02	2.014E+05	1.353E+01	7.219E-01	2.014E+02	1.353E-02
2154	3.542E+02	1.935E+05	1.300E+01	6.936E-01	1.935E+02	1.300E-02
2155	3.403E+02	1.859E+05	1.249E+01	6.664E-01	1.859E+02	1.249E-02
2156	3.270E+02	1.786E+05	1.200E+01	6.403E-01	1.786E+02	1.200E-02
2157	3.142E+02	1.716E+05	1.153E+01	6.152E-01	1.716E+02	1.153E-02
2158	3.018E+02	1.649E+05	1.108E+01	5.911E-01	1.649E+02	1.108E-02
2159	2.900E+02	1.584E+05	1.065E+01	5.679E-01	1.584E+02	1.065E-02
2160	2.786E+02	1.522E+05	1.023E+01	5.456E-01	1.522E+02	1.023E-02
2161	2.677E+02	1.463E+05	9.827E+00	5.242E-01	1.463E+02	9.827E-03
2162	2.572E+02	1.405E+05	9.441E+00	5.037E-01	1.405E+02	9.441E-03
2163	2.471E+02	1.350E+05	9.071E+00	4.839E-01	1.350E+02	9.071E-03
2164	2.374E+02	1.297E+05	8.715E+00	4.650E-01	1.297E+02	8.715E-03

Summary Report

Landfill Name or Identifier:

Date: Tuesday, August 31, 2021

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} k L_o \left(\frac{M_i}{10} \right) e^{-k t_{ij}}$$

Where,

Q_{CH4} = annual methane generation in the year of the calculation *(m^3/year)*
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate (*$year^{-1}$*)
L_o = potential methane generation capacity (*m^3/Mg*)

M_i = mass of waste accepted in the i^{th} year (*Mg*)
t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{th} year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**2024**	
Landfill Closure Year (with 80-year limit)	**2026**	
Actual Closure Year (without limit)	***2026***	
Have Model Calculate Closure Year?	**No**	
Waste Design Capacity	**1,226,610**	*short tons*

MODEL PARAMETERS

Methane Generation Rate, k	**0.040**	*year $^{-1}$*
Potential Methane Generation Capacity, L_o	**100**	*m^3/Mg*
NMOC Concentration	**600**	*ppmv as hexane*
Methane Content	**40**	*% by volume*

GASES / POLLUTANTS SELECTED

Gas / Pollutant #1:	**Total landfill gas**
Gas / Pollutant #2:	**Methane**
Gas / Pollutant #3:	**Carbon dioxide**
Gas / Pollutant #4:	**NMOC**

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2024	378,655	416,520	0	0
2025	378,655	416,520	378,655	416,520
2026	378,655	416,520	757,309	833,040
2027	0	0	1,135,964	1,249,560
2028	0	0	1,135,964	1,249,560
2029	0	0	1,135,964	1,249,560
2030	0	0	1,135,964	1,249,560
2031	0	0	1,135,964	1,249,560
2032	0	0	1,135,964	1,249,560
2033	0	0	1,135,964	1,249,560
2034	0	0	1,135,964	1,249,560
2035	0	0	1,135,964	1,249,560
2036	0	0	1,135,964	1,249,560
2037	0	0	1,135,964	1,249,560
2038	0	0	1,135,964	1,249,560
2039	0	0	1,135,964	1,249,560
2040	0	0	1,135,964	1,249,560
2041	0	0	1,135,964	1,249,560
2042	0	0	1,135,964	1,249,560
2043	0	0	1,135,964	1,249,560
2044	0	0	1,135,964	1,249,560
2045	0	0	1,135,964	1,249,560
2046	0	0	1,135,964	1,249,560
2047	0	0	1,135,964	1,249,560
2048	0	0	1,135,964	1,249,560
2049	0	0	1,135,964	1,249,560
2050	0	0	1,135,964	1,249,560
2051	0	0	1,135,964	1,249,560
2052	0	0	1,135,964	1,249,560
2053	0	0	1,135,964	1,249,560
2054	0	0	1,135,964	1,249,560
2055	0	0	1,135,964	1,249,560
2056	0	0	1,135,964	1,249,560
2057	0	0	1,135,964	1,249,560
2058	0	0	1,135,964	1,249,560
2059	0	0	1,135,964	1,249,560
2060	0	0	1,135,964	1,249,560
2061	0	0	1,135,964	1,249,560
2062	0	0	1,135,964	1,249,560
2063	0	0	1,135,964	1,249,560

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2064	0	0	1,135,964	1,249,560
2065	0	0	1,135,964	1,249,560
2066	0	0	1,135,964	1,249,560
2067	0	0	1,135,964	1,249,560
2068	0	0	1,135,964	1,249,560
2069	0	0	1,135,964	1,249,560
2070	0	0	1,135,964	1,249,560
2071	0	0	1,135,964	1,249,560
2072	0	0	1,135,964	1,249,560
2073	0	0	1,135,964	1,249,560
2074	0	0	1,135,964	1,249,560
2075	0	0	1,135,964	1,249,560
2076	0	0	1,135,964	1,249,560
2077	0	0	1,135,964	1,249,560
2078	0	0	1,135,964	1,249,560
2079	0	0	1,135,964	1,249,560
2080	0	0	1,135,964	1,249,560
2081	0	0	1,135,964	1,249,560
2082	0	0	1,135,964	1,249,560
2083	0	0	1,135,964	1,249,560
2084	0	0	1,135,964	1,249,560
2085	0	0	1,135,964	1,249,560
2086	0	0	1,135,964	1,249,560
2087	0	0	1,135,964	1,249,560
2088	0	0	1,135,964	1,249,560
2089	0	0	1,135,964	1,249,560
2090	0	0	1,135,964	1,249,560
2091	0	0	1,135,964	1,249,560
2092	0	0	1,135,964	1,249,560
2093	0	0	1,135,964	1,249,560
2094	0	0	1,135,964	1,249,560
2095	0	0	1,135,964	1,249,560
2096	0	0	1,135,964	1,249,560
2097	0	0	1,135,964	1,249,560
2098	0	0	1,135,964	1,249,560
2099	0	0	1,135,964	1,249,560
2100	0	0	1,135,964	1,249,560
2101	0	0	1,135,964	1,249,560
2102	0	0	1,135,964	1,249,560
2103	0	0	1,135,964	1,249,560

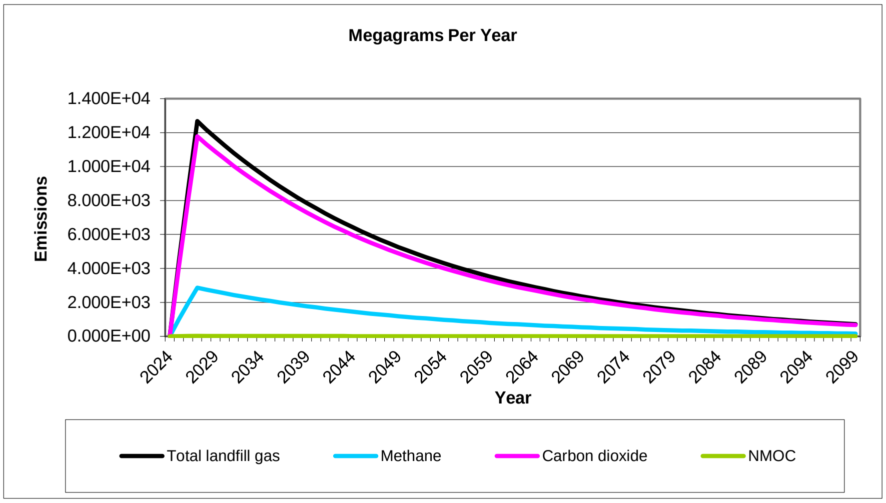
Pollutant Parameters

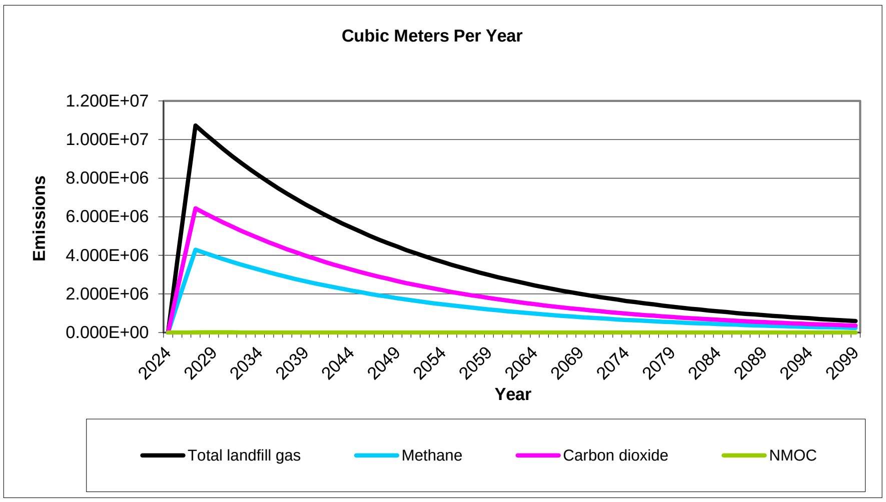
		Gas / Pollutant Default Parameters:		User-specified Pollutant Parameters:	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

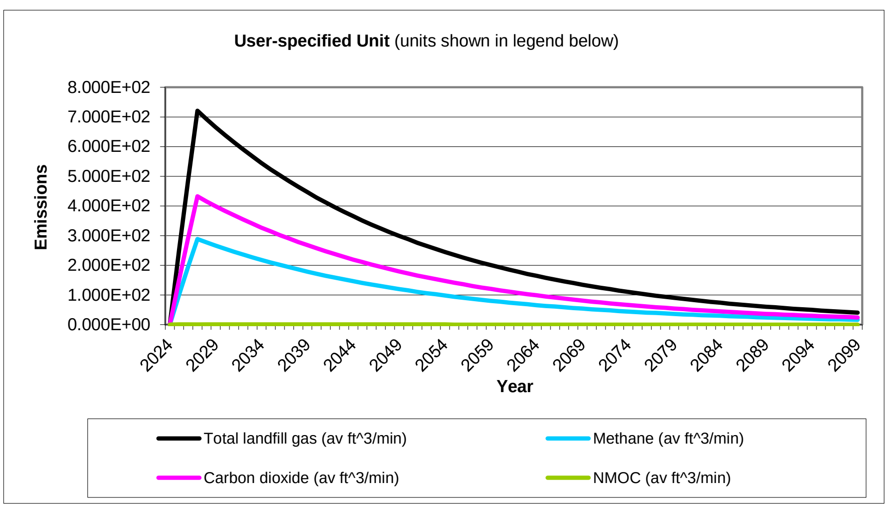
Pollutant Parameters (Continued)

	Compound	Gas / Pollutant Default Parameters: Concentration (*ppmv*)	Molecular Weight	User-specified Pollutant Parameters: Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

Graphs


Megagrams Per Year
Emissions
1.400E+04
1.200E+04
1.000E+04
8.000E+03
6.000E+03
4.000E+03
2.000E+03
0.000E+00
2024 2029 2034 2039 2044 2049 2054 2059 2064 2069 2074 2079 2084 2089 2094 2099
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
Emissions
1.200E+07
1.000E+07
8.000E+06
6.000E+06
4.000E+06
2.000E+06
0.000E+00
2024 2029 2034 2039 2044 2049 2054 2059 2064 2069 2074 2079 2084 2089 2094 2099
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
Emissions
8.000E+02
7.000E+02
6.000E+02
5.000E+02
4.000E+02
3.000E+02
2.000E+02
1.000E+02
0.000E+00
2024 2029 2034 2039 2044 2049 2054 2059 2064 2069 2074 2079 2084 2089 2094 2099
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2024	0	0	0	0	0	0
2025	4.397E+03	3.719E+06	2.499E+02	9.925E+02	1.488E+06	9.996E+01
2026	8.621E+03	7.293E+06	4.900E+02	1.946E+03	2.917E+06	1.960E+02
2027	1.268E+04	1.073E+07	7.207E+02	2.862E+03	4.290E+06	2.883E+02
2028	1.218E+04	1.031E+07	6.924E+02	2.750E+03	4.122E+06	2.770E+02
2029	1.170E+04	9.901E+06	6.653E+02	2.642E+03	3.961E+06	2.661E+02
2030	1.125E+04	9.513E+06	6.392E+02	2.539E+03	3.805E+06	2.557E+02
2031	1.080E+04	9.140E+06	6.141E+02	2.439E+03	3.656E+06	2.456E+02
2032	1.038E+04	8.782E+06	5.900E+02	2.343E+03	3.513E+06	2.360E+02
2033	9.974E+03	8.437E+06	5.669E+02	2.252E+03	3.375E+06	2.268E+02
2034	9.583E+03	8.106E+06	5.447E+02	2.163E+03	3.243E+06	2.179E+02
2035	9.207E+03	7.789E+06	5.233E+02	2.078E+03	3.115E+06	2.093E+02
2036	8.846E+03	7.483E+06	5.028E+02	1.997E+03	2.993E+06	2.011E+02
2037	8.499E+03	7.190E+06	4.831E+02	1.919E+03	2.876E+06	1.932E+02
2038	8.166E+03	6.908E+06	4.641E+02	1.843E+03	2.763E+06	1.857E+02
2039	7.846E+03	6.637E+06	4.459E+02	1.771E+03	2.655E+06	1.784E+02
2040	7.538E+03	6.377E+06	4.285E+02	1.702E+03	2.551E+06	1.714E+02
2041	7.242E+03	6.127E+06	4.117E+02	1.635E+03	2.451E+06	1.647E+02
2042	6.959E+03	5.887E+06	3.955E+02	1.571E+03	2.355E+06	1.582E+02
2043	6.686E+03	5.656E+06	3.800E+02	1.509E+03	2.262E+06	1.520E+02
2044	6.424E+03	5.434E+06	3.651E+02	1.450E+03	2.174E+06	1.460E+02
2045	6.172E+03	5.221E+06	3.508E+02	1.393E+03	2.088E+06	1.403E+02
2046	5.930E+03	5.016E+06	3.370E+02	1.339E+03	2.006E+06	1.348E+02
2047	5.697E+03	4.819E+06	3.238E+02	1.286E+03	1.928E+06	1.295E+02
2048	5.474E+03	4.631E+06	3.111E+02	1.236E+03	1.852E+06	1.244E+02
2049	5.259E+03	4.449E+06	2.989E+02	1.187E+03	1.780E+06	1.196E+02
2050	5.053E+03	4.274E+06	2.872E+02	1.141E+03	1.710E+06	1.149E+02
2051	4.855E+03	4.107E+06	2.759E+02	1.096E+03	1.643E+06	1.104E+02
2052	4.664E+03	3.946E+06	2.651E+02	1.053E+03	1.578E+06	1.060E+02
2053	4.482E+03	3.791E+06	2.547E+02	1.012E+03	1.516E+06	1.019E+02
2054	4.306E+03	3.642E+06	2.447E+02	9.720E+02	1.457E+06	9.790E+01
2055	4.137E+03	3.500E+06	2.351E+02	9.339E+02	1.400E+06	9.406E+01
2056	3.975E+03	3.362E+06	2.259E+02	8.973E+02	1.345E+06	9.037E+01
2057	3.819E+03	3.231E+06	2.171E+02	8.621E+02	1.292E+06	8.683E+01
2058	3.669E+03	3.104E+06	2.086E+02	8.283E+02	1.242E+06	8.342E+01
2059	3.525E+03	2.982E+06	2.004E+02	7.958E+02	1.193E+06	8.015E+01
2060	3.387E+03	2.865E+06	1.925E+02	7.646E+02	1.146E+06	7.701E+01
2061	3.254E+03	2.753E+06	1.850E+02	7.346E+02	1.101E+06	7.399E+01
2062	3.127E+03	2.645E+06	1.777E+02	7.058E+02	1.058E+06	7.109E+01
2063	3.004E+03	2.541E+06	1.707E+02	6.782E+02	1.017E+06	6.830E+01
2064	2.886E+03	2.442E+06	1.641E+02	6.516E+02	9.767E+05	6.562E+01
2065	2.773E+03	2.346E+06	1.576E+02	6.260E+02	9.384E+05	6.305E+01
2066	2.664E+03	2.254E+06	1.514E+02	6.015E+02	9.016E+05	6.058E+01
2067	2.560E+03	2.166E+06	1.455E+02	5.779E+02	8.662E+05	5.820E+01
2068	2.460E+03	2.081E+06	1.398E+02	5.552E+02	8.322E+05	5.592E+01
2069	2.363E+03	1.999E+06	1.343E+02	5.335E+02	7.996E+05	5.373E+01
2070	2.270E+03	1.921E+06	1.290E+02	5.125E+02	7.683E+05	5.162E+01
2071	2.181E+03	1.845E+06	1.240E+02	4.924E+02	7.381E+05	4.960E+01
2072	2.096E+03	1.773E+06	1.191E+02	4.731E+02	7.092E+05	4.765E+01
2073	2.014E+03	1.703E+06	1.145E+02	4.546E+02	6.814E+05	4.578E+01

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2074	1.935E+03	1.637E+06	1.100E+02	4.368E+02	6.547E+05	4.399E+01
2075	1.859E+03	1.572E+06	1.057E+02	4.196E+02	6.290E+05	4.226E+01
2076	1.786E+03	1.511E+06	1.015E+02	4.032E+02	6.043E+05	4.061E+01
2077	1.716E+03	1.452E+06	9.753E+01	3.874E+02	5.806E+05	3.901E+01
2078	1.649E+03	1.395E+06	9.371E+01	3.722E+02	5.579E+05	3.748E+01
2079	1.584E+03	1.340E+06	9.003E+01	3.576E+02	5.360E+05	3.601E+01
2080	1.522E+03	1.287E+06	8.650E+01	3.436E+02	5.150E+05	3.460E+01
2081	1.462E+03	1.237E+06	8.311E+01	3.301E+02	4.948E+05	3.324E+01
2082	1.405E+03	1.188E+06	7.985E+01	3.172E+02	4.754E+05	3.194E+01
2083	1.350E+03	1.142E+06	7.672E+01	3.047E+02	4.567E+05	3.069E+01
2084	1.297E+03	1.097E+06	7.371E+01	2.928E+02	4.388E+05	2.949E+01
2085	1.246E+03	1.054E+06	7.082E+01	2.813E+02	4.216E+05	2.833E+01
2086	1.197E+03	1.013E+06	6.805E+01	2.703E+02	4.051E+05	2.722E+01
2087	1.150E+03	9.730E+05	6.538E+01	2.597E+02	3.892E+05	2.615E+01
2088	1.105E+03	9.349E+05	6.281E+01	2.495E+02	3.740E+05	2.513E+01
2089	1.062E+03	8.982E+05	6.035E+01	2.397E+02	3.593E+05	2.414E+01
2090	1.020E+03	8.630E+05	5.799E+01	2.303E+02	3.452E+05	2.319E+01
2091	9.802E+02	8.292E+05	5.571E+01	2.213E+02	3.317E+05	2.228E+01
2092	9.417E+02	7.967E+05	5.353E+01	2.126E+02	3.187E+05	2.141E+01
2093	9.048E+02	7.654E+05	5.143E+01	2.043E+02	3.062E+05	2.057E+01
2094	8.693E+02	7.354E+05	4.941E+01	1.962E+02	2.942E+05	1.976E+01
2095	8.352E+02	7.066E+05	4.747E+01	1.886E+02	2.826E+05	1.899E+01
2096	8.025E+02	6.789E+05	4.561E+01	1.812E+02	2.715E+05	1.825E+01
2097	7.710E+02	6.522E+05	4.382E+01	1.741E+02	2.609E+05	1.753E+01
2098	7.408E+02	6.267E+05	4.211E+01	1.672E+02	2.507E+05	1.684E+01
2099	7.117E+02	6.021E+05	4.045E+01	1.607E+02	2.408E+05	1.618E+01
2100	6.838E+02	5.785E+05	3.887E+01	1.544E+02	2.314E+05	1.555E+01
2101	6.570E+02	5.558E+05	3.734E+01	1.483E+02	2.223E+05	1.494E+01
2102	6.313E+02	5.340E+05	3.588E+01	1.425E+02	2.136E+05	1.435E+01
2103	6.065E+02	5.131E+05	3.447E+01	1.369E+02	2.052E+05	1.379E+01
2104	5.827E+02	4.930E+05	3.312E+01	1.316E+02	1.972E+05	1.325E+01
2105	5.599E+02	4.736E+05	3.182E+01	1.264E+02	1.895E+05	1.273E+01
2106	5.379E+02	4.551E+05	3.058E+01	1.214E+02	1.820E+05	1.223E+01
2107	5.168E+02	4.372E+05	2.938E+01	1.167E+02	1.749E+05	1.175E+01
2108	4.966E+02	4.201E+05	2.822E+01	1.121E+02	1.680E+05	1.129E+01
2109	4.771E+02	4.036E+05	2.712E+01	1.077E+02	1.614E+05	1.085E+01
2110	4.584E+02	3.878E+05	2.605E+01	1.035E+02	1.551E+05	1.042E+01
2111	4.404E+02	3.726E+05	2.503E+01	9.942E+01	1.490E+05	1.001E+01
2112	4.231E+02	3.580E+05	2.405E+01	9.552E+01	1.432E+05	9.621E+00
2113	4.066E+02	3.439E+05	2.311E+01	9.178E+01	1.376E+05	9.243E+00
2114	3.906E+02	3.304E+05	2.220E+01	8.818E+01	1.322E+05	8.881E+00
2115	3.753E+02	3.175E+05	2.133E+01	8.472E+01	1.270E+05	8.533E+00
2116	3.606E+02	3.050E+05	2.050E+01	8.140E+01	1.220E+05	8.198E+00
2117	3.464E+02	2.931E+05	1.969E+01	7.821E+01	1.172E+05	7.877E+00
2118	3.329E+02	2.816E+05	1.892E+01	7.514E+01	1.126E+05	7.568E+00
2119	3.198E+02	2.705E+05	1.818E+01	7.220E+01	1.082E+05	7.271E+00
2120	3.073E+02	2.599E+05	1.746E+01	6.937E+01	1.040E+05	6.986E+00
2121	2.952E+02	2.497E+05	1.678E+01	6.665E+01	9.990E+04	6.712E+00
2122	2.836E+02	2.399E+05	1.612E+01	6.403E+01	9.598E+04	6.449E+00
2123	2.725E+02	2.305E+05	1.549E+01	6.152E+01	9.222E+04	6.196E+00
2124	2.618E+02	2.215E+05	1.488E+01	5.911E+01	8.860E+04	5.953E+00

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2125	2.516E+02	2.128E+05	1.430E+01	5.679E+01	8.513E+04	5.720E+00
2126	2.417E+02	2.045E+05	1.374E+01	5.456E+01	8.179E+04	5.495E+00
2127	2.322E+02	1.965E+05	1.320E+01	5.243E+01	7.858E+04	5.280E+00
2128	2.231E+02	1.887E+05	1.268E+01	5.037E+01	7.550E+04	5.073E+00
2129	2.144E+02	1.813E+05	1.218E+01	4.839E+01	7.254E+04	4.874E+00
2130	2.060E+02	1.742E+05	1.171E+01	4.650E+01	6.970E+04	4.683E+00
2131	1.979E+02	1.674E+05	1.125E+01	4.467E+01	6.696E+04	4.499E+00
2132	1.901E+02	1.608E+05	1.081E+01	4.292E+01	6.434E+04	4.323E+00
2133	1.827E+02	1.545E+05	1.038E+01	4.124E+01	6.181E+04	4.153E+00
2134	1.755E+02	1.485E+05	9.976E+00	3.962E+01	5.939E+04	3.990E+00
2135	1.686E+02	1.427E+05	9.585E+00	3.807E+01	5.706E+04	3.834E+00
2136	1.620E+02	1.371E+05	9.209E+00	3.658E+01	5.482E+04	3.684E+00
2137	1.557E+02	1.317E+05	8.848E+00	3.514E+01	5.267E+04	3.539E+00
2138	1.496E+02	1.265E+05	8.501E+00	3.376E+01	5.061E+04	3.400E+00
2139	1.437E+02	1.216E+05	8.168E+00	3.244E+01	4.862E+04	3.267E+00
2140	1.381E+02	1.168E+05	7.847E+00	3.117E+01	4.672E+04	3.139E+00
2141	1.327E+02	1.122E+05	7.540E+00	2.995E+01	4.489E+04	3.016E+00
2142	1.274E+02	1.078E+05	7.244E+00	2.877E+01	4.313E+04	2.898E+00
2143	1.225E+02	1.036E+05	6.960E+00	2.764E+01	4.144E+04	2.784E+00
2144	1.177E+02	9.953E+04	6.687E+00	2.656E+01	3.981E+04	2.675E+00
2145	1.130E+02	9.562E+04	6.425E+00	2.552E+01	3.825E+04	2.570E+00
2146	1.086E+02	9.187E+04	6.173E+00	2.452E+01	3.675E+04	2.469E+00
2147	1.043E+02	8.827E+04	5.931E+00	2.356E+01	3.531E+04	2.372E+00
2148	1.003E+02	8.481E+04	5.698E+00	2.263E+01	3.392E+04	2.279E+00
2149	9.632E+01	8.149E+04	5.475E+00	2.175E+01	3.259E+04	2.190E+00
2150	9.255E+01	7.829E+04	5.260E+00	2.089E+01	3.132E+04	2.104E+00
2151	8.892E+01	7.522E+04	5.054E+00	2.007E+01	3.009E+04	2.022E+00
2152	8.543E+01	7.227E+04	4.856E+00	1.929E+01	2.891E+04	1.942E+00
2153	8.208E+01	6.944E+04	4.665E+00	1.853E+01	2.777E+04	1.866E+00
2154	7.886E+01	6.671E+04	4.483E+00	1.780E+01	2.669E+04	1.793E+00
2155	7.577E+01	6.410E+04	4.307E+00	1.711E+01	2.564E+04	1.723E+00
2156	7.280E+01	6.159E+04	4.138E+00	1.643E+01	2.463E+04	1.655E+00
2157	6.995E+01	5.917E+04	3.976E+00	1.579E+01	2.367E+04	1.590E+00
2158	6.720E+01	5.685E+04	3.820E+00	1.517E+01	2.274E+04	1.528E+00
2159	6.457E+01	5.462E+04	3.670E+00	1.458E+01	2.185E+04	1.468E+00
2160	6.204E+01	5.248E+04	3.526E+00	1.400E+01	2.099E+04	1.410E+00
2161	5.960E+01	5.042E+04	3.388E+00	1.346E+01	2.017E+04	1.355E+00
2162	5.727E+01	4.844E+04	3.255E+00	1.293E+01	1.938E+04	1.302E+00
2163	5.502E+01	4.655E+04	3.127E+00	1.242E+01	1.862E+04	1.251E+00
2164	5.286E+01	4.472E+04	3.005E+00	1.193E+01	1.789E+04	1.202E+00

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2024	0	0	0	0	0	0
2025	4.085E+03	2.232E+06	1.499E+02	7.999E+00	2.232E+03	1.499E-01
2026	8.010E+03	4.376E+06	2.940E+02	1.568E+01	4.376E+03	2.940E-01
2027	1.178E+04	6.436E+06	4.324E+02	2.307E+01	6.436E+03	4.324E-01
2028	1.132E+04	6.183E+06	4.155E+02	2.216E+01	6.183E+03	4.155E-01
2029	1.087E+04	5.941E+06	3.992E+02	2.129E+01	5.941E+03	3.992E-01
2030	1.045E+04	5.708E+06	3.835E+02	2.046E+01	5.708E+03	3.835E-01
2031	1.004E+04	5.484E+06	3.685E+02	1.966E+01	5.484E+03	3.685E-01
2032	9.645E+03	5.269E+06	3.540E+02	1.889E+01	5.269E+03	3.540E-01
2033	9.267E+03	5.062E+06	3.401E+02	1.815E+01	5.062E+03	3.401E-01
2034	8.903E+03	4.864E+06	3.268E+02	1.743E+01	4.864E+03	3.268E-01
2035	8.554E+03	4.673E+06	3.140E+02	1.675E+01	4.673E+03	3.140E-01
2036	8.219E+03	4.490E+06	3.017E+02	1.609E+01	4.490E+03	3.017E-01
2037	7.897E+03	4.314E+06	2.898E+02	1.546E+01	4.314E+03	2.898E-01
2038	7.587E+03	4.145E+06	2.785E+02	1.486E+01	4.145E+03	2.785E-01
2039	7.289E+03	3.982E+06	2.676E+02	1.427E+01	3.982E+03	2.676E-01
2040	7.004E+03	3.826E+06	2.571E+02	1.371E+01	3.826E+03	2.571E-01
2041	6.729E+03	3.676E+06	2.470E+02	1.318E+01	3.676E+03	2.470E-01
2042	6.465E+03	3.532E+06	2.373E+02	1.266E+01	3.532E+03	2.373E-01
2043	6.212E+03	3.393E+06	2.280E+02	1.216E+01	3.393E+03	2.280E-01
2044	5.968E+03	3.260E+06	2.191E+02	1.169E+01	3.260E+03	2.191E-01
2045	5.734E+03	3.133E+06	2.105E+02	1.123E+01	3.133E+03	2.105E-01
2046	5.509E+03	3.010E+06	2.022E+02	1.079E+01	3.010E+03	2.022E-01
2047	5.293E+03	2.892E+06	1.943E+02	1.037E+01	2.892E+03	1.943E-01
2048	5.086E+03	2.778E+06	1.867E+02	9.959E+00	2.778E+03	1.867E-01
2049	4.886E+03	2.669E+06	1.794E+02	9.568E+00	2.669E+03	1.794E-01
2050	4.695E+03	2.565E+06	1.723E+02	9.193E+00	2.565E+03	1.723E-01
2051	4.511E+03	2.464E+06	1.656E+02	8.833E+00	2.464E+03	1.656E-01
2052	4.334E+03	2.368E+06	1.591E+02	8.486E+00	2.368E+03	1.591E-01
2053	4.164E+03	2.275E+06	1.528E+02	8.154E+00	2.275E+03	1.528E-01
2054	4.001E+03	2.185E+06	1.468E+02	7.834E+00	2.185E+03	1.468E-01
2055	3.844E+03	2.100E+06	1.411E+02	7.527E+00	2.100E+03	1.411E-01
2056	3.693E+03	2.017E+06	1.356E+02	7.232E+00	2.017E+03	1.356E-01
2057	3.548E+03	1.938E+06	1.302E+02	6.948E+00	1.938E+03	1.302E-01
2058	3.409E+03	1.862E+06	1.251E+02	6.676E+00	1.862E+03	1.251E-01
2059	3.275E+03	1.789E+06	1.202E+02	6.414E+00	1.789E+03	1.202E-01
2060	3.147E+03	1.719E+06	1.155E+02	6.162E+00	1.719E+03	1.155E-01
2061	3.024E+03	1.652E+06	1.110E+02	5.921E+00	1.652E+03	1.110E-01
2062	2.905E+03	1.587E+06	1.066E+02	5.689E+00	1.587E+03	1.066E-01
2063	2.791E+03	1.525E+06	1.024E+02	5.465E+00	1.525E+03	1.024E-01
2064	2.682E+03	1.465E+06	9.843E+01	5.251E+00	1.465E+03	9.843E-02
2065	2.576E+03	1.408E+06	9.457E+01	5.045E+00	1.408E+03	9.457E-02
2066	2.475E+03	1.352E+06	9.086E+01	4.847E+00	1.352E+03	9.086E-02
2067	2.378E+03	1.299E+06	8.730E+01	4.657E+00	1.299E+03	8.730E-02
2068	2.285E+03	1.248E+06	8.388E+01	4.475E+00	1.248E+03	8.388E-02
2069	2.196E+03	1.199E+06	8.059E+01	4.299E+00	1.199E+03	8.059E-02
2070	2.109E+03	1.152E+06	7.743E+01	4.131E+00	1.152E+03	7.743E-02
2071	2.027E+03	1.107E+06	7.439E+01	3.969E+00	1.107E+03	7.439E-02
2072	1.947E+03	1.064E+06	7.148E+01	3.813E+00	1.064E+03	7.148E-02
2073	1.871E+03	1.022E+06	6.867E+01	3.664E+00	1.022E+03	6.867E-02

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2074	1.798E+03	9.820E+05	6.598E+01	3.520E+00	9.820E+02	6.598E-02
2075	1.727E+03	9.435E+05	6.339E+01	3.382E+00	9.435E+02	6.339E-02
2076	1.659E+03	9.065E+05	6.091E+01	3.249E+00	9.065E+02	6.091E-02
2077	1.594E+03	8.710E+05	5.852E+01	3.122E+00	8.710E+02	5.852E-02
2078	1.532E+03	8.368E+05	5.623E+01	3.000E+00	8.368E+02	5.623E-02
2079	1.472E+03	8.040E+05	5.402E+01	2.882E+00	8.040E+02	5.402E-02
2080	1.414E+03	7.725E+05	5.190E+01	2.769E+00	7.725E+02	5.190E-02
2081	1.359E+03	7.422E+05	4.987E+01	2.660E+00	7.422E+02	4.987E-02
2082	1.305E+03	7.131E+05	4.791E+01	2.556E+00	7.131E+02	4.791E-02
2083	1.254E+03	6.851E+05	4.603E+01	2.456E+00	6.851E+02	4.603E-02
2084	1.205E+03	6.583E+05	4.423E+01	2.360E+00	6.583E+02	4.423E-02
2085	1.158E+03	6.324E+05	4.249E+01	2.267E+00	6.324E+02	4.249E-02
2086	1.112E+03	6.076E+05	4.083E+01	2.178E+00	6.076E+02	4.083E-02
2087	1.069E+03	5.838E+05	3.923E+01	2.093E+00	5.838E+02	3.923E-02
2088	1.027E+03	5.609E+05	3.769E+01	2.011E+00	5.609E+02	3.769E-02
2089	9.865E+02	5.389E+05	3.621E+01	1.932E+00	5.389E+02	3.621E-02
2090	9.478E+02	5.178E+05	3.479E+01	1.856E+00	5.178E+02	3.479E-02
2091	9.107E+02	4.975E+05	3.343E+01	1.783E+00	4.975E+02	3.343E-02
2092	8.750E+02	4.780E+05	3.212E+01	1.713E+00	4.780E+02	3.212E-02
2093	8.407E+02	4.593E+05	3.086E+01	1.646E+00	4.593E+02	3.086E-02
2094	8.077E+02	4.412E+05	2.965E+01	1.582E+00	4.412E+02	2.965E-02
2095	7.760E+02	4.239E+05	2.848E+01	1.520E+00	4.239E+02	2.848E-02
2096	7.456E+02	4.073E+05	2.737E+01	1.460E+00	4.073E+02	2.737E-02
2097	7.164E+02	3.913E+05	2.629E+01	1.403E+00	3.913E+02	2.629E-02
2098	6.883E+02	3.760E+05	2.526E+01	1.348E+00	3.760E+02	2.526E-02
2099	6.613E+02	3.613E+05	2.427E+01	1.295E+00	3.613E+02	2.427E-02
2100	6.354E+02	3.471E+05	2.332E+01	1.244E+00	3.471E+02	2.332E-02
2101	6.104E+02	3.335E+05	2.241E+01	1.195E+00	3.335E+02	2.241E-02
2102	5.865E+02	3.204E+05	2.153E+01	1.148E+00	3.204E+02	2.153E-02
2103	5.635E+02	3.078E+05	2.068E+01	1.103E+00	3.078E+02	2.068E-02
2104	5.414E+02	2.958E+05	1.987E+01	1.060E+00	2.958E+02	1.987E-02
2105	5.202E+02	2.842E+05	1.909E+01	1.019E+00	2.842E+02	1.909E-02
2106	4.998E+02	2.730E+05	1.835E+01	9.787E-01	2.730E+02	1.835E-02
2107	4.802E+02	2.623E+05	1.763E+01	9.403E-01	2.623E+02	1.763E-02
2108	4.614E+02	2.520E+05	1.693E+01	9.034E-01	2.520E+02	1.693E-02
2109	4.433E+02	2.422E+05	1.627E+01	8.680E-01	2.422E+02	1.627E-02
2110	4.259E+02	2.327E+05	1.563E+01	8.340E-01	2.327E+02	1.563E-02
2111	4.092E+02	2.235E+05	1.502E+01	8.013E-01	2.235E+02	1.502E-02
2112	3.931E+02	2.148E+05	1.443E+01	7.699E-01	2.148E+02	1.443E-02
2113	3.777E+02	2.064E+05	1.386E+01	7.397E-01	2.064E+02	1.386E-02
2114	3.629E+02	1.983E+05	1.332E+01	7.107E-01	1.983E+02	1.332E-02
2115	3.487E+02	1.905E+05	1.280E+01	6.828E-01	1.905E+02	1.280E-02
2116	3.350E+02	1.830E+05	1.230E+01	6.560E-01	1.830E+02	1.230E-02
2117	3.219E+02	1.758E+05	1.181E+01	6.303E-01	1.758E+02	1.181E-02
2118	3.093E+02	1.689E+05	1.135E+01	6.056E-01	1.689E+02	1.135E-02
2119	2.971E+02	1.623E+05	1.091E+01	5.818E-01	1.623E+02	1.091E-02
2120	2.855E+02	1.560E+05	1.048E+01	5.590E-01	1.560E+02	1.048E-02
2121	2.743E+02	1.498E+05	1.007E+01	5.371E-01	1.498E+02	1.007E-02
2122	2.635E+02	1.440E+05	9.673E+00	5.161E-01	1.440E+02	9.673E-03
2123	2.532E+02	1.383E+05	9.294E+00	4.958E-01	1.383E+02	9.294E-03
2124	2.433E+02	1.329E+05	8.930E+00	4.764E-01	1.329E+02	8.930E-03

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2125	2.337E+02	1.277E+05	8.579E+00	4.577E-01	1.277E+02	8.579E-03
2126	2.246E+02	1.227E+05	8.243E+00	4.397E-01	1.227E+02	8.243E-03
2127	2.158E+02	1.179E+05	7.920E+00	4.225E-01	1.179E+02	7.920E-03
2128	2.073E+02	1.132E+05	7.609E+00	4.059E-01	1.132E+02	7.609E-03
2129	1.992E+02	1.088E+05	7.311E+00	3.900E-01	1.088E+02	7.311E-03
2130	1.914E+02	1.045E+05	7.024E+00	3.747E-01	1.045E+02	7.024E-03
2131	1.839E+02	1.004E+05	6.749E+00	3.600E-01	1.004E+02	6.749E-03
2132	1.767E+02	9.651E+04	6.484E+00	3.459E-01	9.651E+01	6.484E-03
2133	1.697E+02	9.272E+04	6.230E+00	3.324E-01	9.272E+01	6.230E-03
2134	1.631E+02	8.909E+04	5.986E+00	3.193E-01	8.909E+01	5.986E-03
2135	1.567E+02	8.559E+04	5.751E+00	3.068E-01	8.559E+01	5.751E-03
2136	1.505E+02	8.224E+04	5.525E+00	2.948E-01	8.224E+01	5.525E-03
2137	1.446E+02	7.901E+04	5.309E+00	2.832E-01	7.901E+01	5.309E-03
2138	1.390E+02	7.591E+04	5.101E+00	2.721E-01	7.591E+01	5.101E-03
2139	1.335E+02	7.294E+04	4.901E+00	2.614E-01	7.294E+01	4.901E-03
2140	1.283E+02	7.008E+04	4.708E+00	2.512E-01	7.008E+01	4.708E-03
2141	1.232E+02	6.733E+04	4.524E+00	2.413E-01	6.733E+01	4.524E-03
2142	1.184E+02	6.469E+04	4.346E+00	2.319E-01	6.469E+01	4.346E-03
2143	1.138E+02	6.215E+04	4.176E+00	2.228E-01	6.215E+01	4.176E-03
2144	1.093E+02	5.972E+04	4.012E+00	2.140E-01	5.972E+01	4.012E-03
2145	1.050E+02	5.737E+04	3.855E+00	2.057E-01	5.737E+01	3.855E-03
2146	1.009E+02	5.512E+04	3.704E+00	1.976E-01	5.512E+01	3.704E-03
2147	9.695E+01	5.296E+04	3.559E+00	1.898E-01	5.296E+01	3.559E-03
2148	9.315E+01	5.089E+04	3.419E+00	1.824E-01	5.089E+01	3.419E-03
2149	8.950E+01	4.889E+04	3.285E+00	1.752E-01	4.889E+01	3.285E-03
2150	8.599E+01	4.697E+04	3.156E+00	1.684E-01	4.697E+01	3.156E-03
2151	8.261E+01	4.513E+04	3.032E+00	1.618E-01	4.513E+01	3.032E-03
2152	7.938E+01	4.336E+04	2.914E+00	1.554E-01	4.336E+01	2.914E-03
2153	7.626E+01	4.166E+04	2.799E+00	1.493E-01	4.166E+01	2.799E-03
2154	7.327E+01	4.003E+04	2.690E+00	1.435E-01	4.003E+01	2.690E-03
2155	7.040E+01	3.846E+04	2.584E+00	1.379E-01	3.846E+01	2.584E-03
2156	6.764E+01	3.695E+04	2.483E+00	1.324E-01	3.695E+01	2.483E-03
2157	6.499E+01	3.550E+04	2.385E+00	1.273E-01	3.550E+01	2.385E-03
2158	6.244E+01	3.411E+04	2.292E+00	1.223E-01	3.411E+01	2.292E-03
2159	5.999E+01	3.277E+04	2.202E+00	1.175E-01	3.277E+01	2.202E-03
2160	5.764E+01	3.149E+04	2.116E+00	1.129E-01	3.149E+01	2.116E-03
2161	5.538E+01	3.025E+04	2.033E+00	1.084E-01	3.025E+01	2.033E-03
2162	5.321E+01	2.907E+04	1.953E+00	1.042E-01	2.907E+01	1.953E-03
2163	5.112E+01	2.793E+04	1.876E+00	1.001E-01	2.793E+01	1.876E-03
2164	4.912E+01	2.683E+04	1.803E+00	9.618E-02	2.683E+01	1.803E-03

Summary Report

Landfill Name or Identifier:

Date: Tuesday, August 31, 2021

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left(\frac{M_i}{10} \right) e^{-kt_{ij}}$$

Where,

Q_{CH4} = annual methane generation in the year of the calculation *(m^3/year)*
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate (*year^{-1}*)
L_o = potential methane generation capacity (*m^3/Mg*)

M_i = mass of waste accepted in the i^{th} year (*Mg*)
t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{th} year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**2026**	
Landfill Closure Year (with 80-year limit)	**2036**	
Actual Closure Year (without limit)	***2036***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**4,304,718**	*short tons*

MODEL PARAMETERS

Methane Generation Rate, k	**0.040**	*$year^{-1}$*
Potential Methane Generation Capacity, L_o	**100**	*m^3/Mg*
NMOC Concentration	**600**	*ppmv as hexane*
Methane Content	**40**	*% by volume*

GASES / POLLUTANTS SELECTED

Gas / Pollutant #1:	**Total landfill gas**
Gas / Pollutant #2:	**Methane**
Gas / Pollutant #3:	**Carbon dioxide**
Gas / Pollutant #4:	**NMOC**

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2026	378,655	416,520	0	0
2027	378,655	416,520	378,655	416,520
2028	378,655	416,520	757,309	833,040
2029	378,655	416,520	1,135,964	1,249,560
2030	378,655	416,520	1,514,618	1,666,080
2031	378,655	416,520	1,893,273	2,082,600
2032	378,655	416,520	2,271,927	2,499,120
2033	378,655	416,520	2,650,582	2,915,640
2034	378,655	416,520	3,029,236	3,332,160
2035	378,655	416,520	3,407,891	3,748,680
2036	126,835	139,518	3,786,545	4,165,200
2037	0	0	3,913,380	4,304,718
2038	0	0	3,913,380	4,304,718
2039	0	0	3,913,380	4,304,718
2040	0	0	3,913,380	4,304,718
2041	0	0	3,913,380	4,304,718
2042	0	0	3,913,380	4,304,718
2043	0	0	3,913,380	4,304,718
2044	0	0	3,913,380	4,304,718
2045	0	0	3,913,380	4,304,718
2046	0	0	3,913,380	4,304,718
2047	0	0	3,913,380	4,304,718
2048	0	0	3,913,380	4,304,718
2049	0	0	3,913,380	4,304,718
2050	0	0	3,913,380	4,304,718
2051	0	0	3,913,380	4,304,718
2052	0	0	3,913,380	4,304,718
2053	0	0	3,913,380	4,304,718
2054	0	0	3,913,380	4,304,718
2055	0	0	3,913,380	4,304,718
2056	0	0	3,913,380	4,304,718
2057	0	0	3,913,380	4,304,718
2058	0	0	3,913,380	4,304,718
2059	0	0	3,913,380	4,304,718
2060	0	0	3,913,380	4,304,718
2061	0	0	3,913,380	4,304,718
2062	0	0	3,913,380	4,304,718
2063	0	0	3,913,380	4,304,718
2064	0	0	3,913,380	4,304,718
2065	0	0	3,913,380	4,304,718

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2066	0	0	3,913,380	4,304,718
2067	0	0	3,913,380	4,304,718
2068	0	0	3,913,380	4,304,718
2069	0	0	3,913,380	4,304,718
2070	0	0	3,913,380	4,304,718
2071	0	0	3,913,380	4,304,718
2072	0	0	3,913,380	4,304,718
2073	0	0	3,913,380	4,304,718
2074	0	0	3,913,380	4,304,718
2075	0	0	3,913,380	4,304,718
2076	0	0	3,913,380	4,304,718
2077	0	0	3,913,380	4,304,718
2078	0	0	3,913,380	4,304,718
2079	0	0	3,913,380	4,304,718
2080	0	0	3,913,380	4,304,718
2081	0	0	3,913,380	4,304,718
2082	0	0	3,913,380	4,304,718
2083	0	0	3,913,380	4,304,718
2084	0	0	3,913,380	4,304,718
2085	0	0	3,913,380	4,304,718
2086	0	0	3,913,380	4,304,718
2087	0	0	3,913,380	4,304,718
2088	0	0	3,913,380	4,304,718
2089	0	0	3,913,380	4,304,718
2090	0	0	3,913,380	4,304,718
2091	0	0	3,913,380	4,304,718
2092	0	0	3,913,380	4,304,718
2093	0	0	3,913,380	4,304,718
2094	0	0	3,913,380	4,304,718
2095	0	0	3,913,380	4,304,718
2096	0	0	3,913,380	4,304,718
2097	0	0	3,913,380	4,304,718
2098	0	0	3,913,380	4,304,718
2099	0	0	3,913,380	4,304,718
2100	0	0	3,913,380	4,304,718
2101	0	0	3,913,380	4,304,718
2102	0	0	3,913,380	4,304,718
2103	0	0	3,913,380	4,304,718
2104	0	0	3,913,380	4,304,718
2105	0	0	3,913,380	4,304,718

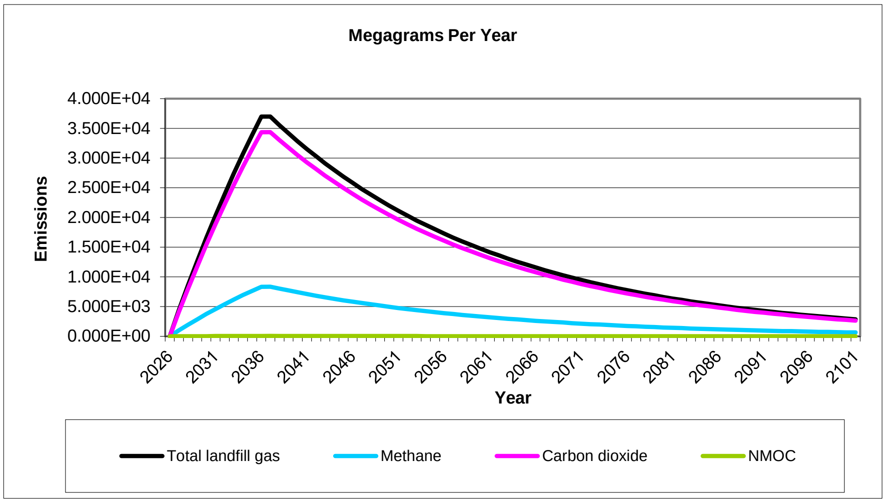
Pollutant Parameters

		Gas / Pollutant Default Parameters:		User-specified Pollutant Parameters:	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

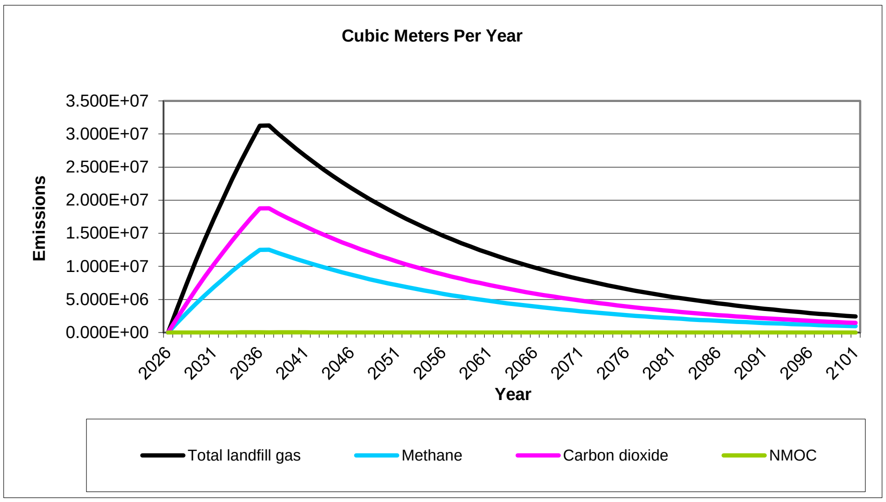
Pollutant Parameters (Continued)

		Gas / Pollutant Default Parameters:		User-specified Pollutant Parameters:	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

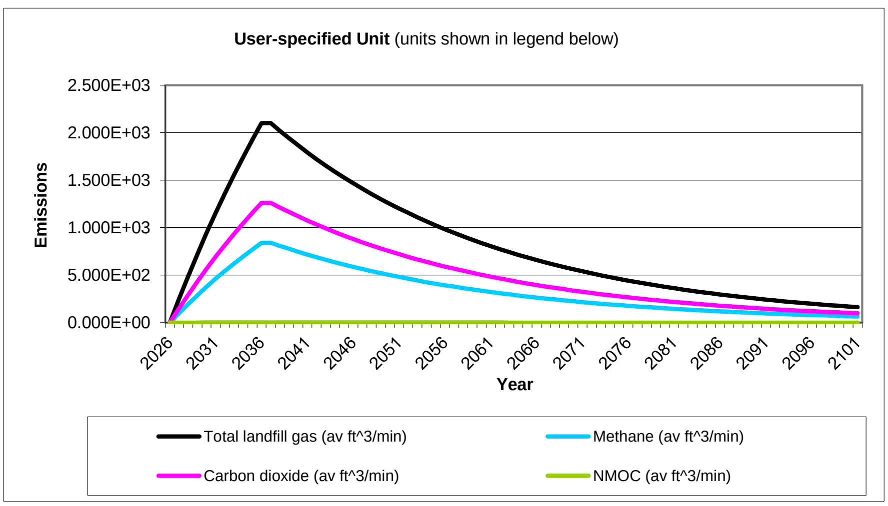
Graphs



Megagrams Per Year
4.000E+04
3.500E+04
3.000E+04
2.500E+04
2.000E+04
1.500E+04
1.000E+04
5.000E+03
0.000E+00
Emissions
2026 2031 2036 2041 2046 2051 2056 2061 2066 2071 2076 2081 2086 2091 2096 2101
Year
Total landfill gas
Methane
Carbon dioxide
NMOC



Cubic Meters Per Year
3.500E+07
3.000E+07
2.500E+07
2.000E+07
1.500E+07
1.000E+07
5.000E+06
0.000E+00
Emissions
2026 2031 2036 2041 2046 2051 2056 2061 2066 2071 2076 2081 2086 2091 2096 2101
Year
Total landfill gas
Methane
Carbon dioxide
NMOC



User-specified Unit (units shown in legend below)
2.500E+03
2.000E+03
1.500E+03
1.000E+03
5.000E+02
0.000E+00
Emissions
2026 2031 2036 2041 2046 2051 2056 2061 2066 2071 2076 2081 2086 2091 2096 2101
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2026	0	0	0	0	0	0
2027	4.397E+03	3.719E+06	2.499E+02	9.925E+02	1.488E+06	9.996E+01
2028	8.621E+03	7.293E+06	4.900E+02	1.946E+03	2.917E+06	1.960E+02
2029	1.268E+04	1.073E+07	7.207E+02	2.862E+03	4.290E+06	2.883E+02
2030	1.658E+04	1.402E+07	9.423E+02	3.743E+03	5.610E+06	3.769E+02
2031	2.033E+04	1.719E+07	1.155E+03	4.588E+03	6.878E+06	4.621E+02
2032	2.392E+04	2.024E+07	1.360E+03	5.401E+03	8.096E+06	5.439E+02
2033	2.738E+04	2.316E+07	1.556E+03	6.182E+03	9.266E+06	6.226E+02
2034	3.071E+04	2.598E+07	1.745E+03	6.932E+03	1.039E+07	6.981E+02
2035	3.390E+04	2.868E+07	1.927E+03	7.653E+03	1.147E+07	7.707E+02
2036	3.697E+04	3.127E+07	2.101E+03	8.345E+03	1.251E+07	8.404E+02
2037	3.699E+04	3.129E+07	2.102E+03	8.350E+03	1.252E+07	8.410E+02
2038	3.554E+04	3.006E+07	2.020E+03	8.023E+03	1.203E+07	8.080E+02
2039	3.415E+04	2.889E+07	1.941E+03	7.708E+03	1.155E+07	7.763E+02
2040	3.281E+04	2.775E+07	1.865E+03	7.406E+03	1.110E+07	7.459E+02
2041	3.152E+04	2.666E+07	1.792E+03	7.116E+03	1.067E+07	7.166E+02
2042	3.028E+04	2.562E+07	1.721E+03	6.837E+03	1.025E+07	6.885E+02
2043	2.910E+04	2.461E+07	1.654E+03	6.569E+03	9.846E+06	6.615E+02
2044	2.796E+04	2.365E+07	1.589E+03	6.311E+03	9.460E+06	6.356E+02
2045	2.686E+04	2.272E+07	1.527E+03	6.064E+03	9.089E+06	6.107E+02
2046	2.581E+04	2.183E+07	1.467E+03	5.826E+03	8.732E+06	5.867E+02
2047	2.479E+04	2.097E+07	1.409E+03	5.597E+03	8.390E+06	5.637E+02
2048	2.382E+04	2.015E+07	1.354E+03	5.378E+03	8.061E+06	5.416E+02
2049	2.289E+04	1.936E+07	1.301E+03	5.167E+03	7.745E+06	5.204E+02
2050	2.199E+04	1.860E+07	1.250E+03	4.964E+03	7.441E+06	5.000E+02
2051	2.113E+04	1.787E+07	1.201E+03	4.770E+03	7.149E+06	4.804E+02
2052	2.030E+04	1.717E+07	1.154E+03	4.583E+03	6.869E+06	4.615E+02
2053	1.950E+04	1.650E+07	1.109E+03	4.403E+03	6.600E+06	4.434E+02
2054	1.874E+04	1.585E+07	1.065E+03	4.230E+03	6.341E+06	4.260E+02
2055	1.800E+04	1.523E+07	1.023E+03	4.065E+03	6.092E+06	4.093E+02
2056	1.730E+04	1.463E+07	9.832E+02	3.905E+03	5.853E+06	3.933E+02
2057	1.662E+04	1.406E+07	9.447E+02	3.752E+03	5.624E+06	3.779E+02
2058	1.597E+04	1.351E+07	9.076E+02	3.605E+03	5.403E+06	3.631E+02
2059	1.534E+04	1.298E+07	8.721E+02	3.464E+03	5.192E+06	3.488E+02
2060	1.474E+04	1.247E+07	8.379E+02	3.328E+03	4.988E+06	3.351E+02
2061	1.416E+04	1.198E+07	8.050E+02	3.197E+03	4.792E+06	3.220E+02
2062	1.361E+04	1.151E+07	7.734E+02	3.072E+03	4.604E+06	3.094E+02
2063	1.307E+04	1.106E+07	7.431E+02	2.951E+03	4.424E+06	2.972E+02
2064	1.256E+04	1.063E+07	7.140E+02	2.836E+03	4.250E+06	2.856E+02
2065	1.207E+04	1.021E+07	6.860E+02	2.725E+03	4.084E+06	2.744E+02
2066	1.160E+04	9.809E+06	6.591E+02	2.618E+03	3.924E+06	2.636E+02
2067	1.114E+04	9.425E+06	6.332E+02	2.515E+03	3.770E+06	2.533E+02
2068	1.070E+04	9.055E+06	6.084E+02	2.416E+03	3.622E+06	2.434E+02
2069	1.028E+04	8.700E+06	5.846E+02	2.322E+03	3.480E+06	2.338E+02
2070	9.881E+03	8.359E+06	5.616E+02	2.231E+03	3.344E+06	2.247E+02
2071	9.494E+03	8.031E+06	5.396E+02	2.143E+03	3.212E+06	2.158E+02
2072	9.121E+03	7.716E+06	5.185E+02	2.059E+03	3.086E+06	2.074E+02
2073	8.764E+03	7.414E+06	4.981E+02	1.978E+03	2.965E+06	1.992E+02
2074	8.420E+03	7.123E+06	4.786E+02	1.901E+03	2.849E+06	1.914E+02
2075	8.090E+03	6.844E+06	4.598E+02	1.826E+03	2.737E+06	1.839E+02

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2076	7.773E+03	6.575E+06	4.418E+02	1.755E+03	2.630E+06	1.767E+02
2077	7.468E+03	6.318E+06	4.245E+02	1.686E+03	2.527E+06	1.698E+02
2078	7.175E+03	6.070E+06	4.078E+02	1.620E+03	2.428E+06	1.631E+02
2079	6.894E+03	5.832E+06	3.918E+02	1.556E+03	2.333E+06	1.567E+02
2080	6.624E+03	5.603E+06	3.765E+02	1.495E+03	2.241E+06	1.506E+02
2081	6.364E+03	5.383E+06	3.617E+02	1.437E+03	2.153E+06	1.447E+02
2082	6.114E+03	5.172E+06	3.475E+02	1.380E+03	2.069E+06	1.390E+02
2083	5.875E+03	4.970E+06	3.339E+02	1.326E+03	1.988E+06	1.336E+02
2084	5.644E+03	4.775E+06	3.208E+02	1.274E+03	1.910E+06	1.283E+02
2085	5.423E+03	4.587E+06	3.082E+02	1.224E+03	1.835E+06	1.233E+02
2086	5.210E+03	4.408E+06	2.961E+02	1.176E+03	1.763E+06	1.185E+02
2087	5.006E+03	4.235E+06	2.845E+02	1.130E+03	1.694E+06	1.138E+02
2088	4.810E+03	4.069E+06	2.734E+02	1.086E+03	1.627E+06	1.094E+02
2089	4.621E+03	3.909E+06	2.627E+02	1.043E+03	1.564E+06	1.051E+02
2090	4.440E+03	3.756E+06	2.524E+02	1.002E+03	1.502E+06	1.009E+02
2091	4.266E+03	3.609E+06	2.425E+02	9.630E+02	1.443E+06	9.698E+01
2092	4.099E+03	3.467E+06	2.330E+02	9.252E+02	1.387E+06	9.318E+01
2093	3.938E+03	3.331E+06	2.238E+02	8.890E+02	1.332E+06	8.953E+01
2094	3.783E+03	3.201E+06	2.150E+02	8.541E+02	1.280E+06	8.602E+01
2095	3.635E+03	3.075E+06	2.066E+02	8.206E+02	1.230E+06	8.265E+01
2096	3.493E+03	2.954E+06	1.985E+02	7.884E+02	1.182E+06	7.940E+01
2097	3.356E+03	2.839E+06	1.907E+02	7.575E+02	1.135E+06	7.629E+01
2098	3.224E+03	2.727E+06	1.832E+02	7.278E+02	1.091E+06	7.330E+01
2099	3.098E+03	2.620E+06	1.761E+02	6.993E+02	1.048E+06	7.043E+01
2100	2.976E+03	2.518E+06	1.692E+02	6.719E+02	1.007E+06	6.766E+01
2101	2.859E+03	2.419E+06	1.625E+02	6.455E+02	9.676E+05	6.501E+01
2102	2.747E+03	2.324E+06	1.562E+02	6.202E+02	9.296E+05	6.246E+01
2103	2.640E+03	2.233E+06	1.500E+02	5.959E+02	8.932E+05	6.001E+01
2104	2.536E+03	2.145E+06	1.441E+02	5.725E+02	8.582E+05	5.766E+01
2105	2.437E+03	2.061E+06	1.385E+02	5.501E+02	8.245E+05	5.540E+01
2106	2.341E+03	1.980E+06	1.331E+02	5.285E+02	7.922E+05	5.323E+01
2107	2.249E+03	1.903E+06	1.278E+02	5.078E+02	7.611E+05	5.114E+01
2108	2.161E+03	1.828E+06	1.228E+02	4.879E+02	7.313E+05	4.913E+01
2109	2.076E+03	1.757E+06	1.180E+02	4.687E+02	7.026E+05	4.721E+01
2110	1.995E+03	1.688E+06	1.134E+02	4.504E+02	6.751E+05	4.536E+01
2111	1.917E+03	1.621E+06	1.089E+02	4.327E+02	6.486E+05	4.358E+01
2112	1.842E+03	1.558E+06	1.047E+02	4.157E+02	6.232E+05	4.187E+01
2113	1.769E+03	1.497E+06	1.006E+02	3.994E+02	5.987E+05	4.023E+01
2114	1.700E+03	1.438E+06	9.663E+01	3.838E+02	5.752E+05	3.865E+01
2115	1.633E+03	1.382E+06	9.284E+01	3.687E+02	5.527E+05	3.713E+01
2116	1.569E+03	1.328E+06	8.920E+01	3.543E+02	5.310E+05	3.568E+01
2117	1.508E+03	1.275E+06	8.570E+01	3.404E+02	5.102E+05	3.428E+01
2118	1.449E+03	1.225E+06	8.234E+01	3.270E+02	4.902E+05	3.294E+01
2119	1.392E+03	1.177E+06	7.911E+01	3.142E+02	4.710E+05	3.164E+01
2120	1.337E+03	1.131E+06	7.601E+01	3.019E+02	4.525E+05	3.040E+01
2121	1.285E+03	1.087E+06	7.303E+01	2.900E+02	4.348E+05	2.921E+01
2122	1.234E+03	1.044E+06	7.016E+01	2.787E+02	4.177E+05	2.807E+01
2123	1.186E+03	1.003E+06	6.741E+01	2.677E+02	4.013E+05	2.697E+01
2124	1.140E+03	9.640E+05	6.477E+01	2.572E+02	3.856E+05	2.591E+01
2125	1.095E+03	9.262E+05	6.223E+01	2.472E+02	3.705E+05	2.489E+01
2126	1.052E+03	8.899E+05	5.979E+01	2.375E+02	3.559E+05	2.392E+01

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2127	1.011E+03	8.550E+05	5.745E+01	2.282E+02	3.420E+05	2.298E+01
2128	9.711E+02	8.215E+05	5.519E+01	2.192E+02	3.286E+05	2.208E+01
2129	9.330E+02	7.892E+05	5.303E+01	2.106E+02	3.157E+05	2.121E+01
2130	8.964E+02	7.583E+05	5.095E+01	2.024E+02	3.033E+05	2.038E+01
2131	8.612E+02	7.286E+05	4.895E+01	1.944E+02	2.914E+05	1.958E+01
2132	8.275E+02	7.000E+05	4.703E+01	1.868E+02	2.800E+05	1.881E+01
2133	7.950E+02	6.726E+05	4.519E+01	1.795E+02	2.690E+05	1.808E+01
2134	7.639E+02	6.462E+05	4.342E+01	1.724E+02	2.585E+05	1.737E+01
2135	7.339E+02	6.208E+05	4.171E+01	1.657E+02	2.483E+05	1.669E+01
2136	7.051E+02	5.965E+05	4.008E+01	1.592E+02	2.386E+05	1.603E+01
2137	6.775E+02	5.731E+05	3.851E+01	1.529E+02	2.292E+05	1.540E+01
2138	6.509E+02	5.506E+05	3.700E+01	1.469E+02	2.203E+05	1.480E+01
2139	6.254E+02	5.290E+05	3.555E+01	1.412E+02	2.116E+05	1.422E+01
2140	6.009E+02	5.083E+05	3.415E+01	1.356E+02	2.033E+05	1.366E+01
2141	5.773E+02	4.884E+05	3.281E+01	1.303E+02	1.953E+05	1.313E+01
2142	5.547E+02	4.692E+05	3.153E+01	1.252E+02	1.877E+05	1.261E+01
2143	5.329E+02	4.508E+05	3.029E+01	1.203E+02	1.803E+05	1.212E+01
2144	5.120E+02	4.331E+05	2.910E+01	1.156E+02	1.733E+05	1.164E+01
2145	4.920E+02	4.162E+05	2.796E+01	1.111E+02	1.665E+05	1.118E+01
2146	4.727E+02	3.998E+05	2.687E+01	1.067E+02	1.599E+05	1.075E+01
2147	4.541E+02	3.842E+05	2.581E+01	1.025E+02	1.537E+05	1.032E+01
2148	4.363E+02	3.691E+05	2.480E+01	9.850E+01	1.476E+05	9.920E+00
2149	4.192E+02	3.546E+05	2.383E+01	9.464E+01	1.419E+05	9.531E+00
2150	4.028E+02	3.407E+05	2.289E+01	9.093E+01	1.363E+05	9.157E+00
2151	3.870E+02	3.274E+05	2.200E+01	8.736E+01	1.309E+05	8.798E+00
2152	3.718E+02	3.145E+05	2.113E+01	8.394E+01	1.258E+05	8.453E+00
2153	3.572E+02	3.022E+05	2.030E+01	8.064E+01	1.209E+05	8.122E+00
2154	3.432E+02	2.903E+05	1.951E+01	7.748E+01	1.161E+05	7.803E+00
2155	3.298E+02	2.790E+05	1.874E+01	7.444E+01	1.116E+05	7.497E+00
2156	3.168E+02	2.680E+05	1.801E+01	7.152E+01	1.072E+05	7.203E+00
2157	3.044E+02	2.575E+05	1.730E+01	6.872E+01	1.030E+05	6.921E+00
2158	2.925E+02	2.474E+05	1.662E+01	6.603E+01	9.897E+04	6.650E+00
2159	2.810E+02	2.377E+05	1.597E+01	6.344E+01	9.509E+04	6.389E+00
2160	2.700E+02	2.284E+05	1.535E+01	6.095E+01	9.136E+04	6.138E+00
2161	2.594E+02	2.194E+05	1.474E+01	5.856E+01	8.778E+04	5.898E+00
2162	2.492E+02	2.108E+05	1.417E+01	5.626E+01	8.433E+04	5.666E+00
2163	2.395E+02	2.026E+05	1.361E+01	5.406E+01	8.103E+04	5.444E+00
2164	2.301E+02	1.946E+05	1.308E+01	5.194E+01	7.785E+04	5.231E+00
2165	2.210E+02	1.870E+05	1.256E+01	4.990E+01	7.480E+04	5.026E+00
2166	2.124E+02	1.797E+05	1.207E+01	4.794E+01	7.186E+04	4.829E+00

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2026	0	0	0	0	0	0
2027	4.085E+03	2.232E+06	1.499E+02	7.999E+00	2.232E+03	1.499E-01
2028	8.010E+03	4.376E+06	2.940E+02	1.568E+01	4.376E+03	2.940E-01
2029	1.178E+04	6.436E+06	4.324E+02	2.307E+01	6.436E+03	4.324E-01
2030	1.540E+04	8.415E+06	5.654E+02	3.016E+01	8.415E+03	5.654E-01
2031	1.888E+04	1.032E+07	6.932E+02	3.698E+01	1.032E+04	6.932E-01
2032	2.223E+04	1.214E+07	8.159E+02	4.353E+01	1.214E+04	8.159E-01
2033	2.544E+04	1.390E+07	9.339E+02	4.982E+01	1.390E+04	9.339E-01
2034	2.853E+04	1.559E+07	1.047E+03	5.587E+01	1.559E+04	1.047E+00
2035	3.150E+04	1.721E+07	1.156E+03	6.167E+01	1.721E+04	1.156E+00
2036	3.435E+04	1.876E+07	1.261E+03	6.725E+01	1.876E+04	1.261E+00
2037	3.437E+04	1.877E+07	1.261E+03	6.730E+01	1.877E+04	1.261E+00
2038	3.302E+04	1.804E+07	1.212E+03	6.466E+01	1.804E+04	1.212E+00
2039	3.172E+04	1.733E+07	1.164E+03	6.212E+01	1.733E+04	1.164E+00
2040	3.048E+04	1.665E+07	1.119E+03	5.969E+01	1.665E+04	1.119E+00
2041	2.929E+04	1.600E+07	1.075E+03	5.735E+01	1.600E+04	1.075E+00
2042	2.814E+04	1.537E+07	1.033E+03	5.510E+01	1.537E+04	1.033E+00
2043	2.703E+04	1.477E+07	9.923E+02	5.294E+01	1.477E+04	9.923E-01
2044	2.597E+04	1.419E+07	9.534E+02	5.086E+01	1.419E+04	9.534E-01
2045	2.496E+04	1.363E+07	9.160E+02	4.887E+01	1.363E+04	9.160E-01
2046	2.398E+04	1.310E+07	8.801E+02	4.695E+01	1.310E+04	8.801E-01
2047	2.304E+04	1.258E+07	8.456E+02	4.511E+01	1.258E+04	8.456E-01
2048	2.213E+04	1.209E+07	8.124E+02	4.334E+01	1.209E+04	8.124E-01
2049	2.127E+04	1.162E+07	7.806E+02	4.164E+01	1.162E+04	7.806E-01
2050	2.043E+04	1.116E+07	7.500E+02	4.001E+01	1.116E+04	7.500E-01
2051	1.963E+04	1.072E+07	7.206E+02	3.844E+01	1.072E+04	7.206E-01
2052	1.886E+04	1.030E+07	6.923E+02	3.693E+01	1.030E+04	6.923E-01
2053	1.812E+04	9.900E+06	6.652E+02	3.548E+01	9.900E+03	6.652E-01
2054	1.741E+04	9.511E+06	6.391E+02	3.409E+01	9.511E+03	6.391E-01
2055	1.673E+04	9.139E+06	6.140E+02	3.276E+01	9.139E+03	6.140E-01
2056	1.607E+04	8.780E+06	5.899E+02	3.147E+01	8.780E+03	5.899E-01
2057	1.544E+04	8.436E+06	5.668E+02	3.024E+01	8.436E+03	5.668E-01
2058	1.484E+04	8.105E+06	5.446E+02	2.905E+01	8.105E+03	5.446E-01
2059	1.425E+04	7.787E+06	5.232E+02	2.791E+01	7.787E+03	5.232E-01
2060	1.370E+04	7.482E+06	5.027E+02	2.682E+01	7.482E+03	5.027E-01
2061	1.316E+04	7.189E+06	4.830E+02	2.577E+01	7.189E+03	4.830E-01
2062	1.264E+04	6.907E+06	4.641E+02	2.476E+01	6.907E+03	4.641E-01
2063	1.215E+04	6.636E+06	4.459E+02	2.379E+01	6.636E+03	4.459E-01
2064	1.167E+04	6.376E+06	4.284E+02	2.285E+01	6.376E+03	4.284E-01
2065	1.121E+04	6.126E+06	4.116E+02	2.196E+01	6.126E+03	4.116E-01
2066	1.077E+04	5.886E+06	3.954E+02	2.110E+01	5.886E+03	3.954E-01
2067	1.035E+04	5.655E+06	3.799E+02	2.027E+01	5.655E+03	3.799E-01
2068	9.945E+03	5.433E+06	3.650E+02	1.947E+01	5.433E+03	3.650E-01
2069	9.555E+03	5.220E+06	3.507E+02	1.871E+01	5.220E+03	3.507E-01
2070	9.181E+03	5.015E+06	3.370E+02	1.798E+01	5.015E+03	3.370E-01
2071	8.821E+03	4.819E+06	3.238E+02	1.727E+01	4.819E+03	3.238E-01
2072	8.475E+03	4.630E+06	3.111E+02	1.660E+01	4.630E+03	3.111E-01
2073	8.142E+03	4.448E+06	2.989E+02	1.594E+01	4.448E+03	2.989E-01
2074	7.823E+03	4.274E+06	2.872E+02	1.532E+01	4.274E+03	2.872E-01
2075	7.516E+03	4.106E+06	2.759E+02	1.472E+01	4.106E+03	2.759E-01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2076	7.222E+03	3.945E+06	2.651E+02	1.414E+01	3.945E+03	2.651E-01
2077	6.939E+03	3.791E+06	2.547E+02	1.359E+01	3.791E+03	2.547E-01
2078	6.666E+03	3.642E+06	2.447E+02	1.305E+01	3.642E+03	2.447E-01
2079	6.405E+03	3.499E+06	2.351E+02	1.254E+01	3.499E+03	2.351E-01
2080	6.154E+03	3.362E+06	2.259E+02	1.205E+01	3.362E+03	2.259E-01
2081	5.913E+03	3.230E+06	2.170E+02	1.158E+01	3.230E+03	2.170E-01
2082	5.681E+03	3.103E+06	2.085E+02	1.112E+01	3.103E+03	2.085E-01
2083	5.458E+03	2.982E+06	2.003E+02	1.069E+01	2.982E+03	2.003E-01
2084	5.244E+03	2.865E+06	1.925E+02	1.027E+01	2.865E+03	1.925E-01
2085	5.038E+03	2.752E+06	1.849E+02	9.866E+00	2.752E+03	1.849E-01
2086	4.841E+03	2.645E+06	1.777E+02	9.479E+00	2.645E+03	1.777E-01
2087	4.651E+03	2.541E+06	1.707E+02	9.108E+00	2.541E+03	1.707E-01
2088	4.469E+03	2.441E+06	1.640E+02	8.750E+00	2.441E+03	1.640E-01
2089	4.293E+03	2.346E+06	1.576E+02	8.407E+00	2.346E+03	1.576E-01
2090	4.125E+03	2.254E+06	1.514E+02	8.078E+00	2.254E+03	1.514E-01
2091	3.963E+03	2.165E+06	1.455E+02	7.761E+00	2.165E+03	1.455E-01
2092	3.808E+03	2.080E+06	1.398E+02	7.457E+00	2.080E+03	1.398E-01
2093	3.659E+03	1.999E+06	1.343E+02	7.164E+00	1.999E+03	1.343E-01
2094	3.515E+03	1.920E+06	1.290E+02	6.883E+00	1.920E+03	1.290E-01
2095	3.377E+03	1.845E+06	1.240E+02	6.613E+00	1.845E+03	1.240E-01
2096	3.245E+03	1.773E+06	1.191E+02	6.354E+00	1.773E+03	1.191E-01
2097	3.118E+03	1.703E+06	1.144E+02	6.105E+00	1.703E+03	1.144E-01
2098	2.995E+03	1.636E+06	1.099E+02	5.866E+00	1.636E+03	1.099E-01
2099	2.878E+03	1.572E+06	1.056E+02	5.636E+00	1.572E+03	1.056E-01
2100	2.765E+03	1.511E+06	1.015E+02	5.415E+00	1.511E+03	1.015E-01
2101	2.657E+03	1.451E+06	9.752E+01	5.202E+00	1.451E+03	9.752E-02
2102	2.553E+03	1.394E+06	9.369E+01	4.998E+00	1.394E+03	9.369E-02
2103	2.452E+03	1.340E+06	9.002E+01	4.802E+00	1.340E+03	9.002E-02
2104	2.356E+03	1.287E+06	8.649E+01	4.614E+00	1.287E+03	8.649E-02
2105	2.264E+03	1.237E+06	8.310E+01	4.433E+00	1.237E+03	8.310E-02
2106	2.175E+03	1.188E+06	7.984E+01	4.259E+00	1.188E+03	7.984E-02
2107	2.090E+03	1.142E+06	7.671E+01	4.092E+00	1.142E+03	7.671E-02
2108	2.008E+03	1.097E+06	7.370E+01	3.932E+00	1.097E+03	7.370E-02
2109	1.929E+03	1.054E+06	7.081E+01	3.778E+00	1.054E+03	7.081E-02
2110	1.854E+03	1.013E+06	6.803E+01	3.630E+00	1.013E+03	6.803E-02
2111	1.781E+03	9.729E+05	6.537E+01	3.487E+00	9.729E+02	6.537E-02
2112	1.711E+03	9.347E+05	6.280E+01	3.350E+00	9.347E+02	6.280E-02
2113	1.644E+03	8.981E+05	6.034E+01	3.219E+00	8.981E+02	6.034E-02
2114	1.579E+03	8.629E+05	5.798E+01	3.093E+00	8.629E+02	5.798E-02
2115	1.518E+03	8.290E+05	5.570E+01	2.972E+00	8.290E+02	5.570E-02
2116	1.458E+03	7.965E+05	5.352E+01	2.855E+00	7.965E+02	5.352E-02
2117	1.401E+03	7.653E+05	5.142E+01	2.743E+00	7.653E+02	5.142E-02
2118	1.346E+03	7.353E+05	4.940E+01	2.636E+00	7.353E+02	4.940E-02
2119	1.293E+03	7.065E+05	4.747E+01	2.532E+00	7.065E+02	4.747E-02
2120	1.242E+03	6.788E+05	4.561E+01	2.433E+00	6.788E+02	4.561E-02
2121	1.194E+03	6.521E+05	4.382E+01	2.338E+00	6.521E+02	4.382E-02
2122	1.147E+03	6.266E+05	4.210E+01	2.246E+00	6.266E+02	4.210E-02
2123	1.102E+03	6.020E+05	4.045E+01	2.158E+00	6.020E+02	4.045E-02
2124	1.059E+03	5.784E+05	3.886E+01	2.073E+00	5.784E+02	3.886E-02
2125	1.017E+03	5.557E+05	3.734E+01	1.992E+00	5.557E+02	3.734E-02
2126	9.773E+02	5.339E+05	3.587E+01	1.914E+00	5.339E+02	3.587E-02

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2127	9.390E+02	5.130E+05	3.447E+01	1.839E+00	5.130E+02	3.447E-02
2128	9.022E+02	4.929E+05	3.312E+01	1.767E+00	4.929E+02	3.312E-02
2129	8.668E+02	4.735E+05	3.182E+01	1.697E+00	4.735E+02	3.182E-02
2130	8.328E+02	4.550E+05	3.057E+01	1.631E+00	4.550E+02	3.057E-02
2131	8.002E+02	4.371E+05	2.937E+01	1.567E+00	4.371E+02	2.937E-02
2132	7.688E+02	4.200E+05	2.822E+01	1.505E+00	4.200E+02	2.822E-02
2133	7.387E+02	4.035E+05	2.711E+01	1.446E+00	4.035E+02	2.711E-02
2134	7.097E+02	3.877E+05	2.605E+01	1.390E+00	3.877E+02	2.605E-02
2135	6.819E+02	3.725E+05	2.503E+01	1.335E+00	3.725E+02	2.503E-02
2136	6.551E+02	3.579E+05	2.405E+01	1.283E+00	3.579E+02	2.405E-02
2137	6.294E+02	3.439E+05	2.310E+01	1.233E+00	3.439E+02	2.310E-02
2138	6.048E+02	3.304E+05	2.220E+01	1.184E+00	3.304E+02	2.220E-02
2139	5.811E+02	3.174E+05	2.133E+01	1.138E+00	3.174E+02	2.133E-02
2140	5.583E+02	3.050E+05	2.049E+01	1.093E+00	3.050E+02	2.049E-02
2141	5.364E+02	2.930E+05	1.969E+01	1.050E+00	2.930E+02	1.969E-02
2142	5.153E+02	2.815E+05	1.892E+01	1.009E+00	2.815E+02	1.892E-02
2143	4.951E+02	2.705E+05	1.817E+01	9.696E-01	2.705E+02	1.817E-02
2144	4.757E+02	2.599E+05	1.746E+01	9.316E-01	2.599E+02	1.746E-02
2145	4.571E+02	2.497E+05	1.678E+01	8.950E-01	2.497E+02	1.678E-02
2146	4.392E+02	2.399E+05	1.612E+01	8.599E-01	2.399E+02	1.612E-02
2147	4.219E+02	2.305E+05	1.549E+01	8.262E-01	2.305E+02	1.549E-02
2148	4.054E+02	2.215E+05	1.488E+01	7.938E-01	2.215E+02	1.488E-02
2149	3.895E+02	2.128E+05	1.430E+01	7.627E-01	2.128E+02	1.430E-02
2150	3.742E+02	2.044E+05	1.374E+01	7.328E-01	2.044E+02	1.374E-02
2151	3.595E+02	1.964E+05	1.320E+01	7.041E-01	1.964E+02	1.320E-02
2152	3.454E+02	1.887E+05	1.268E+01	6.765E-01	1.887E+02	1.268E-02
2153	3.319E+02	1.813E+05	1.218E+01	6.499E-01	1.813E+02	1.218E-02
2154	3.189E+02	1.742E+05	1.171E+01	6.244E-01	1.742E+02	1.171E-02
2155	3.064E+02	1.674E+05	1.125E+01	6.000E-01	1.674E+02	1.125E-02
2156	2.944E+02	1.608E+05	1.081E+01	5.764E-01	1.608E+02	1.081E-02
2157	2.828E+02	1.545E+05	1.038E+01	5.538E-01	1.545E+02	1.038E-02
2158	2.717E+02	1.485E+05	9.974E+00	5.321E-01	1.485E+02	9.974E-03
2159	2.611E+02	1.426E+05	9.583E+00	5.113E-01	1.426E+02	9.583E-03
2160	2.508E+02	1.370E+05	9.208E+00	4.912E-01	1.370E+02	9.208E-03
2161	2.410E+02	1.317E+05	8.846E+00	4.719E-01	1.317E+02	8.846E-03
2162	2.316E+02	1.265E+05	8.500E+00	4.534E-01	1.265E+02	8.500E-03
2163	2.225E+02	1.215E+05	8.166E+00	4.357E-01	1.215E+02	8.166E-03
2164	2.138E+02	1.168E+05	7.846E+00	4.186E-01	1.168E+02	7.846E-03
2165	2.054E+02	1.122E+05	7.538E+00	4.022E-01	1.122E+02	7.538E-03
2166	1.973E+02	1.078E+05	7.243E+00	3.864E-01	1.078E+02	7.243E-03

ATTACHMENT 11B

Radius of Influence

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Radius of Influence		
	Job No. 2018-3854	Made by: TD TD	Date 07-13-20
	Ref. Chesapeake Terrace Rubble Fill	Checked by: VEF VEF	Sheet 1 of 2

Revised by PGS 08/30/2021

Objective:

To calculate the radius of influence to be used for the design of the landfill gas well field.

References:

1. LandGEM Model calculation by Montrose Environmental, Project No. 20183854, dated 7/08/20.
2. Landfill Off-Gas Collection and Treatment Systems, Department of the Army, US Army Corps of Engineers, May 2008.

Attachments:

Appendix A – Radius of Influence, Microsoft Excel spreadsheet by Montrose Environmental, Project No. 20183854.

Appendix B – Well Flows & Per Foot of Well Screen Gas Production Rate, Microsoft Excel spreadsheet by Montrose Environmental, Project No. 20183854.

Calculation:

The following equation is used to calculate the radius of influence, ROI (ft.)

$$R = \sqrt{\frac{Q}{\pi * t * G * D}} \; (Ref. 2)$$

Where R is a function of:

- Methane flow rate, Q (CFM)
- Waste thickness, t (ft)
- Methane production rate, G =

$$\overset{2,430}{\cancel{4,472}}\; scfm \left(\frac{1440\, min}{day}\right)\left(\overset{5,000,000}{\cancel{9,200,000}}\; tons\right)^{-1} = \overset{0.700}{\cancel{0.700}}\; \frac{ft^3}{ton \cdot day} \; (\text{Ref. } 1)$$

- Waste density, D (γ_{waste}) $= 0.66 \frac{ton}{yd^3} = 0.0244 \frac{ton}{ft^3}$

The peak landfill gas production occurs at ~~4,472~~ 2,430 scfm (Ref. 1) for 99 wells with a combined screen length of ~~6,844~~ 4,363 LF, which yields a collection rate of ~~0.65~~ 0.56 scfm/ft of well screen. A spreadsheet was prepared for various flows and depths and is attached. The following sample calculation is for a flow of 39 scfm and 60 feet of waste depth.

ADVANCED GeoServices

a Montrose Environmental Group company

Subject: Radius of Influence		
Job No. 2018-3854	**Made by:** TD TD	**Date** 07-13-20
Ref. Chesapeake Terrace Rubble Fill	**Checked by:** VEF VEF	**Sheet** 2 of 2

$$R = \sqrt{\frac{39\,\frac{ft^3}{min}}{\left[\pi\,(60\ ft)\left(0.700\,\frac{ft^3}{ton\cdot day}\right)\left(0.0244\,\frac{ton}{ft^3}\right)\left(\frac{day}{1440\ min}\right)\right]}}$$

$$= \sqrt{\frac{39\,\frac{ft^3}{min}}{0.00224\,\frac{ft}{min}}} = 132.1\ ft$$

It is assumed that for the rubble fill, ~~0.65~~ 0.56 ft^3 gas will be collected per foot of well screen, this data is found in Appendix B. We chose to use ~~125~~ 130 ft. ~~for conservation,~~ in addition to the waste being heterogeneous.

Conclusion:

A design ROI of 130 feet will be used to design the Chesapeake Terrace Rubble Fill well field.

$$R = \sqrt{\frac{Q}{\pi * t * G * D}}$$

Where the radius of influence, ft, is a function of:

- Methane flow rate, Q (CFM)
- Waste thickness, t (ft)
- Methane production rate, G = 0.700 $\frac{ft^3}{ton \cdot day}$
- Waste density, D (γ_{waste}) = 0.0244 $\frac{ton}{ft^3}$

Calculated R Values, feet

	Depth, ft										
Flow (CFM)	40	50	60	70	80	90	100	120	130	140	150
150	317	284	259	240	224	211	201	183	176	170	164
140	306	274	250	232	217	204	194	177	170	164	158
130	295	264	241	223	209	197	187	171	164	158	153
120	284	254	232	214	201	189	179	164	157	152	147
110	272	243	222	205	192	181	172	157	151	145	140
100	259	232	211	196	183	173	164	150	144	138	134
90	246	220	201	186	174	164	155	142	136	131	127
80	232	207	189	175	164	154	147	134	129	124	120
75	224	201	183	170	159	150	142	130	124	120	116
60	201	179	164	152	142	134	127	116	111	107	104
50	183	164	150	138	130	122	116	106	102	98	95
40	164	147	134	124	116	109	104	95	91	88	85
30	142	127	116	107	100	95	90	82	79	76	73
25	130	116	106	98	92	86	82	75	72	69	67
10	82	73	67	62	58	55	52	47	45	44	42

Appendix B Revised Sept 2021

West Section					
Well ID	Final Cover Proposed Elevation (ft.)	Top of Leachate System Elevation (ft.)	Elevation Difference (ft.)	Length of Well Screen System (ft.)	Q (SCFM)
EW-01	161	116	45	27	15.0
EW-02	160	109	51	33	18.4
EW-03	156	101	55	37	20.6
EW-04	190	118	72	54	30.1
EW-05	188	115	73	55	30.6
EW-06	150	96	54	36	20.1
EW-07	184	105	79	61	34.0
EW-08	140	101	39	21	11.7
EW-09	135	107	28	10	5.6
EW-10	130	106	24	6	3.3
EW-11	137	110	27	9	5.0
EW-12	144	113	31	13	7.2
EW-13	181	109	72	54	30.1
EW-14	168	112	56	38	21.2
EW-15	158	112	46	28	15.6
EW-16	192	114	78	60	33.4
EW-17	190	117	73	55	30.6
EW-18	180	119	61	43	23.9
EW-19	150	119	31	13	7.2
EW-20	197	128	69	51	28.4
EW-21	185	127	58	40	22.3
EW-22	151	122	29	11	6.1
EW-23	187	138	49	31	17.3
EW-24	154	126	28	10	5.6
EW-25	155	130	25	7	3.9
EW-26	196	127	69	51	28.4
EW-27	189	140	49	31	17.3
EW-28	158	128	30	12	6.7
EW-29	190	143	47	29	16.2
EW-30	163	129	34	16	8.9
EW-31	197	135	62	44	24.5
EW-32	165	137	28	10	5.6
EW-33	203	133	70	52	29.0
EW-34	170	126	44	26	14.5
EW-35	212	138	74	56	31.2
EW-36	175	127	48	30	16.7
EW-37	215	131	84	66	36.8
EW-38	178	128	50	32	17.8
EW-39	217	126	91	73	40.7
EW-40	180	126	54	36	20.1
EW-41	217	130	87	69	38.4
EW-42	184	123	61	43	23.9

Footnote: The Length of Well Screen took into consideration the height of the cap and liner system.

West Section					
Well ID	Final Cover Proposed Elevation (ft.)	Top of Leachate System Elevation (ft.)	Elevation Difference (ft.)	Length of Well Screen System (ft.)	Q (SCFM)
EW-43	194	120	74	56	31.2
EW-44	205	121	84	66	36.8
EW-45	222	124	98	80	44.6
EW-46	224	125	99	81	45.1
EW-47	210	132	78	60	33.4
EW-48	224	119	105	87	48.5
EW-49	218	117	101	83	46.2
EW-50	212	129	83	65	36.2
EW-51	220	114	106	88	49.0
EW-52	187	114	73	55	30.6
EW-53	202	131	71	53	29.5
EW-54	192	110	82	64	35.6
EW-55	188	120	68	50	27.8
EW-56	217	124	93	75	41.8
EW-57	223	134	89	71	39.5
EW-58	182	126	56	38	21.2
EW-59	217	132	85	67	37.3
EW-60	182	119	63	45	25.1
EW-61	211	123	88	70	39.0
EW-62	210	139	71	53	29.5
EW-63	181	123	58	40	22.3
EW-64	206	133	73	55	30.6
EW-65	201	124	77	59	32.9
EW-66	206	130	76	58	32.3
EW-67	175	112	63	45	25.1
EW-68	192	115	77	59	32.9
EW-69	198	123	75	57	31.7
EW-70	198	131	67	49	27.3
EW-71	166	119	47	29	16.2
EW-72	189	123	66	48	26.7
EW-73	195	124	71	53	29.5
EW-74	197	129	68	50	27.8
EW-75	196	121	75	57	31.7
			Total Length (ft.)	**3445**	

East Section					
Well ID	Final Cover Proposed Elevation (ft.)	Top of Leachate System Elevation (ft.)	Elevation Difference (ft.)	Length of Well Screen System (ft.)	Q (SCFM)
EW-76	126	87	39	21	11.7
EW-77	152	89	63	45	25.1
EW-78	126	80	46	28	15.6
EW-79	159	93	66	48	26.7
EW-80	132	91	41	23	12.8
EW-81	162	102	60	42	23.4
EW-82	168	92	76	58	32.3
EW-83	181	101	80	62	34.5
EW-84	155	99	56	38	21.2
EW-85	140	90	50	32	17.8
EW-86	132	92	40	22	12.3
EW-87	170	92	78	60	33.4
EW-88	170	98	72	54	30.1
EW-89	125	86	39	21	11.7
EW-90	174	93	81	63	35.1
EW-91	122	81	41	23	12.8
EW-92	121	88	33	15	8.4
EW-93	179	99	80	62	34.5
EW-94	132	90	42	24	13.4
EW-95	174	92	82	64	35.6
EW-96	130	88	42	24	13.4
EW-97	124	90	34	16	8.9
EW-98	124	86	38	20	11.1
EW-99	167	96	71	53	29.5
			Total Length (ft.)	**918**	

Total landfill gas (av ft^3/min)
2430

*LandGEM Model Calculation Ref.

Landfill Section	
West	3445
East	918
Total Length (ft.)	**4363**

Per foot of well screen gas produciton rate (ft^3/min)
0.56

ATTACHMENT 11C

Piping Network Analysis

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Gas Friction Loss Calculation		
	Job No. 2018-3854	Made by: TD TD	Date 07-13-20
	Ref. Chesapeake Terrace Rubble Fill	Checked by:	Sheet 1 of 5

Revised by PGS 08/30/2021

Purpose:

The objective of this analysis is to perform friction loss calculation in the landfill pipeline using the Microsoft Excel spreadsheet. EPANET, a computerized simulation program, was used only to model the conceptual landfill gas extraction system design layout. The output from the spreadsheet provides data on flow rate, friction head loss, friction factor, and velocity. The following demonstrates the manual calculation used in the spreadsheet to show the friction loss through the landfill gas pipe.

Problem:

The example calculation will focus on the East Section of the landfill system. There are a total of 24 gas extraction wells producing their respective flow rates of Landfill Gas (for a total of 514 801 SCFM). They each have their own lateral that eventually runs to a common junction. The vacuum at the blower is set at -50 inches of water. A manual calculation is performed that will find the head loss that occurs due to friction of the landfill gas traveling through the pipe. This is done using the Darcy-Weisbach Equation:

$$h_f = f \cdot \frac{L}{D} \cdot \frac{V^2}{2g}$$

Where h_f is the head loss (in.), L is the pipe length, D is the pipe diameter, V is the velocity, g is acceleration of gravity, and *f* is the friction coefficient.

References:

1. EPANET Model, V. 2.0, USEPA, Sep. 2000.
2. Bhave, P.R. 1991. Analysis of Flow in Water Distribution Networks. (PA): Technomic Publishing.
3. Landfill Off-Gas Collection and Treatment Systems, Department of the Army, US Army Corps of Engineers, May 2008.

Attachments:

Appendix A – EPANET System Layout Map

Appendix B – Landfill System Friction Factor Loss Calculation Microsoft Excel spreadsheet by Montrose Environmental, Project No. 20183854.

ADVANCED GeoServices a Montrose Environmental Group company	**Subject:** Gas Friction Loss Calculation		
	Job No. 2018-3854	**Made by:** TD TD	**Date** 07-13-20
	Ref. Chesapeake Terrace Rubble Fill	**Checked by:** VEJ	**Sheet** 2 of 5

Revised by PGS 08/30/2021

Known Properties:

Landfill System Known Properties		
Operating Temp. (°F)	87	
Use 12" header Area (ft^2)	~~1.7671~~ 0.785	
ρ_{AIR} @ 87 °F, 12.89 psia (lb/ft^3)	0.07647	
Specific Gravity, SG_{CH4} (ρ_{CH4}/ρ_{AIR})	0.55	
ρ_{CH4} @ 87 °F, 12.89 psia (lb/ft^3)	0.035	
ε_{PVC}(millifeet)	0.1	
Absolute Viscosity, μ_{CH4} (lbf s/ft^2)	2.33E-07	
ρ_{CH4} @ 60°F, 14.696 psia (lb/ft^3)	0.04	
ρ_{H2O} @ 60°F (lb/ft^3)	62.1459	
g (ft/s^2) = 9.81 m/s^2	32.174	
1 lbf= 32.174 pdl =	32.174	lb ft/s^2
P_{ATM} =	14.696	psia
$P_{B\ (Blower)}$ = -50" H_2O =	12.89	psia

The area is based on the diameter of the main header pipe, the pipe running from the blower to the common junction (node HP19, Appendix A).

Volumetric Flow Rate and Velocity – Compressible VS. Incompressible

For incompressible flow, the velocity (V) may be calculated by using the following equation:

$$V_1 = \frac{Q_1}{A} = \frac{\overset{514}{\cancel{801}}\ ft^3}{min} \cdot \frac{min}{60\ s} \cdot \frac{1}{\underset{0.785}{\cancel{1.7671}}\ ft^2} = \overset{10.91}{\cancel{7.55}}\ ft/s$$

Where the velocity, V, is a function of:

- Flow, Q (ft^3/sec)
- Cross-sectional area of the pipe (ft^2)

For landfill gas pipelines, however, the compressibility of gasses is to be considered. Under a vacuum, gasses expand, and this will lead to a higher value for velocity and volumetric flow rate. In the Darcy-Weisbach Equation, the term of velocity is a squared term, and has significiant impact on the calculation of pressure loss. To calculate the actual flow rate, the volumetric flow must be converted to mass based flow.

$$\frac{1lb}{s}\cdot\frac{ft^3{}_{AIR}}{0.07647lb_{AIR}}\cdot\frac{60\ s}{min}=784.6\ ft^3{}_{AIR}/min$$

$$V_c=\frac{Q_c}{A}\cdot\frac{\overset{514}{\cancel{801}}\ ft^3{}_{AIR}}{min}\cdot\frac{\frac{lb_{AIR}}{s}}{784.6\ ft^3{}_{AIR}/min}\cdot\frac{0.55lb_{CH4}}{1lb_{AIR}}\cdot\frac{ft^3}{0.035lb_{CH4}}\cdot\frac{1}{\underset{0.785}{\cancel{1.7671}}\ ft^2}=\overset{13.1}{\cancel{9.08}}\frac{ft}{s}=\overset{4.0}{\cancel{2.7681}}\ m/s$$

In the following example, the pipe-in-question is the pipe directly connected to the blower, so P_{GAS} is assumed to be equal to P_B 12.89 psi. This yields a density of 0.035lb/ft^3 for methane. The corrected values for velocity and volumetric flow are V_c = 9.08 ft/s (2.7681 m/s) and

$$A\cdot V=\overset{0.785}{\cancel{1.7671}}\ ft^2\cdot\frac{\overset{13.1}{\cancel{9.08}}\ ft}{s}\cdot\frac{60\ s}{min}=Q_c=\overset{617}{\cancel{962.72}}\ SCFM$$

The Friction Coefficient:

The coefficient of friction was found using the Swamee – Jain equation:

$$f=\frac{0.25}{\left[\log_{10}\left(\frac{\epsilon}{3.7d}+\frac{5.74}{Re^{0.9}}\right)\right]^2}\qquad \text{Swamee – Jain equation}$$

where the friciton factor, *f*, is a function of:

- Surface roughness height, ϵ (ft)
- Pipe Diameter, *D* (ft)
- Reynolds number, *Re* (unitless)

For transition and rough turbulent flow (Re ≥ 4,000)

For laminar flow where Reynolds number is less than 2000, the Hagen-Poiseuille equation: $f_l = 64/Re$ was used to solve for the friction factor. For Reynolds number between 2000 (laminar, f_l) and 4000 (turbulent, f_2) the friction factor was interpolated using the following equation:

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Gas Friction Loss Calculation		
	Job No. 2018-3854	Made by: TD TD	Date 07-13-20
	Ref. Chesapeake Terrace Rubble Fill	Checked by: VEJ	Sheet 4 of 5

Revised by PGS 08/30/2021

$$f = \left(f_1 \cdot \frac{(Re - 2000)}{2000}\right) + \left(f_2 \cdot \frac{(4000 - Re)}{2000}\right)$$

The following was done in three steps,

1.

$$\frac{\varepsilon}{D} = \frac{0.0001\,ft}{\underset{1.0}{\cancel{1.5}}\,ft} = \cancel{0.000067}$$

2. Reynolds Number:

Where v is kinematic viscosity found by:

$$v = \frac{\mu}{\rho} = \frac{2.33e-07lbf \cdot s}{ft^2} \cdot \frac{ft^3}{0.04lb_{CH4(abs)}} \cdot \frac{32.174pdl}{lbf} \cdot \frac{lb \cdot ft/s^2}{pdl} \cdot \frac{0.0929m^2}{ft^2} = 1.7411e-05m^2/s$$

$$Re = \frac{V \cdot D}{v} = \frac{\overset{4.0}{\cancel{2.7681}}\,m/s \cdot \overset{0.3048}{\cancel{0.45720}}m}{1.7411e{-}05m^2/s} = \overset{70{,}025}{\cancel{72{,}688}}$$

3. Using these two numbers the friction coefficient can be found using the Swamee – Jain equation:

$$f = \frac{0.25}{\left[\log_{10}\left(\frac{0.001\,ft}{3.7 \cdot \underset{1.0}{\cancel{1.5}}\,ft} + \frac{5.74}{\underset{70{,}025}{\cancel{72{,}688}}^{0.9}}\right)\right]^2} = \overset{0.020}{\cancel{0.019}}$$

Head Loss:

Using the solutions above, the Darcy-Weisbach equation is now satisfied:

Revised by PGS 08/30/2021

$$h_f = f \cdot \frac{L}{D} \cdot \frac{V^2}{2g} = \overset{0.020}{\cancel{0.019}} \cdot \frac{400\ ft}{\underset{1.0}{\cancel{1.5}}\ ft} \cdot \frac{(\overset{13.1}{\cancel{9.08}}\ ft/s)^2}{2 \cdot 32.174\ ft/s^2} = \overset{21.34}{\cancel{6.49}}\ ft_{GAS}$$

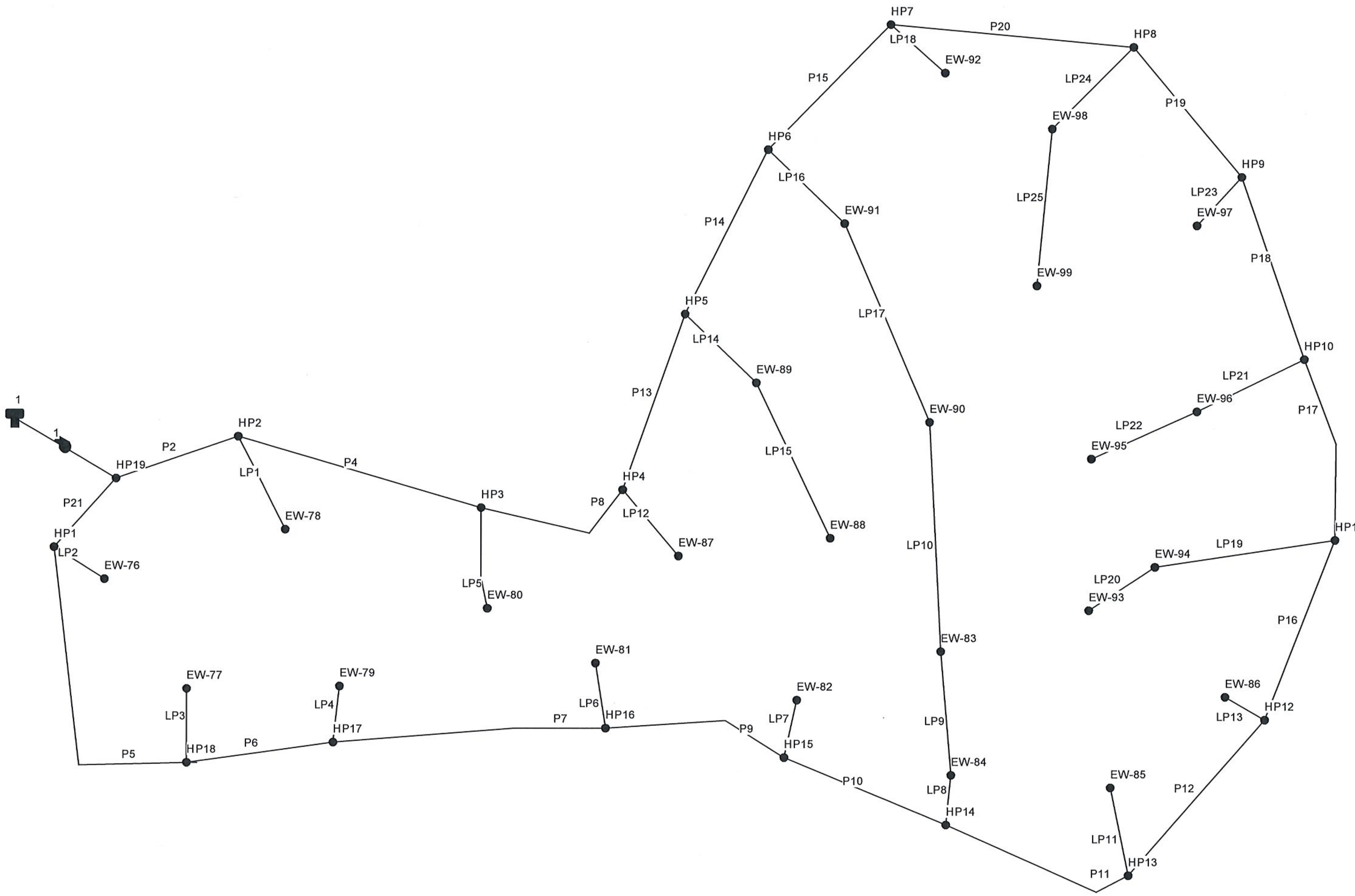
Units converted to inches of water column

$$\overset{21.34}{\cancel{1403}}\ ft_{GAS} \cdot \frac{0.035\ lb_{GAS}}{ft^3} \cdot \frac{1\ lb_{H2O}}{1\ lb_{GAS}} \cdot \frac{ft^3}{62.1459\ lb_{H20}} \cdot \frac{12\ in}{1\ ft} = \overset{0.14}{\cancel{0.04}}\ inches\ of\ water$$

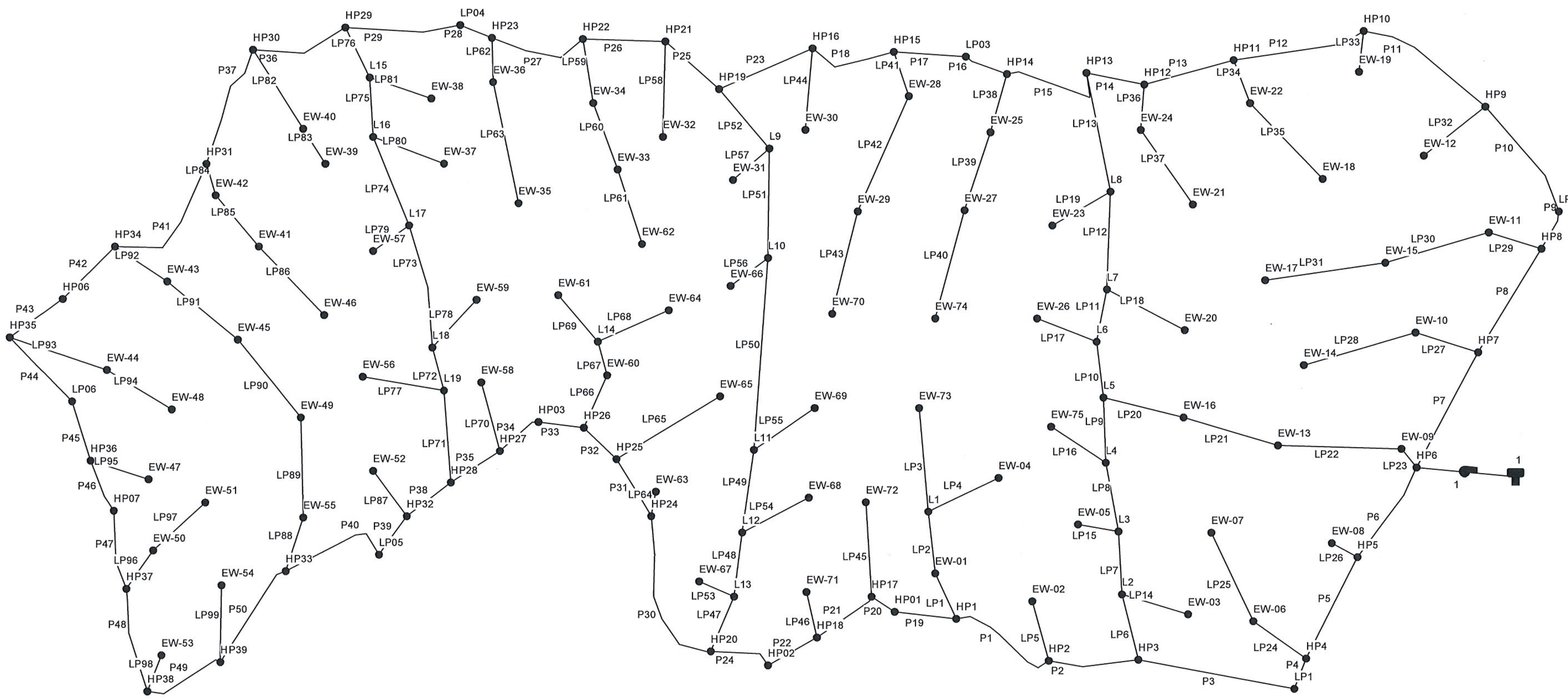
Results and Conclusion

The result of the manual calculation is ~~0.47~~ 0.14 inches of water loss.

East Section Chesapeake Terrace Rubble Landfill



West Section Chesapeake Terrace Rubble Landfill



a Montrose Environmental Group company

WEST SECTION

Landfill System Known Properties		
Operating Temp. (°F)	87	
Area (ft^2)	1.7671	
ρ_{AIR} @ 87 °F, 12.89 psia (lb/ft^3)	0.07647	
Specific Gravity, SG_{CH4} (ρ_{CH4}/ρ_{AIR})	0.55	
ρ_{CH4} @ 87 °F, 12.89 psia (lb/ft^3)	0.035	
ε_{PVC} (millifeet)	0.1	
Absolute Viscosity, μ_{CH4} ($lbf\ s/ft^2$)	2.33E-07	
ρ_{CH4} @ 60°F, 14.696 psia (lb/ft^3)	0.04	
ρ_{H2O} @ 60°F (lb/ft^3)	62.1459	
g (ft/s^2)	32.174	
1 lbf = 32.174 pdl =	32.174	lb ft/s^2
P_{ATM} =	14.696	psia
$P_{B\ (Blower)}$ = -50" H_2O =	12.89	psia

West Section Known Parameters

Well ID	Proposed Elevation (ft.)	Demand, Q (SCFM)	Lateral Intersection ID	Proposed Elevation (ft.)	Lateral Pipe ID	Length (ft.)	Diameter (in.)	Lateral Pipe ID (cont.)	Length (ft.)	Diameter (in.)	Header Intersection ID	Proposed Elevation (ft.)	Pipe ID	Length (ft.)	Diameter (in.)
EW-01	161	15.0	L1	188	LP1	15	6	LP82	60	6	HP1	160	P1	240	12
EW-02	160	18.4	L2	155	LP2	150	6	LP83	210	6	HP2	148	P2	195	12
EW-03	156	20.6	L3	187	LP3	195	6	LP84	3	6	HP3	137	P3	345	12
EW-04	190	30.1	L4	195	LP4	135	6	LP85	165	12	HP4	125	P4	60	12
EW-05	188	30.6	L5	195	LP5	67	6	LP86	210	12	HP5	132	P5	210	12
EW-06	150	20.1	L6	196	LP6	70	12	LP87	75	6	HP6	128	P6	246	12
EW-07	184	34.0	L7	195	LP7	180	12	LP88	90	6	HP7	122	P7	225	12
EW-08	140	11.7	L8	184	LP8	210	12	LP89	210	12	HP8	129	P8	210	12
EW-09	135	5.6	L9	193	LP9	60	12	LP90	225	6	HP9	140	P9	135	12
EW-10	130	3.3	L10	202	LP10	180	12	LP91	240	6	HP10	150	P10	210	12
EW-11	137	5.0	L11	198	LP11	15	12	LP92	3	6	HP11	140	P11	270	12
EW-12	144	7.2	L12	192	LP12	240	12	LP93	90	6	HP12	143	P12	255	12
EW-13	181	30.1	L13	170	LP13	160	12	LP94	240	6	HP13	138	P13	210	12
EW-14	168	21.2	L14	199	LP14	40	6	LP95	45	6	HP14	147	P14	45	12
EW-15	158	15.6	L15	176	LP15	45	6	LP96	45	6	HP15	142	P15	210	12
EW-16	192	33.4	L16	214	LP16	67	6	LP97	225	6	HP16	152	P16	135	12
EW-17	190	30.6	L17	222	LP17	120	6	LP98	75	6	HP17	157	P17	45	12
EW-18	180	23.9	L18	217	LP18	97	6	LP99	90	6	HP18	150	P18	230	12
EW-19	150	7.2	L19	210	LP19	105	6				HP19	155	P19	45	12
EW-20	197	28.4			LP20	160	6				HP20	147	P20	45	12
EW-21	185	22.3			LP21	195	6				HP21	160	P21	150	12
EW-22	151	6.1			LP22	225	6				HP22	155	P22	120	12
EW-23	187	17.3			LP23	60	6				HP23	155	P23	60	12
EW-24	154	5.6			LP24	105	6				HP24	162	P24	75	12
EW-25	155	3.9			LP25	225	6				HP25	174	P25	165	12
EW-26	196	28.4			LP26	45	6				HP26	178	P26	240	12
EW-27	189	17.3			LP27	30	6				HP27	174	P27	240	12
EW-28	158	6.7			LP28	225	12				HP28	172	P28	80	12
EW-29	190	16.2			LP29	3	6				HP29	161	P29	233	12
EW-30	163	8.9			LP30	195	6				HP30	172	P30	465	12
EW-31	197	24.5			LP31	240	6				HP31	184	P31	120	12
EW-32	165	5.6			LP32	6	6				HP32	166	P32	105	12

Known Parameters (Continued)

West Section Known Parameters															
Well ID	**Proposed Elevation (ft.)**	**Demand, Q (SCFM)**	**Lateral Intersection ID**	**Proposed Elevation (ft.)**	**Lateral Pipe ID**	**Length (ft.)**	**Diameter (in.)**	**Lateral Pipe ID (cont.)**	**Length (ft.)**	**Diameter (in.)**	**Header Intersection ID**	**Proposed Elevation (ft.)**	**Pipe ID**	**Length (ft.)**	**Diameter (in.)**
EW-33	203	29.0			LP33	1.5	6				HP33	167	P33	75	12
EW-34	170	14.5			LP34	18	6				HP34	189	P34	120	12
EW-35	212	31.2			LP35	210	6				HP35	193	P35	130	12
EW-36	175	16.7			LP36	30	6				HP36	203	P36	225	12
EW-37	215	36.8			LP37	210	6				HP37	204	P37	315	12
EW-38	178	17.8			LP38	45	6				HP38	192	P38	150	12
EW-39	217	40.7			LP39	225	6				HP39	176	P39	90	12
EW-40	180	20.1			LP40	225	6						P40	90	12
EW-41	217	38.4			LP41	60	6						P41	240	12
EW-42	184	23.9			LP42	240	6						P42	135	12
EW-43	194	31.2			LP43	210	6						P43	135	12
EW-44	205	36.8			LP44	53	12						P44	15	12
EW-45	222	44.6			LP45	195	6						P45	255	12
EW-46	224	45.1			LP46	75	6						P46	125	12
EW-47	210	33.4			LP47	120	6						P47	120	12
EW-48	224	48.5			LP48	174	6						P48	285	12
EW-49	218	46.2			LP49	45	6						P49	300	12
EW-50	212	36.2			LP50	450	6						P50	240	12
EW-51	220	49.0			LP51	180	6								
EW-52	187	30.6			LP52	195	6								
EW-53	202	29.5			LP53	75	6								
EW-54	192	35.6			LP54	30	6								
EW-55	188	27.8			LP55	210	6								
EW-56	217	41.8			LP56	90	6								
EW-57	223	39.5			LP57	60	12								
EW-58	182	21.2			LP58	30	6								
EW-59	217	37.3			LP59	45	8								
EW-60	182	25.1			LP60	180	6								
EW-61	211	39.0			LP61	165	6								
EW-62	210	29.5			LP62	90	6								
EW-63	181	22.3			LP63	270	6								
EW-64	206	30.6			LP64	60	6								
EW-65	201	32.9			LP65	270	6								
EW-66	206	32.3			LP66	15	6								
EW-67	175	25.1			LP67	120	6								
EW-68	192	32.9			LP68	120	6								
EW-69	198	31.7			LP69	135	6								
EW-70	198	27.3			LP70	40	6								
EW-71	166	16.2			LP71	165	6								
EW-72	189	26.7			LP72	30	6								
EW-73	195	29.5			LP73	255	6								
EW-74	197	27.8			LP74	165	6								
EW-75	196	31.7			LP75	210	6								
Blower		1918.7			LP76	60	6								
					LP77	90	6								
					LP78	165	6								
					LP79	75	6								
					LP80	45	6								
					LP81	60	6								

Pipe Network Input Data				
Pipe	Start	End	Length	Diameter
ID	Node	Node	(ft.)	(in.)
Blower	HP6	1	400	18
P1	HP1	HP2	15	12
P2	HP2	HP3	195	12
P3	HP3	LP1	345	12
P4	LP1	HP4	60	12
P5	HP4	HP5	210	12
P6	HP5	HP6	246	12
P7	HP7	HP6	225	12
P8	HP8	HP7	210	12
P9	LP02	HP8	135	12
P10	HP9	LP02	210	12
P11	HP10	HP9	270	12
P12	HP11	HP10	255	12
P13	HP12	HP11	210	12
P14	HP13	HP12	45	12
P15	HP14	HP13	210	12
P16	LP03	HP14	135	12
P17	HP15	LP03	45	12
P18	HP16	HP15	230	12
P19	HP01	HP1	45	12
P20	HP17	HP01	45	12
P21	HP18	HP17	150	12
P22	HP02	HP18	120	12
P23	HP19	HP16	60	12
P24	HP20	HP02	75	12
P25	HP21	HP19	165	12
P26	HP22	HP21	240	12
P27	HP23	HP22	240	12
P28	LP04	HP23	80	12
P29	HP29	LP04	233	12
P30	HP24	HP20	465	12
P31	HP25	HP24	120	12
P32	HP26	HP25	105	12
P33	HP03	HP26	75	12
P34	HP27	HP03	120	12
P35	HP28	HP27	130	12
P36	HP30	HP29	225	12
P37	HP30	HP31	315	12
P38	HP30	HP31	150	12
P39	LP05	HP32	90	12
P40	HP33	LP05	90	12
P41	HP31	HP34	240	12
P42	HP34	HP06	135	12
P43	HP06	HP35	135	12
P44	HP35	LP06	15	12
P45	LP06	HP36	255	12
P46	HP36	HP07	125	12
P47	HP07	HP37	120	12
P48	HP37	HP38	285	12

Pipe Network Output Data Results									
Pipe	Start	End	Flow	Head loss	Velocity, V_c	Demand, Q_c	Friction	Re	ε_{PVC}/D
ID	Node	Node	(SCFM)	(in.-water)	(ft/s)	(SCFM)	Factor		
Blower	HP6	1	1918.7	0.002	1.36	144.1	0.030	10878	0.0000667
P1	HP1	HP2	-768.93	0.000	1.23	129.9	0.035	6539	0.0001000
P2	HP2	HP3	-787.31	0.001	1.25	133.0	0.035	6695	0.0001000
P3	HP3	LP1	-1150.86	0.004	1.83	194.5	0.031	9787	0.0001000
P4	LP1	HP4	-1150.86	0.001	1.83	194.5	0.031	9787	0.0001000
P5	HP4	HP5	-1204.89	0.003	1.92	203.6	0.031	10246	0.0001000
P6	HP5	HP6	-1216.58	0.003	1.94	205.6	0.031	10346	0.0001000
P7	HP6	HP7	-1000.08	0.002	1.59	169.0	0.033	8505	0.0001000
P8	HP7	HP8	-975.57	0.002	1.55	164.9	0.033	8296	0.0001000
P9	HP8	LP2	-924.33	0.001	1.47	156.2	0.033	7860	0.0001000
P10	LP2	HP9	-924.33	0.002	1.47	156.2	0.033	7860	0.0001000
P11	HP9	HP10	-917.09	0.002	1.46	155.0	0.033	7799	0.0001000
P12	HP10	HP11	-909.85	0.002	1.45	153.8	0.033	7737	0.0001000
P13	HP11	HP12	-879.77	0.001	1.40	148.7	0.034	7481	0.0001000
P14	HP12	HP13	-851.93	0.000	1.36	144.0	0.034	7245	0.0001000
P15	HP13	HP14	-884.09	0.001	1.41	149.4	0.034	7518	0.0001000
P16	HP14	LP3	-835.08	0.001	1.33	141.1	0.034	7101	0.0001000
P17	LP3	HP15	-835.08	0.000	1.33	141.1	0.034	7101	0.0001000
P18	HP15	HP16	-784.95	0.001	1.25	132.6	0.035	6675	0.0001000
P19	HP1	HP01	-694.30	0.000	1.11	117.3	0.036	5904	0.0001000
P20	HP01	HP17	-694.30	0.000	1.11	117.3	0.036	5904	0.0001000
P21	HP17	HP18	-667.57	0.001	1.06	112.8	0.037	5677	0.0001000
P22	HP18	HP02	-651.42	0.001	1.04	110.1	0.037	5540	0.0001000
P23	HP16	HP19	-776.04	0.000	1.24	131.1	0.035	6599	0.0001000
P24	HP02	HP20	-651.42	0.000	1.04	110.1	0.037	5540	0.0001000
P25	HP19	HP21	-710.51	0.001	1.13	120.1	0.036	6042	0.0001000
P26	HP21	HP22	-704.94	0.001	1.12	119.1	0.036	5995	0.0001000
P27	HP22	HP23	-631.98	0.001	1.01	106.8	0.037	5374	0.0001000
P28	HP23	LP04	-584.08	0.000	0.93	98.7	0.001	4967	0.0001000
P29	LP04	HP29	-584.08	0.000	0.93	98.7	0.001	4967	0.0001000
P30	HP20	HP24	-570.47	0.002	0.91	96.4	0.038	4851	0.0001000
P31	HP24	HP25	-548.19	0.000	0.87	92.6	0.039	4662	0.0001000
P32	HP25	HP26	-515.33	0.000	0.82	87.1	0.040	4382	0.0001000
P33	P26	HP03	-420.65	0.000	0.67	71.1	0.023	3577	0.0001000
P34	HP03	HP27	-420.65	0.000	0.67	71.1	0.023	3577	0.0001000
P35	HP27	HP28	-399.48	0.000	0.64	67.5	0.026	3397	0.0001000
P36	HP29	HP30	-499.05	0.000	0.80	84.3	0.012	4244	0.0001000
P37	HP30	HP31	406.25	0.000	0.65	68.7	0.025	3455	0.0001000
P38	HP28	HP32	-311.30	0.000	0.50	52.6	0.039	2647	0.0001000
P39	HP32	LP05	-280.67	0.000	0.45	47.4	0.044	2387	0.0001000
P40	LP05	HP33	-280.67	0.000	0.45	47.4	0.044	2387	0.0001000
P41	HP31	HP34	298.76	0.000	0.48	50.5	0.025	2541	0.0001000
P42	HP34	HP06	-67.32	0.000	0.11	11.4	0.112	572	0.0001000
P43	HP06	HP35	-67.32	0.000	0.11	11.4	0.112	572	0.0001000
P44	HP35	LP06	-17.90	0.000	0.03	3.0	0.421	152	0.0001000
P45	LP06	HP36	-17.90	0.000	0.03	3.0	0.421	152	0.0001000
P46	HP36	HP07	-51.31	0.000	0.08	8.7	0.147	436	0.0001000
P47	HP07	HP37	-51.31	0.000	0.08	8.7	0.147	436	0.0001000
P48	HP37	HP38	-136.53	0.000	0.22	23.1	0.055	1161	0.0001000

Pipe Network Input Data (Continued)

Pipe Network Input Data				
Pipe ID	Start Node	End Node	Length (ft.)	Diameter (in.)
P49	HP38	HP39	240	12
P50	HP39	HP33	240	12
LP1	EW-01	HP1	15	6
LP2	L1	EW-01	150	6
LP3	EW-73	L1	195	6
LP4	EW-04	L1	135	6
LP5	EW-02	HP2	67	6
LP6	L2	HP3	70	12
LP7	L3	L2	180	12
LP8	L3	L4	210	12
LP9	L4	L5	60	12
LP10	L6	L5	180	12
LP11	L7	L6	15	12
LP12	L8	L7	240	12
LP13	L8	HP13	160	12
LP14	EW-03	L2	40	6
LP15	EW-05	L3	45	6
LP16	EW-75	L4	67	6
LP17	EW-26	L6	120	6
LP18	EW-20	LP18	97	6
LP19	EW-23	L8	105	6
LP20	L5	EW-16	160	6
LP21	EW-16	EW-13	195	6
LP22	EW-13	EW-09	225	6
LP23	EW-09	HP6	60	6
LP24	EW-06	HP4	105	6
LP25	EW-07	EW-06	225	6
LP26	EW-08	HP5	45	6
LP27	EW-10	HP7	30	6
LP28	EW-14	EW-10	225	12
LP29	EW-11	HP8	3	6
LP30	EW-15	EW-11	195	6
LP31	EW-17	EW-15	240	6
LP32	EW-12	HP9	6	6
LP33	EW-19	HP10	1.5	6
LP34	EW-22	HP11	18	6
LP35	EW-18	EW-22	210	6
LP36	EW-24	HP12	30	6
LP37	EW-21	EW-24	210	6
LP38	EW-25	HP14	45	6
LP39	EW-27	EW-25	225	6
LP40	EW-74	EW-27	225	6
LP41	EW-28	HP15	60	6
LP42	EW-29	EW-28	240	6
LP43	EW-70	EW-29	210	6
LP44	EW-30	HP16	53	12
LP45	EW-72	HP17	195	6
LP46	EW-71	HP18	75	6
LP47	L13	HP20	120	6
LP48	L12	L13	174	6
LP49	L11	L12	45	6

Pipe Network Output Data Results (Continued)

Pipe Network Output Data Results									
Pipe ID	Start Node	End Node	Flow (SCFM)	Head loss (in.-water)	Velocity, V_c (ft/s)	Demand, Q_c (SCFM)	Friction Factor	Re	ε_{PVC}/D
P49	HP38	HP39	-166.05	0.000	0.26	28.06	0.0453	1412	0.000100
P50	HP39	HP33	-201.69	0.000	0.32	34.08	0.037	1715	0.000100
LP1	EW-01	HP1	-74.63	0.000	0.48	50.45	0.064	1269	0.000200
LP2	L1	EW-01	-59.59	0.000	0.38	40.28	0.068	1014	0.000200
LP3	EW-73	L1	-29.5	0.000	0.19	19.95	0.127	502	0.000200
LP4	EW-04	L1	-30.1	0.000	0.19	20.33	0.125	512	0.000200
LP5	EW-02	HP2	-18.4	0.000	0.12	12.42	0.205	313	0.000200
LP6	L2	HP3	-363.55	0.000	0.58	61.43	0.031	3092	0.000100
LP7	L3	L2	-342.94	0.000	0.55	57.95	0.034	2916	0.000100
LP8	L3	L4	283.44	0.000	0.45	47.90	0.048	2410	0.000100
LP9	L4	L5	251.69	0.000	0.40	42.53	0.030	2140	0.000100
LP10	L6	L5	-157.53	0.000	0.25	26.62	0.048	1340	0.000100
LP11	L7	L6	-129.1	0.000	0.21	21.82	0.058	1098	0.000100
LP12	L8	L7	49.43	0.000	0.08	8.35	0.152	420	0.000100
LP13	L8	HP13	32.16	0.000	0.05	5.44	0.234	274	0.000100
LP14	EW-03	L2	-20.6	0.000	0.13	13.93	0.183	350	0.000200
LP15	EW-05	L3	-30.6	0.000	0.20	20.71	0.123	521	0.000200
LP16	EW-75	L4	-31.7	0.000	0.20	21.46	0.119	540	0.000200
LP17	EW-26	L6	-28.4	0.000	0.18	19.20	0.132	483	0.000200
LP18	EW-20	LP18	-28.4	0.000	0.18	19.20	0.132	483	0.000200
LP19	EW-23	L8	-17.3	0.000	0.11	11.67	0.218	294	0.000200
LP20	L5	EW-16	94.16	0.000	-0.60	-63.65	-0.040	-1601	0.000200
LP21	EW-16	EW-13	60.74	0.000	-0.39	-41.06	-0.062	-1033	0.000200
LP22	EW-13	EW-09	30.67	0.000	-0.20	-20.73	-0.123	-522	0.000200
LP23	EW-09	HP6	25.10	0.000	-0.16	-16.96	-0.150	-427	0.000200
LP24	EW-06	HP4	-54.0	0.000	0.34	36.52	0.070	919	0.000200
LP25	EW-07	EW-06	-34.0	0.000	0.22	22.96	0.111	578	0.000200
LP26	EW-08	HP5	-11.7	0.000	0.07	7.91	0.322	199	0.000200
LP27	EW-10	HP7	-24.51	0.000	0.16	16.56	0.154	417	0.000200
LP28	EW-14	EW-10	-21.2	0.000	0.03	3.58	0.356	180	0.000100
LP29	EW-11	HP8	-51.24	0.000	0.33	34.64	0.073	871	0.000200
LP30	EW-15	EW-11	-46.23	0.000	0.29	31.25	0.081	786	0.000200
LP31	EW-17	EW-15	-30.6	0.000	0.20	20.71	0.123	521	0.000200
LP32	EW-12	HP9	-7.2	0.000	0.05	4.89	0.520	123	0.000200
LP33	EW-19	HP10	-7.2	0.000	0.05	4.89	0.520	123	0.000200
LP34	EW-22	HP11	-30.1	0.000	0.19	20.33	0.125	512	0.000200
LP35	EW-18	EW-22	-23.9	0.000	0.15	16.19	0.157	407	0.000200
LP36	EW-24	HP12	-27.8	0.000	0.18	18.82	0.135	474	0.000200
LP37	EW-21	EW-24	-22.3	0.000	0.14	15.06	0.169	379	0.000200
LP38	EW-25	HP14	-49	0.000	0.31	33.13	0.069	834	0.000200
LP39	EW-27	EW-25	-45	0.000	0.29	30.49	0.083	767	0.000200
LP40	EW-74	EW-27	-27.8	0.000	0.18	18.82	0.135	474	0.000200
LP41	EW-28	HP15	-50	0.000	0.32	33.88	0.069	853	0.000200
LP42	EW-29	EW-28	-43	0.000	0.28	29.36	0.068	739	0.000200
LP43	EW-70	EW-29	-27.3	0.000	0.17	18.45	0.138	464	0.000200
LP44	EW-30	HP16	8.9	0.000	0.01	1.51	0.845	76	0.000100
LP45	EW-72	HP17	-26.7	0.000	0.17	18.07	0.141	455	0.000200
LP46	EW-71	HP18	-16.2	0.000	0.10	10.92	0.233	275	0.000200
LP47	L13	HP20	-80.95	0.000	0.52	54.72	0.063	1377	0.000200
LP48	L12	L13	-55.88	0.000	0.36	37.77	0.068	950	0.000200
LP49	L11	L12	-23.02	0.000	0.15	15.56	0.163	392	0.000200

Pipe Network Input Data (Continued)

Pipe Network Input Data				
Pipe	Start	End	Length	Diameter
ID	Node	Node	(ft.)	(in.)
LP50	L10	L11	45	6
LP51	L10	L9	180	6
LP52	L9	HP19	195	6
LP53	EW-67	L13	75	6
LP54	EW-68	L12	30	6
LP55	EW-69	L11	210	6
LP56	EW-66	L10	90	6
LP57	EW-31	L9	60	12
LP58	EW-32	HP21	30	6
LP59	EW-34	HP22	45	8
LP60	EW-33	EW-34	180	6
LP61	EW-62	EW-33	165	6
LP62	EW-36	HP23	90	6
LP63	EW-35	EW-36	270	6
LP64	EW-63	HP24	60	6
LP65	EW-65	HP25	270	6
LP66	EW-60	HP26	15	6
LP67	L14	EW-60	120	6
LP68	EW-64	L14	120	6
LP69	EW-61	L14	135	6
LP70	EW-58	HP27	40	6
LP71	L19	HP28	165	6
LP72	L18	L19	30	6
LP73	L17	L18	255	6
LP74	L17	L16	165	6
LP75	L16	L15	210	6
LP76	L15	HP29	60	6
LP77	EW-56	L19	90	6
LP78	EW-59	L18	165	6
LP79	EW-57	L17	75	6
LP80	EW-37	L16	45	6
LP81	EW-38	L15	60	6
LP82	EW-40	HP30	60	6
LP83	EW-39	EW-40	210	6
LP84	EW-42	HP31	3	6
LP85	EW-41	EW-42	165	12
LP86	EW-46	EW-41	210	12
LP87	EW-52	HP32	75	6
LP88	EW-55	HP33	90	6
LP89	EW-49	EW-55	210	12
LP90	EW-45	EW-49	225	6
LP91	EW-45	EW-43	240	6
LP92	EW-43	HP34	3	6
LP93	EW-44	HP35	90	6
LP94	EW-48	EW-44	240	6
LP95	EW-47	HP36	45	6
LP96	EW-50	HP37	45	6
LP97	EW-51	EW-50	225	6
LP98	EW-53	HP38	75	6
LP99	EW-54	HP39	90	6

Pipe Network Output Data Results (Continued)

Pipe Network Output Data Results									
Pipe	Start	End	Flow	Head loss	Velocity, V_c	Demand, Q_c	Friction	Re	ε_{PVC}/D
ID	Node	Node	(SCFM)	(in.-water)	(ft/s)	(SCFM)	Factor		
LP50	L10	L11	8.7	0.000	0.06	5.90	0.431	148	0.000200
LP51	L10	L9	-41.0	0.000	0.26	27.73	0.092	698	0.000200
LP52	L9	HP19	-65.53	0.000	0.42	44.30	0.066	1115	0.000200
LP53	EW-67	L13	-25.1	0.000	0.16	16.94	0.150	426	0.000200
LP54	EW-68	L12	-32.9	0.000	0.21	22.21	0.115	559	0.000200
LP55	EW-69	L11	-31.7	0.000	0.20	21.46	0.119	540	0.000200
LP56	EW-66	L10	-32.3	0.000	0.21	21.84	0.116	549	0.000200
LP57	EW-31	L9	-24.5	0.000	0.04	4.14	0.307	208	0.000100
LP58	EW-32	HP21	-5.6	0.000	0.04	3.76	0.676	95	0.000200
LP59	EW-34	HP22	-72.96	0.000	0.26	27.74	0.069	931	0.000150
LP60	EW-33	EW-34	-58	0.000	0.37	39.53	0.068	995	0.000200
LP61	EW-62	EW-33	-29.5	0.000	0.19	19.95	0.127	502	0.000200
LP62	EW-36	HP23	-47.9	0.000	0.31	32.38	0.079	815	0.000200
LP63	EW-35	EW-36	-31.2	0.000	0.20	21.08	0.121	530	0.000200
LP64	EW-63	HP24	-22.3	0.000	0.14	15.06	0.169	379	0.000200
LP65	EW-65	HP25	-32.9	0.000	0.21	22.21	0.115	559	0.000200
LP66	EW-60	HP26	-95	0.000	0.60	64.00	0.058	1610	0.000200
LP67	L14	EW-60	-70	0.000	0.44	47.06	0.066	1184	0.000200
LP68	EW-64	L14	-30.6	0.000	0.20	20.71	0.123	521	0.000200
LP69	EW-61	L14	-39.0	0.000	0.25	26.35	0.097	663	0.000200
LP70	EW-58	HP27	-21.2	0.000	0.13	14.31	0.178	360	0.000200
LP71	L19	HP28	-88.18	0.001	0.56	59.61	0.060	1500	0.000200
LP72	L18	L19	-46.4	0.000	0.30	31.37	0.081	789	0.000200
LP73	L17	L18	9.1	0.000	0.06	6.15	0.414	155	0.000200
LP74	L17	L16	-30.4	0.000	0.19	20.58	0.124	518	0.000200
LP75	L16	L15	-67.2	0.000	0.43	45.43	0.056	1143	0.000200
LP76	L15	HP29	-85.0	0.000	0.54	57.48	0.061	1446	0.000200
LP77	EW-56	L19	-41.8	0.000	0.27	28.24	0.090	710	0.000200
LP78	EW-59	L18	-37.3	0.000	0.24	25.22	0.101	635	0.000200
LP79	EW-57	L17	-39.5	0.000	0.25	26.73	0.095	673	0.000200
LP80	EW-37	L16	-36.8	0.000	0.23	24.85	0.102	625	0.000200
LP81	EW-38	L15	-17.8	0.000	0.11	12.05	0.211	303	0.000200
LP82	EW-40	HP30	-60.7	0.000	0.39	41.04	0.062	1033	0.000200
LP83	EW-39	EW-40	-40.7	0.000	0.26	27.48	0.093	691	0.000200
LP84	EW-42	HP31	-107	0.000	0.69	72.66	0.054	1828	0.000200
LP85	EW-41	EW-42	-84	0.000	0.13	14.12	0.090	710	0.000100
LP86	EW-46	EW-41	-45.1	0.000	0.07	7.62	0.167	384	0.000100
LP87	EW-52	HP32	-30.6	0.000	0.20	20.71	0.123	521	0.000200
LP88	EW-55	HP33	-79	0.000	0.50	53.38	0.063	1343	0.000200
LP89	EW-49	EW-55	-51.1	0.000	0.08	8.64	0.147	435	0.000100
LP90	EW-45	EW-49	-4.90	0.000	0.03	3.31	0.768	83	0.000200
LP91	EW-45	EW-43	-39.7	0.000	0.25	26.80	0.095	674	0.000200
LP92	EW-43	HP34	-70.84	0.000	0.45	47.89	0.065	1205	0.000200
LP93	EW-44	HP35	-85.2	0.000	0.54	57.60	0.061	1449	0.000200
LP94	EW-48	EW-44	-48.5	0.000	0.31	32.75	0.078	824	0.000200
LP95	EW-47	HP36	-33.4	0.000	0.21	22.59	0.113	568	0.000200
LP96	EW-50	HP37	-85	0.000	0.54	57.60	0.061	1449	0.000200
LP97	EW-51	EW-50	-49.0	0.000	0.31	33.13	0.077	834	0.000200
LP98	EW-53	HP38	-29.5	0.000	0.19	19.95	0.127	502	0.000200
LP99	EW-54	HP39	-35.6	0.000	0.23	24.09	0.106	606	0.000200

ADVANCED GeoServices

a Montrose Environmental Group company

EAST SECTION

Appendix B: East Section

Landfill System Known Properties		
Operating Temp. (°F)	87	
Area (ft^2)	1.7671	
ρ_{AIR} @ 87 °F, 12.89 psia (lb/ft^3)	0.07647	
Specific Gravity, SG_{CH4} (ρ_{CH4}/ρ_{AIR})	0.55	
ρ_{CH4} @ 87 °F, 12.89 psia (lb/ft^3)	0.035	
ε_{PVC} (millifeet)	0.1	
Absolute Viscosity, μ_{CH4} ($lbf\ s/ft^2$)	2.33E-07	
ρ_{CH4} @ 60°F, 14.696 psia (lb/ft^3)	0.04	
ρ_{H2O} @ 60°F (lb/ft^3)	62.1459	
g (ft/s^2) = 9.81 m/s^2	32.174	
1 lbf = 32.174 pdl =	32.174	lb ft/s^2
P_{ATM} =	14.696	psia
$P_{B\ (Blower)}$ = -50" H_2O =	12.89	psia

East Section Known Values

Well ID	Proposed Elevation (ft.)	Demand, Q (SCFM)	Lateral Pipe ID	Length (ft.)	Diameter (in)	Header Intersection ID	Proposed Elevation (ft.)	Pipe ID	Length (ft.)	Diameter (in)
EW-76	126	11.7	LP1	110	6	HP1	114	P2	150	12
EW-77	159	25.1	LP2	80	6	HP2	104	P4	240	12
EW-78	132	15.6	LP3	90	6	HP3	112	P5	530	12
EW-79	162	26.7	LP4	108	6	HP4	116	P6	210	12
EW-80	168	12.8	LP5	80	6	HP5	107	P7	320	12
EW-81	181	23.4	LP6	45	6	HP6	114	P8	190	12
EW-82	155	32.3	LP7	60	6	HP7	110	P9	260	12
EW-83	140	34.5	LP8	60	6	HP8	103	P10	220	12
EW-84	132	21.2	LP9	190	6	HP9	110	P11	290	12
EW-85	170	17.8	LP10	320	6	HP10	116	P12	280	12
EW-86	170	12.3	LP11	80	6	HP11	116	P13	210	12
EW-87	125	33.4	LP12	70	6	HP12	129	P14	240	12
EW-88	174	30.1	LP13	30	6	HP13	124	P15	280	12
EW-89	122	11.7	LP14	70	6	HP14	141	P16	250	12
EW-90	121	35.1	LP15	240	6	HP15	154	P17	240	12
EW-91	179	12.8	LP16	100	6	HP16	167	P18	270	12
EW-92	132	8.4	LP17	310	6	HP17	146	P19	280	12
EW-93	174	34.5	LP18	50	6	HP18	139	P20	230	12
EW-94	130	13.4	LP19	70	6	HP19	114	P21	150	12
EW-95	124	35.6	LP20	220	6					
EW-96	124	13.4	LP21	70	6					
EW-97	167	8.9	LP22	210	6					
EW-98	136	11.1	LP23	80	6					
EW-99	196	29.5	LP24	100	6					
Blower		-511	LP25	210	6					

Pipe Network Input Data

Pipe	Start	End	Length	Diam.
ID	Node	Node	(Ft.)	(in.)
Blower	HP19	Blower	400	18
P2	HP2	HP19	150	12
P4	HP3	HP2	240	12
P5	HP18	HP1	530	12
P6	HP17	HP18	210	12
P7	HP16	HP17	320	12
P8	HP4	HP3	190	12
P9	HP15	HP16	260	12
P10	HP14	HP15	220	12
P11	HP13	HP14	290	12
P12	HP12	HP13	280	12
P13	HP5	HP4	210	12
P14	HP6	H5	240	12
P15	HP7	HP6	280	12
P16	HP11	HP12	250	12
P17	HP10	HP11	240	12
P18	HP10	HP9	270	12
P19	HP9	HP8	280	12
P20	HP8	HP7	230	12
P21	HP1	HP19	150	12
LP1	EW-78	HP2	110	6
LP2	EW-76	HP1	80	6
LP3	EW-77	HP18	90	6
LP4	EW-79	HP17	108	6
LP5	EW-80	HP3	80	6
LP6	EW-81	HP16	45	6
LP7	EW-82	HP15	60	6
LP8	EW-84	HP14	60	6
LP9	EW-83	EW-84	190	6
LP10	EW-90	EW-83	320	6
LP11	EW-85	HP13	80	6
LP12	EW-87	HP4	70	6
LP13	EW-86	HP12	30	6
LP14	EW-89	HP5	70	6
LP15	EW-88	EW-89	80	6
LP16	EW-91	HP6	100	6
LP17	EW-90	EW-91	310	6
LP18	EW-92	HP7	50	6
LP19	EW-94	HP11	70	6
LP20	EW-93	EW-94	220	6
LP21	EW-96	HP10	70	6
LP22	EW-95	EW-96	210	6
LP23	EW-97	HP9	80	6
LP24	EW-98	HP8	100	6
LP25	EW-99	EW-98	210	6

Pipe Network Output Data Results									
Pipe ID	Start Node	End Node	Flow (SCFM)	Headloss (in.-water)	Velocity, V_c (ft/s)	Demand, Q_c (SCFM)	Friction Factor	Re	ε_{PVC}/D
Blower	HP19	Blower	511.29	0.02	5.79	614.40	0.021	46380	0.000067
P2	HP2	HP19	-271.33	0.02	6.92	733.60	0.023	36919	0.000100
P4	HP3	HP2	-255.73	0.02	6.52	691.44	0.023	34797	0.000100
P5	HP18	HP1	-228.26	0.04	5.82	617.17	0.023	31059	0.000100
P6	HP17	HP18	-203.20	0.01	5.18	549.40	0.024	27649	0.000100
P7	HP16	HP17	-176.47	0.02	4.50	477.12	0.025	24012	0.000100
P8	HP4	HP3	-242.92	0.02	6.19	656.80	0.023	33054	0.000100
P9	HP15	HP16	-153.07	0.01	3.90	413.88	0.026	20829	0.000100
P10	HP14	HP15	-120.77	0.01	3.08	326.53	0.027	16433	0.000100
P11	HP13	HP14	-72.09	0.00	1.84	194.92	0.031	9810	0.000100
P12	HP12	HP13	-54.27	0.00	1.38	146.73	0.034	7384	0.000100
P13	HP5	HP4	-209.50	0.02	5.34	566.45	0.024	28507	0.000100
P14	HP6	HP5	-167.73	0.01	4.28	453.51	0.025	22823	0.000100
P15	HP7	HP6	-112.8	0.01	2.88	305.03	0.028	15351	0.000100
P16	HP11	HP12	-42.02	0.00	1.07	113.60	0.036	5717	0.000100
P17	HP10	HP11	5.88	0.00	0.15	15.90	0.080	800	0.000100
P18	HP10	HP9	-54.9	0.00	1.40	148.42	0.034	7469	0.000100
P19	HP9	HP8	-63.8	0.00	1.63	172.51	0.032	8682	0.000100
P20	HP8	HP7	-104.5	0.00	2.66	282.44	0.028	14214	0.000100
P21	HP1	HP19	-239.96	0.01	6.12	648.79	0.023	32651	0.000100
LP1	EW-78	HP2	-15.6	0.00	1.59	168.66	0.040	4244	0.000200
LP2	EW-76	HP1	-11.7	0.00	1.19	126.49	0.044	3183	0.000200
LP3	EW-77	HP18	-25.1	0.00	2.56	271.06	0.035	6821	0.000200
LP4	EW-79	HP17	-26.7	0.01	2.73	289.13	0.034	7275	0.000200
LP5	EW-80	HP3	-12.8	0.00	1.31	138.54	0.043	3486	0.000200
LP6	EW-81	HP16	-23.4	0.00	2.39	252.99	0.035	6366	0.000200
LP7	EW-82	HP15	-32.3	0.00	3.29	349.36	0.032	8791	0.000200
LP8	EW-84	HP14	-48.7	0.01	4.97	526.45	0.029	13247	0.000200
LP9	EW-83	EW-84	-27.5	0.01	2.81	297.56	0.034	7487	0.000200
LP10	EW-90	EW-83	7.02	0.00	0.72	75.90	0.034	1910	0.000200
LP11	EW-85	HP13	-17.8	0.00	1.82	192.75	0.038	4850	0.000200
LP12	EW-87	HP4	-33.4	0.01	3.41	361.41	0.032	9094	0.000200
LP13	EW-86	HP12	-12.3	0.00	1.25	132.52	0.043	3335	0.000200
LP14	EW-89	HP5	-41.8	0.01	4.26	451.76	0.030	11368	0.000200
LP15	EW-88	EW-89	-30.1	0.01	3.07	325.27	0.033	8185	0.000200
LP16	EW-91	HP6	-54.9	0.02	5.60	593.92	0.028	14945	0.000200
LP17	EW-90	EW-91	-42.1	0.04	4.29	455.38	0.030	11459	0.000200
LP18	EW-92	HP7	-8.4	0.00	0.85	90.35	0.049	2274	0.000200
LP19	EW-94	HP11	-47.9	0.01	4.89	518.02	0.029	13035	0.000200
LP20	EW-93	EW-94	-34.5	0.02	3.52	373.46	0.032	9397	0.000200
LP21	EW-96	HP10	-49.0	0.01	5.00	530.07	0.029	13338	0.000200
LP22	EW-95	EW-96	-35.6	0.02	3.64	385.50	0.032	9700	0.000200
LP23	EW-97	HP9	-8.9	0.00	0.91	96.38	0.048	2425	0.000200
LP24	EW-98	HP8	-40.7	0.01	4.15	439.72	0.030	11065	0.000200
LP25	EW-99	EW-98	-29.5	0.01	3.01	319.25	0.033	8033	0.000200

ADVANCED GeoServices
a Montrose Environmental Group company

ATTACHMENT 11D

Example Landfill Gas Probe Monitoring Log

LANDFILL GAS PROBE MONITORING LOG

Technician: ______________________________ **Temperature:_____________________**
Date: ____________________Time:_________ **Barometric Press.:________________**
Project No. ______________________________ **Weather Conditions:______________**
Site:____________________________________ **Wind:____________________________**
Monitoring Equipment & Serial No.:____

Probe Number or Facility Structure	% Methane (CH_4)	% Carbon Dioxide (CO_2)	% Oxygen (O_2)	% Balance Gas	Static Pressure (inches of water)	Comments

a Montrose Environmental Group company

SECTION 12

OPERATIONS PLAN

SECTION 12.0
OPERATIONS PLAN

FOR
CHESAPEAKE TERRACE RUBBLE LANDFILL
ANNE ARUNDEL COUNTY, MARYLAND

PREPARED FOR:

National Waste Managers, Inc.
2900 Linden Lane
Silver Spring, MD 20910

PREPARED BY:

ADVANCED GeoServices
a Montrose Environmental Group company

1055 Andrew Drive, Suite A
West Chester, PA

PROJECT NO. 2018-3854
JULY 2020
(Revised September 3, 2021)

a Montrose Environmental Group company

TABLE OF CONTENTS

LIST OF ATTACHMENTS

Attachments

12.0 OPERATIONS MANUAL

12.1 General

The purpose of this Operation Manual is to serve as a guide for the daily operations, the training of landfill personnel, emergency procedures and the construction of future disposal areas for the National Waste Manager's, Inc. (NWM), Chesapeake Terrace Rubble Landfill.

This Operation Manual was prepared using the Maryland Department of the Environment (MDE) Code of Maryland Regulations (COMAR) Regulations 26.04.07.16 and 26.04.07.18. Sound engineering judgment and accepted solid waste landfilling techniques are the basis for the procedures outlined in this manual.

NWM is the Operator of this facility. For the purpose of this document, the term "Operator" refers to the person, persons, or entity responsible for daily operations at the facility. NWM is the owner of the facility and permits associated with the facility are maintained in the owner's name.

12.2 Purpose of the Manual

This Manual is designed to be the reference book for the personnel who operate or supervise the Chesapeake Terrace Rubble Landfill. It addresses rubble waste placement in the landfill.

The sections that follow present project operating instructions and include:

- Design criteria;
- Project facilities description;
- Normal operating procedures;
- Waste placement procedures;
- Leachate management;
- Safety and security programs;
- Monitoring requirements;
- Maintenance programs; and,
- Procedures for responding to emergencies that may arise in conjunction with landfill operations.

In addition, the NWM has developed guidelines, procedures, forms, and plans that support the operation of the facility and are included as Appendices A through D as follows:

Attachment 12A	Equipment and Personnel Requirements
Attachment 12B	Asbestos Waste Management
Attachment 12C	Safety Plan
Attachment 12D	Emergency Response Plan
Attachment 12E	Alternative Daily Cover Fabric

12.3 Service Information

The Chesapeake Terrace Rubble Landfill is located in Anne Arundel County Maryland. The rubble landfill will accept the types of rubble waste listed in the COMAR 26.04.07.13 summarized in Section 12.7.

The Chesapeake Terrace Rubble Landfill has a total design capacity of approximately 9.3 million cubic yards (MCY) (8.4 MCY compacted rubble, 0.9 MCY cover material). The average daily rubble intake used for calculating the life of the Landfill is 1,602 tons per day. At the average daily rubble intake rate and 5-day per week operation, the life of the Chesapeake Terrace Rubble Landfill facility is 12 years. The average daily rubble intake is used for estimating purposes and the actual rubble intake rate may lead to a different facility life span. The landfill will be operated until the design capacity has been reached, or the life allowed under the special exception has expired..

At that time, the landfill will be closed, maintained, and monitored according to the COMAR regulations and the facility’s Closure and Post Closure Plan.

12.4 Personnel

12.4.1 Manpower

The manpower present at the landfill will vary according to the rate rubble waste is being accepted. The landfill operational staff shall consist of a minimum of a landfill manager, a scale operator, and two (2) equipment operators. The landfill manager and scale house operator will be in charge of the day-to-day operations including inspecting, monitoring, and recording incoming loads and directing traffic to the working face. Ultimate responsibility for accepting/rejecting waste shall rest with the landfill manager. The manpower presented in Attachment 12A is for several filling rate ranges of 500 to 7,500 tons of rubble waste per day. If filling rates increase or decrease, equipment and manpower will be altered accordingly.

12.4.2 Training

All employees will be trained for the jobs that they will be expected to perform at the landfill. The facility will have an Operator certified as a Manager of Landfill Operations (MOLO) through the Solid Waste Association of North America (SWANA). In addition, on-the-job training will be provided by NWM for all employees. The training will emphasize the safe and environmentally sound operation of the landfill.

All employees will be given safety training covering the equipment and systems that they will be expected to operate on a daily basis. The dangers associated with heavy equipment operation, truck traffic, waste unloading, use of personal protective equipment, methane gas and leachate handling, and the handling and precautions associated with special wastes such as asbestos will also be included in the safety training. Documentation of the employee's participation in the safety training will be maintained in the employee's personnel file and/or on-site files.

A training program for the more specific tasks, e.g., scale operator, will be documented with written records of meetings and types of instruction. This instruction will include identification of special wastes and unacceptable wastes; emergency procedures in case of fire, spill or injury; confined space entry; respirator use and fit testing; and other issues that could potentially arise from time to time. Documentation will also be kept on file at the main personnel office and reviewed annually for any necessary updates.

12.5 Site preparation

12.5.1 Specifications

Various aspects of the construction of the landfill disposal areas will be performed by the landfill personnel. Construction will have to be in compliance with the approved MDE permit and supporting construction documents. A copy of the Phase I, Phase II, and Phase III Permit Applications and final state permit that includes the design report and engineering drawings shall be kept at the landfill site as reference documents to assist in construction activities and for daily operational questions. The Phase III Permit Application includes technical specifications, quality assurance/quality control plan, and other essential information describing construction activities.

Phase III Permit Application Technical Specifications

SECTION	TITLE
02100	Site Preparation
02110	Site Clearing and Grubbing
02125	Erosion and Sedimentation Control
02130	Monitoring Well Abandonment
02140	Construction Dewatering
02150	Shoring and Bracing
02220	Excavation
02223	Structural/General Fill
02224	Intermediate Cover
02225	Prepared Subbase Soil
02227	Articulating Concrete Mats
02231	Subsurface Drainage System
02232	Leachate Collection Layer
02233	Coarse Aggregate
02234	Protective Cover
02235	Vegetative Support Layer
02271	Stone Riprap
02402	Liquids Handling and Disposal
02418	Geocomposite Drainage Layer
02530	Geosynthetic Clay Liner
02595	Geotextile
02597	High Density Polyethylene (HDPE) Geomembrane
02598	Linear Low Density Polyethylene (LLDPE) Geomembrane
02607	Air Release and Check Valve Vaults
02612	Reinforced Concrete Pipe
02614	PE Drainage Pipe
02615	HDPE Pipe
02650	Leachate Collection & Removal System (LCRS)
02652	Leachate Side Slope Pumps
02653	Leachate Storage Facilities
02831	Chain Link Fence and Gates
02936	Seeding
03100	Concrete Formwork
03200	Concrete Reinforcement
03300	Cast-In-Place Concrete
13211	Bolted Steel Waste Water Tanks

13214	Leachate Pumping and Storage Controls System
13215	Pumps and Controls
15250	Leachate Pump House
15251	Pipe Insulation and Heat Tracing
16050	Basic Electrical Requirements

12.5.2 Quality Assurance and Control

Parameters used for quality control for the landfill disposal cells are included in the Phase III Report, the Construction Quality Assurance Plan, and the Technical Specifications. Refer to these documents for the quality control requirements. Reference is made to the facility's Closure and Post-Closure Plan for the quality assurance program and Technical Specifications specific to closure activities.

12.5.3 Timetables

Construction of the Chesapeake Terrace Rubble Landfill includes the development of 21 individual cells as shown on the Subgrade Grading Plans of the drawings (Drawings 10 and 11). Operation of the Chesapeake Terrace Rubble Landfill is expected to begin upon completion of Cell 11 construction and will last 12 years at an average rubble intake rate of 1,602 tons per day. Filling will begin in the East Section in Cell 11 and proceed as described on Drawing 63. When rubble reaches grades in an approximate 5 to 10 acre area, Closure Cap installation within that area will commence.

12.6 Operational Conditions

12.6.1 Operational Facilities and Services

As shown on the Drawings, operational support facilities include a scale house for vehicle weighing, a maintenance building for equipment storage and office facilities, and access roads. Support services include communication systems, water supply, and sanitary sewerage systems.

Potable Water	A well will be developed for drinking water and washroom facilities at the scale house.
Sanitary Facilities	Toilet facilities will be provided in the scale house building, and a septic system will be installed to provide on-site wastewater disposal.
Telephone	Telephone service will be provided in the scale house building – emergency telephone numbers and contact persons for fires, medical emergencies, spills of hazardous materials or other emergency situations shall be listed at this location at all times.
Communications	Landfill personnel will utilize portable 2-way radios (or other proven technology) to communicate between the scale house and the working face, or other on-site remote locations. Internet access will be available at the Scalehouse.
Other Facilities	Buildings will be provided near the scale house to serve as vehicle/equipment maintenance and equipment storage facilities. The landfill offices are located inside the maintenance building. Potable water supply and restroom facilities for landfill personnel shall be provided in accordance

	with applicable Anne Arundel County and State of Maryland regulations.

12.6.2 Site Access

12.6.2.1 Hours of Operation

In accordance with the Permit granted by Anne Arundel County, the landfill can be operated during the following times:

Monday through Friday	7:00 AM to 5:00 PM
Saturday and Sunday	No Operation

These hours may be amended as agreed by MDE and Anne Arundel County. The hours of operation will be posted at the entrance(s) to the facility.

If demand for disposal of rubble waste increases, NWM may pursue a change in the hours of operation with MDE and Anne Arundel County.

12.6.2.2 Site Access Control

Site access will be controlled by surveillance using rubble landfill personnel. Persons on-site without the Owner's permission or legitimate business will be asked to leave the premises or risk arrest for trespassing. Access to the site will be limited to:

- Rubble fill and other Owner personnel.
- Customers depositing waste.
- State and local authorities.
- Persons with legitimate on-site business.
- Others as permitted by the Owner.

There is no public access to the site. As part of the construction, a new site security fence will be constructed around the entire proposed limits of disturbance.

With this security fence in-place, access to the site by the public will be limited to those times when authorized personnel are on duty at the facility. A locking gate will be provided across the entrance road(s) to prevent after-hours site access. At all times, the site will be fenced as required to prevent illegal dumping. Unauthorized persons are not permitted to enter the site at any time. Domestic animals will be excluded from the site.

12.6.2.3 Optional North and South Entrances

Over the life of the facility, the site will be accessed by up to three asphalt-paved entrance roads; one originating from Patuxent Road and two from Conway Road as shown on Drawing 2. The assumed East Entrance is the entrance approved by Anne Arundel County. In the event that the

East Entrance is not constructed, the Optional North Entrance or Optional South Entrance may be constructed.

An emergency vehicle lane for the assumed East Entrance and allowance for emergency vehicle movement through the Operational North or South Entrance is also provided, whichever is approved at the time of construction. The site will be fenced with a locking gate across the access road(s) that will prevent after-hours access and illegal dumping. After entering the site, the vehicles will proceed to the scale area, where they will be weighed. The vehicles will then proceed to the appropriate unloading area. Vehicles without a documented tare weight, will be weighed as they leave the site, after dumping their load at the working face. Inspection of incoming waste will be performed at the unloading area.

It is anticipated that the facility will accept rubble waste at the rate of approximately 1,602 tons per day delivered to the site by semi-trailers. Under the assumption that each semi-trailer delivers 20 tons of waste to the site, 80 semi-trailers per day would be required to meet 1,602 tons per day throughput. It is expected to require approximately two minutes processing per vehicle to move a vehicle from the truck scale onto the landfill perimeter access road. During an 8-hour day with 1,602tons per day, the average arrival rate of semi-trailers at the site would be approximately 6 minutes. In addition to waste disposal traffic, vehicles transporting recycled or reclaimed material from the site is expected. The number of loads per day will be a function of the amount of material recycled and reclaimed. If the proportion of such materials can achieve a level of 30% the number of additional vehicles would be 24 (assuming none of the trucks delivering waste are used for transport from the site, and all loads are made with 20 ton semi-trailers). In addition, the facility is expected to generate up to an average of 15 tanker truck loads of leachate per day that will be removed from the site.

In addition to queue lane provision (per Sections 3.4 of the Phase III Report), to accommodate any peak flow traffic events for any site entrance, inbound and outbound traffic will be controlled and given direction verbally, with signage, or other appropriate method. One outbound traffic lane will remain open for outbound trucks.

All vehicles traveling to the working face will drive down the access road to a landfill perimeter road and subsequently on an internal road to an active cell working face. These internal cell roads will be temporary and will move as the working face moves. Empty vehicles will exit the cell through internal roads to the perimeter road then exit the landfill via the entrance road. The entrance road is surfaced with asphalt pavement and crushed stone, as required by the Anne Arundel County Special Exception Permit for this landfill construction.

During wet weather when mud could be a problem on vehicle tires, all vehicles will be required to pass through the wheel wash. This wheel wash together with the paved access road are intended to eliminate tracking mud from the landfill perimeter access roads to off-site. Every effort shall be made to keep the entrance roads free of mud and dust.

In dry periods, water or other dust-inhibiting agents will be applied to the roads to keep dust to a minimum. When needed, additional gravel or other appropriate road materials will be applied to keep roads passable under all conditions. All roads will be constructed with a cross slope to ensure drainage from the roadway surface.

All visitors will report to the gate attendant or administrative staff on duty, sign in, and park in the designated area indicated by the attendant. No unauthorized visitors will be allowed on the site for any reason. Visitor parking spaces near the gate attendant are provided. A designated employee parking area is also provided near the landfill entrance.

12.6.3 Inclement Weather

In the event of inclement weather conditions, landfill design considerations will permit the continued operation of the landfill. Daily cover material will be stockpiled adjacent to the working face. The access roads will be kept passable at all times. In wet conditions, additional road base will be available to stabilize soft spots in the landfill's internal roads. During cold weather, salt and/or sand shall be applied to icy spots or access roads to ensure adequate traction. During windy weather, portable litter fences will be utilized at the working face to control blowing litter (See section 12.7.2 for additional detail).

12.7 Waste handling

12.7.1 Types of Waste

The landfill will accept only those wastes permitted in a rubble landfill as described by COMAR 26.04.07.13. Those materials area as follows:

- Land Clearing Debris, includes the following:
  - Earth material such as clays, sands, gravels, and silts;
  - Topsoil;
  - Tree Stumps;
  - Root Mats;
  - Brush and Limbs;
  - Logs;
  - Vegetation; and,
  - Rock.
- Demolition Debris, includes the following:
  - Acceptable demolition debris associated with the razing of buildings, roads, bridges, and other structures includes structural steel, concrete, bricks (excluding refractory type), lumber, plaster and plasterboard, insulation material, cement, shingles and roofing material, floor and wall tile, asphalt, pipes and wires, and other items physically attached to the structure, including appliances if they have been or will be compacted to their smallest practical volume.
- Unacceptable demolition debris includes industrial waste or byproducts, any waste materials contained within a structure or on the grounds of the structure being demolished that are not physically part of the structure, or which are comprised of or contain materials that pose an undue risk to public health or the environment.
- Construction Debris, includes the following:
  - Acceptable construction debris is structural building materials, including cement, concrete, bricks (excluding refractory type), lumber, plaster and

plasterboard, insulation, shingles, floor, wall and ceiling tile, pipes, glass, wires, carpet, wallpaper, roofing, felt, or other structural fabrics.

- Paper or cardboard packaging, spacing, or building materials, provided that they do not exceed 10 percent by volume of the waste, may be accepted at the rubble landfill.
- Paint containers, caulk containers, or glaze containers are acceptable, provided that they are empty and any residual material that is dried before acceptance at the rubble fill, and further provided that this waste category does not exceed 1 percent by volume of the waste accepted at the rubble landfill.
- Unacceptable construction debris includes commercial, domestic, or industrial wastes or byproducts, paint, tar or tar containers, caulking compounds, glazing compounds, paint thinner or other solvents or their containers, creosote or other preservatives or their containers, tile, paneling, or carpet cement or other adhesives, and other solid waste which may contain an unacceptable waste or substance as may be determined by the approving authority to be unacceptable.

■ Tires. Scrap tires may be accepted at the facility and managed in accordance with the requirements of a scrap tire collection facility license issued under COMAR 26.04.08. Disposal of tires in a landfill is prohibited.

■ Asbestos Waste. Asbestos waste is acceptable provided that the material that is received is packaged and labeled as specified in COMAR 26.11.15.04, and is managed in the following manner:

- Prior notification to the landfill manager is required;
- The waste asbestos is unloaded carefully to prevent emission of fibers into the air;
- The area used for burial of asbestos shall be restricted to the working face of the landfill, or a separate cell dedicated solely to asbestos disposal;
- The waste shall be completely covered with earth, other rubble, or alternate daily cover materials, and may not be compacted or driven over until sufficient cover has been applied to prevent the release of asbestos fibers to the atmosphere during compaction or application of other cover material; and,
- Operators at the landfill shall be appropriately trained and wear respiratory protection approved by the National Institute for Occupational Safety and Health for protection against asbestos fibers, and protective clothing when considered necessary.

■ Household Appliances and White Goods. Household appliances and white goods are acceptable provided that any refrigerant is removed from the appliances before burial in the landfill and is managed in accordance with §608 of the Federal Clean Air Act (42 U.S.C. §7671g).

■ Processed Debris. Processed debris is acceptable because the facility is a rubble landfill having a liner and leachate collection system constructed to the standards as specified in MDE COMAR Regulations 26.04.07.16.

- Other Waste Materials. Waste materials not specifically listed in this section may not be disposed of in a rubble landfill before receiving written approval of the Approving Authority.

The proposed facility will not accept or dispose of hazardous waste. In the instance the facility receives hazardous waste it must comply with COMAR 26.04.07.18T(3).

12.7.2 Litter Control

Every effort shall be made to prevent litter from being blown off the landfill site. All vehicles shall be covered while on site to prevent loose waste from being blown out of the vehicles. Litter control fencing will be placed downwind from the working face to prevent litter from being blown away if blowing material becomes a persistent problem. All rubble waste will be covered as quickly as possible on windy days to prevent blowing wastes from leaving the working area. Daily cover will be applied at the minimum of the close of every third operating day to further control litter. Fences and site perimeters will be policed daily and collected litter will be deposited in the cell area being worked. Work areas and access roads will be kept clean by use of a street sweeper, tank truck and litter patrol.

12.7.3 Noise, Dust, Odor, and Vector Control

Noise

Noise levels are regulated by the State of Maryland. It is expected that the surrounding woodland vegetation and topographic conditions will limit the exposure of the neighbors to landfill operations. All vehicles associated with the landfill operation will meet OSHA standards for noise levels. Operation of site equipment that contributes to excessive noise shall the limited to operating only during approved hours for landfill operation and during landfill cell or cap construction efforts or noise mufflers will be added to the equipment.

If landfill personnel observe that mufflers fitted to equipment are damaged, personnel shall report the need to repair the equipment to the Landfill Manager who will schedule the required repairs, as soon as possible. If this damaged muffler results in the noise exceeding regulated levels, the affected equipment will be removed from service until repairs have been completed.

If noise levels recorded at the site boundary are determined to be above State of Maryland limits, the Landfill Manager (or his designee) will work with equipment manufacturers to further muffle equipment noise or upgrade equipment. The Landfill Manager may also choose to adjust his landfill operations to assure that noise levels do not exceed state limits.

Dust

Dust and airborne particulate matter are regulated by the State of Maryland. Levels of such matter will be in compliance with Maryland and local regulations, if applicable. Dust is created by excavating operations, hauling cover from stockpiles and covering/filling operations. Vehicular traffic along the aggregate portion of the access roads may raise dust during dry periods and in the summer. Dust will be controlled by sprinkling working areas with water. Stockpiles and excavation areas will be sprinkled periodically while being worked. During dry periods and in the summer, a water truck equipped with pump and hose will be available to add moisture when dust conditions arise. All paved roads will be swept or washed when dirt and mud have accumulated on them.

Outgoing trucks will be routed through the wheel wash to limit the amount of mud tracked out of the landfill property during wet conditions.

Odor
Odors are generally not a problem at rubble landfills, due to the nature of the waste materials accepted. All waste will be covered at 3-day maximum intervals or daily as required to control odor. The proposed design includes an active gas extraction system to mitigate decomposition gases (primarily methane) that can create odor issues.

Vector Control
Vector prevention can be accomplished by limiting the size of the working area, keeping waste confined and compacted, and providing the specified depth of cover. Special attention must be given to eliminating voids associated with bulky wastes. Excess cover will be added to fill up voids created by bulky waste and sufficient cover will be added to obtain compaction over this waste. If vector activity becomes a problem, a vector control program will be implemented through the County Health Department or through a licensed pest control/exterminator contractor.

Mosquitoes breed during spring and fall in this area. Eggs are laid in water or places that flood. In warm weather, the eggs of most species hatch in two to three days; eggs of other species require a drying period, and may remain dormant for months and hatch within minutes after being flooded by a spring or summer rain. Larvae (wigglers) that hatch from the eggs feed mainly on bits of organic matter in the water. Standing water and depressions will be eliminated by maintaining positive grading to prevent ponding, which will reduce the areas where mosquitoes may breed.

Flies and other insects are usually associated with municipal solid waste rather than rubble waste due to the non-organic nature of the rubble waste. Various species of bees, wasps and ants are present on the site and will be in close proximity during the entire operation. These insects cannot be entirely controlled because their habitat exists on the site and in close proximity to the site. Control of these insects at rubble landfills is possible at or near the operational area by keeping the area clean of vegetation and accumulation of organic debris outside the working face.

12.7.4 Open Burning

Open burning will not be permitted at the landfill. Burning of rubble waste is not allowed except as permitted by MDE and the local Health Department.

12.7.5 Placements of Waste in State Waters

No wastes of any kind are to be deposited in any state waters.

12.7.6 Salvaging

Salvaging of recyclable materials is to be permitted at the landfill site only by authorized personnel. No lead batteries or waste oil are to be deposited in the landfill cells. Waste tires and other unacceptable items will be separated from approved waste, segregated/staged in a designated area and then disposed off-site at appropriately licensed disposal or recycling facilities.

12.7.7 Filling Operation

Waste filling will be by the area method. Wastes shall be deposited in lifts in order to achieve the maximum practical density. Wastes will generally be deposited at the bottom of the lift in layers that are approximately 8 feet thick. For safety reasons, vehicles entering the waste deposition area will be segregated between small vehicles (pickup trucks and single axel dump trucks) and large transport vehicles, with small vehicles unloading at one end of the working face and large vehicles unloading at the other, or one type of vehicle going to one active cell area and the other going to another active cell area. (The procedures for unloading will be the same for both types of vehicles with material being deposited at the bottom of the working face and then spread/compacted by the landfill equipment.) The waste will then be spread in subsequent, uncompacted layers of 8 to 10 feet thick and compacted by at least 3 to 5 passes (dependent on waste type) with a landfill compactor that provides the compactive effort of a Caterpillar 836, or other equipment that provides a greater compactive effort. The compacted lift shall have a maximum thickness of 8 feet.

The liner system includes a 48-inch thick layer of Select Waste over the 24-inch thick leachate collection layer. NWM shall notify MDE prior to placement of the Select Waste The Select Waste shall contain no long pipes, boards, or other objects judged by the operator to be detrimental to the underlying liner system or leachate collection system. The protective layer may be spread in layers as thin as 24-inch thick for the initial lift and 12 inches for subsequent lifts (to facilitate inspection and removal of objects detrimental to the leachate collection system or liner), but the protective layer shall not be compacted until it has achieved a thickness of 48-inches.

If detrimental objects are found and removed, the operator will ensure that the object has not punctured the filter layer. Any detected punctures or penetrations will be repaired. The working face is to be kept as small as possible to ensure adequate compaction and to limit the amount of exposed waste. The maximum truck unloading area width is not expected to exceed 250 feet. This will allow adequate room for the anticipated peak traffic loading. A smaller working face may be technically possible, but this width is preferred by NWM for the safety of its employees and clients.

Due to occasional operational situations, NWM may rotate operations between three filling areas, each with an approximate area of 1-acre. During the rotation of operations among multiple filling areas, the total area will not exceed the 3-acres, and NWM will operate with the required number of equipment at each filling area to support the activities being performed, as specified in Attachment 12A. The operational situations that may necessitate multiple filling areas include, but are not limited to, rubble placement on side-slopes, placement of rubble to final grades, operation in a new cell, waste placement for an access road inside the landfill, or rubble placement during inclement weather.

NWM anticipates that the working face will rotate among these filling areas based upon the nature of the material being disposed. Due to the potentially diverse nature of material being disposed, NWM anticipates that no more than two filling areas will be designated as active working face on any given day. NWM envisions reserving the third filling area for placing select rubble fill or steep side slopes, building an internal access road in the landfill footprint, or other temporary condition.

At the end of each third operational day not less than six inches of compacted soil ("periodic cover material") or approved cover material shall be deposited on any exposed waste in the area of the working face, including the area of other dumping or push platforms. If a fabric-type alternate daily cover is used, the cover shall be deployed over the deposited solid waste in the working face at the end of each day by pulling the cover into position by the available heavy equipment and anchoring by placing soil over the corners of the fabric.

The fabric type cover(s) are not expected to exceed 150 feet by 150 feet in size and can be easily placed by the available personnel and equipment. Prior to depositing waste the next working day, the cover will be pulled from the waste with the available heavy equipment and stored in accordance with the manufacturer's recommendation. Refer to Section 12.7.8 for a discussion of alternate daily cover material (ADCM).

Intermediate cover of 12-inches (an additional six inches to the periodic cover material placed every third day) of compacted soil shall be applied on areas that will not have additional wastes deposited for 30 days or more. Twelve inches of compacted soil cover will be utilized as intermediate cover in areas that have used approved alternate daily cover materials. The intermediate cover shall be graded to minimize infiltration and erosion, while not exceeding the maximum permitted final cover slope or 25%, whichever is less. Additional cover shall be applied or reworked on a weekly basis to any waste filled areas over which the cover is cracked, eroded or uneven.

Previously placed cover materials may not be reused.

As part of the operations when moving into a new cell, NWM will strip intermediate cover prior to placing waste along the interface between the two cells. The removed intermediate cover will be blended and spread within the waste lift. The removed intermediate cover may not be reused as cover materials. The maximum area that will be stripped at one time will be equal to the maximum working face specified in Attachment 12A and any exposed waste will be covered by six inches of compacted periodic cover at a minimum frequency of every 3 days. After the intermediate soil is stripped, the surface will be scarified to mix any remaining soil with the waste and to promote bonding between the new rubble and the existing rubble. Scarifying will be accomplished by "ripping", back-dragging, tilling, disking, harrowing, or other methods to sufficiently scarify the surface.

12.7.8 Alternate Periodic Cover Material

Alternative Periodic Cover Materials (APCM) may be in use at site, with prior approval of MDE. For this project, the APCM being considered are as follows:

- Fabric-type alternate daily covers

The following table provides a summary of how fabric type covers meet the requirements outlined in COMAR 26.04.07.18.

APCM		Fabric-type Alternative Periodic Covers
May not contain free liquids, putrescibles, or toxic materials		The nature of this material prevents it from absorbing free liquids.
May not create a dust or odor problem		A fabric material will not contribute to dust generation nor will it emit odors.
May not attract or harbor vectors		By nature of this material (it does not contain putrescibles); it does not attract or support vectors.

May not impede compaction with standard compaction equipment		This material can be placed, then removed and reused. This material will minimize the amount of airspace lost to daily cover, thereby extending the life of the landfill.

Manufacturer's information for fabric-type alternate daily covers is included in Attachment 12E to this Manual.

12.7.9 Handling of Special Waste

In the daily operation of the landfill, there will be waste types that require special handling. Examples of these wastes are bulky items, tires, and asbestos containing materials. The Chesapeake Terrace Rubble Landfill may accept these wastes when handled and/or treated as specified in the following paragraphs. No hazardous wastes are to be accepted at this landfill.

12.7.9.1 Bulky Wastes

Bulky wastes such as furniture or appliances need special handling to ensure proper compaction and placement in the working face. Bulky waste should be crushed on solid ground before placement in the working area, if possible. If not, the items should be deposited near the working face and run over with the compaction equipment until it is of suitable size. The item should then be buried in the toe of the working face and covered with waste. If any depressions are formed, they also should be backfilled with waste.

12.7.9.2 Asbestos Containing Material

Asbestos waste is acceptable provided that the material that is received is packaged and labeled as specified in COMAR 26.11.15.04, and is managed in the following manner:

- Prior notification to the landfill manager is required;
- The waste asbestos is unloaded carefully to prevent emission of fibers into the air;
- The area used for burial of asbestos shall be restricted to the working face of the landfill, or a separate cell dedicated solely to asbestos disposal;
- The waste shall be completely covered daily with earth or other rubble and may not be compacted or driven over until sufficient cover has been applied to prevent the release of asbestos fibers to the atmosphere during compaction or application of other cover material; and,
- Operators at the landfill shall wear respiratory protection approved by the National Institute for Occupational Safety and Health for protection against asbestos fibers, and protective clothing when considered necessary.

12.7.9.3 Tires

Scrap tires may be accepted at the facility and managed in accordance with the requirements of a scrap tire collection facility license issued under COMAR 26.04.08. Disposal of tires in a landfill is prohibited. The technical and operational standards as described in COMAR 26.04.08.17 include the following:

- Designation of Scrap Tire Storage Areas. For those scrap tire facilities that will store scrap tires, a scrap tire storage area shall be used. Only scrap tires, including processed portions and raw material, may be stored in the designated scrap tire storage area. This area shall be maintained free of excessive vegetation or other flammable materials.
- Scrap tires shall be stored indoors or outdoors under the specifications described in the "Standard for Storage of Rubber Tires", NFPA 230 (2003 Edition), National Fire Protection Association (NFPA), Batterymarch Park, Quincy, Massachusetts, which is incorporated by reference. A copy of this publication shall be maintained at the facility.
- NFPA Standards are superseded if they conflict with or are less stringent than:
  - Applicable State or local fire and zoning regulations or statutes; or
  - Provisions of these regulations.
- The Department may impose additional requirements on a scrap tire facility that stores scrap tires, including adequate on-site fire control equipment, based on the unique characteristics of a site that may affect the facility's potential to endanger the public health and safety, or the environment.
- A scrap tire facility that stores scrap tires shall be operated and maintained in a manner that controls mosquitoes and other insects or vermin to prevent public nuisances or health hazards.
- The site shall be engineered and constructed to keep any liquid runoff from entering waters of the State in the event of a tire fire.
- For those scrap tire facilities that store scrap tires, an up-to-date emergency preparedness manual shall be maintained at the facility at all times. This manual shall be submitted to the MDE for approval at the time the facility applies for a license or otherwise seeks authorization. Once accepted, the manual becomes part of the authorization. This manual shall be updated if a change in the operations of the scrap tire facility occurs, or if the Department requests an update. This emergency preparedness manual shall, at a minimum, contain:
  - A list of names and telephone numbers of persons to contact in the event of a fire, flood, or other emergency involving the facility;
  - A list of emergency response equipment present at the facility or available for use at the facility, the location of the equipment, and how it should be used in the event of a fire or other emergency;
  - The procedures to be followed by facility personnel from discovery of an emergency until the situation is corrected, including the measures that shall be taken to minimize the occurrence, recurrence, or spread of fires, explosions, and releases;
  - The location of known water supplies, fire hydrants, dry chemical extinguishers, or other materials that may be used for fire fighting purposes;

  - Provision for reporting emergency situations to the Department without delay; and,
  - Provision for familiarizing all employees with the requirements of the emergency preparedness manual.

- An emergency preparedness manual may not be approved by the MDE unless the applicant demonstrates that police and fire protection services are available for the facility.

12.7.9.4 Hazardous Waste

No hazardous wastes are to be accepted at this landfill. If they are identified at the time of delivery they shall remain on the truck and the truck and NWM shall reject the load, nofy the transporter or generator of the reason for rejection.

If hazardous waste is identified in an accepted load, NWM shall separate and handle the waste material in accordance with COMAR 26.13.02 Disposal of Controlled Hazardous Substances; notify MDE via phone within 2 hours of discovery. Within 5 days, the facility shall prepare and submit a written report containing the following information:

- Name of the source (if known)
- Name of the transporter (if known)
- Circumstances of discovery
- Description of efforts to secure and control the waste and any releases of pollutants from the waste.
- The current location.
- Final disposition of the waste (if known)

12.8 Equipment and Equipment Maintenance

The landfill is to be equipped with several pieces of heavy equipment and various pieces of support equipment. The heavy equipment is used for compaction of the rubble waste and excavation of cover materials. There are various pieces of support equipment used for mowing, maintenance work and other related tasks. Appendix A lists the equipment that should be available for landfill use. The actual equipment used will vary as new and improved equipment becomes available or the waste stream quantity and composition changes. Equipment breakdown will not be an operational problem providing backup is available. In the event of equipment breakdown, NWM will make every effort to obtain rental equipment or a replacement if necessary for normal operations within 24 hours.

The guardhouse, leachate storage controls and equipment, and leachate collection and conveyance system shall be equipped with sufficient standby backup power to operate those systems during a power outage. The capacity and configuration of the backup power supply shall be detailed in the electrical Building Permit application submitted to the County. The facility shall also maintain at least one towable generator power lighting tower at the site for emergency use.

12.9 Compaction and Cover

12.9.1 Compaction

After the rubble waste is deposited at the base of the working face, the waste shall be spread out in approximate 8-foot thick layers and run over by the compactor with at least 3 to 5 passes depending on waste type. This operation of placement and compaction shall continue until the desired lift height has been reached.

12.9.2 Lifts

The height of the compacted lifts shall be limited to 8 feet. This will ensure that the waste is properly compacted. The maximum 8-foot compacted lift is dictated by COMAR Sec. 26.04.07.18(E). Based on the anticipated waste generation rates and the approximately 250 foot width of the working face, the amount of cover material needed will also be minimized. The surface of the lifts shall be sloped and compacted to prevent runoff to completed fill areas (i.e. areas protected by Final Cover or Closure Cap), or to areas beyond the limits of the liner system. The periodic and intermediate cover layers should be graded and compacted to minimize infiltration and erosion prevent standing water a the working face. The limit of the liner system during stages of construction shall be defined by the completed anchor trench in the perimeter berm or the inter-cell berm (Drawing 14). The runoff from within the active filling areas is intended to enter the leachate collection system and flow to the cell sump, where it will be removed by the submersible pump and conveyed through the double containment piping system to the leachate tanks. The inter-cell berm also functions to prevent the inflow of clean runoff from the adjacent undeveloped or unfilled areas. Water from outside the waste disposal area is not allowed to flow into the waste disposal area. Once waste placement begins within a cell, all runoff occurring in the cell must be handled and disposed as leachate.

12.9.3 Periodic Cover

By the end of the third day’s operation, or more frequently if required, the working face and any other exposed wastes will be covered by a minimum of six inches of uniform compacted clean soil. The cover soil will be graded to minimize infiltration and erosion, and prevent ponding of water at the working face. This will help reduce litter, odor, fire hazard,and vectors. Cover for asbestos waste in the specially designated asbestos waste disposal area isdiscussed in the Asbestos Management and Disposal Plan (Appendix B).

Cover soil will not:

- Contain free liquids, decaying or toxic materials. Moisture present in the cover material solely as a result of precipitation is not free liquid.
- Create a dust or odor problem.
- Attract or harbor animals or insects.
- Impede compaction with standard landfill equipment

If a fabric-type alternate periodic cover is approved by MDE, the cover shall be deployed over the deposited rubble waste (including exposed waste at the tipping area and other dumping or push platforms) by pulling the cover into position by the available heavy equipment and anchoring by placing soil over the corners of the fabric. The fabric type cover(s) are not expected to exceed 150 feet by 150 feet in size and can be easily placed by the available personnel and equipment. Prior to depositing solid waste the next working day, the cover will be pulled from the waste with the available heavy equipment and stored in accordance with the manufacturer's recommendation.

12.9.4 Intermediate Cover

Weather permitting, intermediate cover of compacted soil will be provided over the waste disposal areas not to be used for a period of 30 days or more. Intermediate cover will be compacted by a bulldozer. The intermediate cover shall be graded to minimize infiltration and erosion, while not exceeding the maximum permitted final cover slope or 25%, whichever is less. The intermediate cover layer shall have a minimum thickness of twelve (12) inches. The intermediate cover shall be graded to prevent ponding and promote positive drainage away from the waste cell and working areas.

A 12-inch layer of intermediate cover is also required after each 8-foot lift is placed.

12.9.5 Final Cover

Not later than ninety (90) days following the completion of filling operations as indicated on the Final Grading Plan drawings, Final Cover layer must be applied. Final Cover will consist of a uniform compacted layer of earthen material not less than 2-feet thick. The Final Cover layer supports the 40-mil LLDPE, a geocomposite drainage layer components of the Closure Cap.. No slopes shall be more than 25% or less than 4%. Cross slopes across the surface of the Cover Soil layer beneath terraces and cap access roads shall be 7%. All depressions and low spots shall be filled and the cover graded to promote drainage away from the cell to the proper drainage controls.

12.9.6 Closure Cap

The Closure Cap is installed over the Final Cover Layer. Closure Cap installation must be started within 24 months after reaching top of waste elevations, and be completed within 36 months of reaching top of waste elevations. The Closure Cap consists of a 40 mil geomembrane (textured on both sides), geocomposite drainage layer, 18-inches of Protective Cover Soil and 6-inch thick Vegetative Cover Layer.

12.9.6.1 Closure Cap Geosynthetics

The Closure Cap geosynthetics consist of a geocomposite drainage layer, with a triplanar drainage net and 8 oz./s.y. nonwoven geotextile heat-bonded to both sides; and a 40-mil textured on both sides, linear low density polyethylene (LLDPE) geomembrane with a permeability less than or equal to 1 x 10-10 cm/sec.

12.9.6.2 Protective Cover Layer

The protective cover layer component of the Closure Cap consists of the following components:

12.9.6.3 Vegetative Cover

After the final cover has been applied, a vegetative cover must be established on the cell to prevent erosion. The final grading and landscaping shall be as designated in the final Closure and Post-Closure Plan and drawings. Lime and fertilizer will be applied as necessary to ensure that the vegetative cover is well established. Specifications for seeding of the final cover are attached to the Closure and Post-Closure Plan. Specifications for seeding in other disturbed areas are contained in the Phase III Permit Application.

The final vegetative support layer shall be planted with grass after installation. Ground cover must be maintained by cutting and repairing damaged or eroded areas. Slopes must be maintained by grading and filling to eliminate ponding and to correct for settlement. All seed and mulch, topsoil, fertilizer, lime, sod and all other landscaping items shall conform to and be installed in accordance with the Anne Arundel County Soil Conservation District Specifications. For problem erosion areas, use of a synthetic soil stabilizer is recommended. As part of the closure cap construction, installation of stormwater management terraces and downchutes will be constructed as shown on the Drawings 32 and 33.

12.9.6.4 Protective Cover Soil

The Closure Cap includes a 24-inch thick layer of soil placed on top of the geosynthetic cap components. The uppermost 6-inch thick layer of protective cover soil is the vegetative support layer. Approved materials are defined in the Specification (Section 14.0) and included topsoil reserved from the landfill cell construction, imported topsoil materials, or other material capable of supporting vegetation. The 18-inches of protective cover soils underlying the topsoil and setting directly on the cap geosynthetics shall have a permeability not exceeding 1x10-5 cm/sec and meet the other requirements described in Specification Section 02234.

Cracks or fissures, caused by dry soil, may occur in intermediate cover, Final Cover and Protective Cover layers. This condition, which allows water to enter the fill, shall be corrected by regrading and revegetating the cover.

12.9.7 Stockpiles

Soil shall be stockpiled to ensure there is enough material for approximately nine days worth of cover soil. The stockpiles shall be as designated on the Design Plans or in other suitable areas. Proper erosion control devices shall be implemented for all stockpile areas.

12.9.8 Alternate Periodic Cover

- Fabric: Section 12.7.8 describes the use of a fabric-type periodic cover.

12.10 Safety

Attachment 12C contains the Safety Plan that describes safety procedures to follow for work at the Chesapeake Terrace Rubble Landfill. Attachment 12D contains the Emergency Response Plan developed to assist the personnel at the Chesapeake Terrace Rubble Landfill in the event of an emergency. The safety plans are in compliance with state and local ordinances as well as requirements of the Occupational Safety and Health Act of 1970 (OSHA). Records are to be maintained to verify attendance of safety and training meetings.

12.11 Inspection Plan

An inspection plan shall be implemented to ensure that all of the major aspects of the facility are in compliance with the COMAR regulations for rubble landfills. The major areas requiring inspection are incoming rubble waste, leachate collection, conveyance and storage system, storm water conveyance system, erosion and sedimentation controls, roads and facility structures, equipment used in operations, landfill gas management system, and groundwater monitoring system. Records are to be kept of the inspections and made part of the facility operating record.

The Inspection Checklist included in the Closure and Post-Closure Plan may serve as a guide for inspecting and monitoring on-site systems during active landfill activities as well.

12.11.1 Incoming Rubble Waste Inspection Plan

The incoming rubble waste to the landfill shall be visually inspected by the landfill manager or scale operator to ensure that it does not contain any undesirable waste. The landfill manager or scale operator will keep records of all incoming materials and ascertain whether the material will be accepted or rejected. Operational personnel will be trained to recognize and identify prohibited and hazardous waste. Vehicles shall be inspected at the scale house and by the operators who will be coordinating the placement of waste and visually inspecting all incoming waste as it is unloaded. If undesirable waste is encountered, the load should be isolated and the driver and waste generator's driver's license number recorded. Unless a safety concern exists, the driver shall remain with the vehicle on the site until the landfill manager or his designee can examine the load and determine the proper course of action. If the waste is determined to be regulated, the MDE and the owner of the facility are to be notified immediately (See Section 12.7.9).

12.11.2 Leachate Collection System Inspection Plan

The leachate collection system consists of many different parts, including the piping, sideslope risers, leachate sumps, the force-main, various pumps, manholes, and storage facilities. All of the portions of the leachate collection system that are to remain under the rubble waste shall be checked before any rubble waste is placed in a cell to be sure that the pumps are operating properly and that there are no blockages of the piping.

After the initial startup and inspection, a yearly visual inspection and cleaning of the line (if necessary) should be performed by the landfill manager. All pumps are to be pulled yearly and serviced/inspected. All the manufacturers' recommended periodic maintenance shall be performed at this time. This shall include replacement of the pumps, if necessary. The force-main shall have the same maintenance as the leachate piping and pumps. The storage facilities shall be inspected on a regular basis to check for leakage or other defects.

When inspecting the leachate collection system, be especially careful as methane can be trapped in manholes or other places and could cause explosions. Leachate is of unknown content, so caution should be taken in handling leachate. Protective clothing should be worn whenever working with the leachate collection system, and confined space entry procedures shall be used when appropriate.

If leachate seeps are observed during the leachate collection system inspection, the following steps will be taken to correct the seep:

- Excavate the area around seep down to source if possible;
- If source cannot be found, excavation shall be deep enough to direct leachate down towards leachate collection system;
- Backfill excavation with excavated waste and daily cover material; and,
- Repair intermediate cover layer, as necessary.

The landfill manager shall inspect the repaired area after the repair to ensure that the seep has been eliminated.

12.11.3 Stormwater Conveyance System Inspection Plan

The stormwater conveyance system consists of sediment basins, pipe, and ditches. Quarterly inspections should be performed by the landfill manager to ensure that pipes and ditches are free of obstructions and that there is no visible damage to the system. In addition, the storm water conveyance system will be inspected immediately after major storm events, defined as 0.5-inches, or more, of rainfall in a 24-hour period. If culverts have been used, check to see that the ends are still open and, if they have been crushed, repair or replace them. Periodically regrade the roadside ditches to prevent standing water and ensure adequate capacity. If sediment has accumulated in stormwater conveyance structures to a depth greater than one foot, they should be cleaned out in an appropriate manner. The sediment basin should be cleaned out when sediment has accumulated to the clean out level.

Sediment control and stormwater management devices in-place at the beginning of construction shall be operational throughout the life of the landfill or as detailed on the final sediment control plans, and therefore must be repaired or replaced as required. Particular attention shall be directed to earth dikes and diversion ditches, to prevent surface water from entering the fill. Basins shall be cleaned of sediment when cleanout elevations are reached.

Generally, all exposed earth surfaces that show signs of erosion must be restored and protected with seed and mulch, mulch only, riprap or a synthetic stabilizer, depending on the location and severity.

12.11.4 Erosion and Sedimentation Control Inspection Plan

The erosion and sedimentation control devices will be inspected concurrently with the stormwater conveyance system inspection. If any of the control devices are found to be damaged, they are to be repaired or replaced or upgraded with a more robust control device, as soon as possible. Whenever sediment accumulation in a sediment basin exceeds one-half of the ponds storage capacity, the operator shall remove the accumulated sediment to restore the pond to its design storage capacity.

12.11.5 Roadways and Facility Structure Inspection Plan

Roadways are to be kept clear of mud and dust, and kept in passable condition at all times. Roadways shall be inspected monthly by the landfill manager. New surface gravel/stone will be applied to gravel/stone roads to keep them in passable condition. Potholes and ruts should be filled as soon as they occur. Roads shall be periodically regraded to maintain a cross slope and to keep water from ponding on the roadway surface.

Access to the working face will be provided by temporary cell access roadways, which will be a minimum of 12-inch thick compacted dense graded aggregate, with a minimum width of 24 feet. The temporary access roadways within the cells shall be designed with turning radii adequate for the hauler trucks; vertical grades shall not exceed 15%. All aggregate roads shall be maintained to continuously provide a compacted surface suitable for truck traffic. An aggregate stockpile shall be placed on the site to provide replacement material, as necessary.

All facility structures shall be inspected on a routine basis as determined by the landfill manager. Repairs will be performed whenever necessary to preserve the integrity of the facility.

12.11.6 Equipment Inspection Plan

The equipment used at the landfill shall be inspected each day of operation by the respective operators for any visible signs of deterioration or malfunction. Any daily required maintenance shall be performed as required and the fluid levels checked. This shall include any attachments or accessories that will be used with the equipment. Equipment is to be serviced routinely as suggested in the service manual for each piece of equipment. During routine maintenance, equipment shall be steam- or high-pressure water cleaned, at designated areas (like the wheel wash building) to facilitate inspection of the equipment for signs of wear or deterioration that is not easily visible to the operator. Proper records of all maintenance are also required for each piece of equipment.

12.11.7 Areas Subject to Spills Inspection Plan

A Stormwater Pollution Prevention Plan (SWPPP) is in the process of being prepared and will be submitted to MDE under separate cover. The SWPPP will contain requirements for conducting site operations in a manner to limit impacts to stormwater runoff and prevent spills and releases. The fuel storage area, equipment maintenance area, generators, leachate transmission lines and flare paddock are all facilities subject to spillage that could have significant adverse consequences. Details related to routine inspection, record keeping and responses to releases related to spill prevention will also be provided in the SWPPP.

The fuel storage area will consist of an aboveground tank, waste oil tank and possible used battery storage. These facilities will be surrounded by an earthen containment of adequate capacity to hold the entire contents of the tanks should a spill occur. If a leak occurs, it will be observed during the daily usage of the fuel tank. If this happens, the spilled fuel in the containment will be pumped into a tanker truck, and the tank will be emptied and repaired.

The leachate force main be contained in double-wall pipe where it is outside the landfill liner system. This double-wall pipe will be checked at the cleanout vaults for leakage between the inner and outer liner on a monthly basis.

12.11.8 Gas Management System Inspection Plan

The gas management system will be inspected as described in the Landfill Gas Management Plan (LFGMP) (Section 11.0 of the Phase III Permit Application). The landfill gas extraction (LFGE) system will be monitored monthly and the gas monitoring system will be monitored quarterly by qualified personnel. Refer to the Landfill Gas Management Plan for more details.

12.11.9 Groundwater Monitoring System Inspection Plan

Groundwater monitoring wells are used to measure groundwater levels and as sampling stations to test groundwater quality. A detailed groundwater monitoring plan is provided in Section 17.0 of the Phase III Permit Application. Certain elements of the groundwater monitoring system will require periodic inspections. The inspection of the groundwater monitoring system will be performed concurrently with the collection of samples and the results provided in the respective groundwater monitoring report. All wells are to be inspected as follows:

- Well casings are to be checked for signs of damage;
- The cover of the wells will be examined for signs of cracks or other deterioration that would prevent a weather tight seal;
- The lock should be checked for proper operation and replaced if necessary;
- The concrete base around the well should be examined for cracks and to ensure that it repels water from around the base of the well. Look for signs of erosion that could undermine the base;

- All components of the well should be checked for signs of deterioration and replaced or repaired if necessary;
- Examine the inside of the well for signs of plugging or other foreign objects; and,
- Check the immediate area of the well for visual signs of possible contaminants.

Any portions of the groundwater monitoring system that are found to be deficient shall be repaired or replaced as soon after detection as possible.

The perimeter monitoring probes will remain in-place indefinitely but some monitoring wells will be removed prior to placing waste in the area occupied by the device. Removal of monitoring wells must be performed by a well driller licensed in the State of Maryland in accordance with the provisions of COMAR 26.04.04. Monitoring wells remaining in place must be protected and maintained throughout the landfill operation and beyond.

12.11.10 Safety Equipment Inspection Plan

Various pieces of safety equipment will be specifically available for use by personnel. Other pieces of equipment will be standard on certain pieces of machinery and in designated buildings. Inspections shall be performed monthly and in accordance with manufacturer's specific instructions and frequencies. Below is a list of some of the equipment requiring periodic inspection.

12.11.10.1 Fire Extinguisher

Check periodically to ensure they are in the designated locations. Check the individual extinguisher for proper charge and to ensure they have no visual defects. Fire extinguishers on landfill operations equipment shall be checked daily prior to operating the landfill equipment or whenever the equipment is used. A check of the fire extinguisher on each piece of landfill equipment is included on the mechanic's/operator's daily inspection checklist. Be sure to follow the manufacturer's maintenance schedule.

12.11.10.2 First Aid Kits

Check to ensure they are in the required locations. Inspect each kit on a monthly frequency to ensure that all items are properly supplied and that no items have passed their expiration date. Re-supply as needed.

12.11.10.3 Personal Protective Clothing

Check for signs of deterioration and tears. Check to see that there is ample supply for all personnel and that appropriate sizes are available. For eye wear, check lens for scratches or cracks and replace as needed. These checks shall be performed monthly and whenever the item is used.

12.11.10.4 Respirators

Perform inspections per the manufacturer's specifications before each use. If using a cartridge-type respirator, be sure that any cartridges being used are of the correct type for the anticipated environment.

12.11.10.5 Detection Devices

On a monthly basis, inspect visually for signs of worn or broken pieces. If the device must be calibrated by the manufacturer, check to see that the calibration certification has not expired.

12.11.10.6 Emergency Lighting

On a monthly basis, check to see that the lights are operational and are in good repair. Any safety equipment found to be deficient shall be repaired or replaced immediately. A Site Safety Plan is provided in Attachment 12C.

12.12 Control and Monitoring of Liquids and Gas

12.12.1 Leachate Management

12.12.1.1 Handling of Leachate

Care must be exercised when handling leachate. All personnel that will be engaged in the handling of leachate will be specifically trained in the use and operation of the leachate management system, including pumps, pipes, valves, storage tanks, personnel protective equipment, loading and unloading of leachate, and spill prevention techniques.

12.12.1.2 Collection

Leachate from the Chesapeake Terrace Rubble Landfill is collected via the leachate collection layer and subsequently flows to the leachate collection sumps. The leachate collection system is designed to operate automatically to remove leachate present in the sump so that it does not exceed one foot of head over the liner system. Pumps in the leachate collection sumps will automatically pump the leachate to the leachate Force Mains. Once in the Force Main, the leachate will be routed to one of two leachate storage facilities described in Section 12.12.1.2.2 of this Plan.

12.12.1.2.1 Leachate Pumps

The submersible pumps and accessories for each landfill sump will be manufactured by EPG Companies or engineer-approved equivalent. Existing electrical power supply for pump operation is located near the site in Patuxent Road and Conway Road rights-of-way.

Prior to beginning the landfill operation in each new cell, the operator will ensure that a spare pump for emergency use is stored in the site's maintenance building. The specific spare pump to be used will be dependent upon operational conditions during the life of the landfill operation, as shown on Intermediate Construction Stage Drawings included in Section 7 of the Phase III Permit Application, and Sequence and General Notes for Construction on Drawing 63.

A level sensor for each submersible pump is included in all cell sumps. The leachate levels are monitored at the pump control panel, mounted on the Pump House wall (see Drawing 26). The level sensor pump-off position will be set at 6-inches above the sump floor. The pump-on position will be 12-inches above the sump floor, and pump high- level alarm will be set at 16-inches above top of sump. Drawing 19 includes the materials that are included in the cell sumps.

To ensure that the pump alarm will not be activated in cell sumps containing two pumps, a lead/lag system will be provided. This system includes a pump focused control panel at each cell pumphouse and a master control panel at each Leachate Storage Facility Pump House (see Drawing 10 leachate storage facility control building locations) with duplicate controls for the pumps discharging to that location.

The cell pump control panel is designed to operate one pump. The cell sump sideslope riser pipes are designed to allow the addition of a second pump in the second sideslope riser pipe and be connected to the master control panel, so the two pumps can operate in a lead/lag arrangement, if the cell is actively filling during a particularly wet year or the operator wishes to install the "spare" pump to reduce wear and tear on the primary single, pump.

In the lead/lag, the lead pump starts at the pump start level set point and continues to run until the liquid level decreases to the pump stop level set point as programmed in the level control meter. The lag pump will start after the lead pump starts if the liquid level continues to rise above the pump start level set point and both pumps will continue to run until the liquid level decreases to the pump stop level set point as sensed by the pressure transmitter. If the liquid level rises to the high level alarm set point, a high level alarm will be annunciated. If a motor trips while running due to an overload condition, the other pump will start automatically.-

The control panel will monitor and record leachate levels in the landfill cells. In the event of high level alarm occurrence, a light at the Pump Control Panel will be activated. During landfill operating hours, the alarm signal will be electronically transmitted to the Scale House. During all landfill non-operation hours, the Landfill Manager and Superintendent will receive a high level alarm signal, via electronic telemetry from the Pump Control Panel.

12.12.1.2.1.1 Pump Access and Maintenance

Access to pumps within 24-inch HDPE sideslope riser pipes is provided by means of stainless steel pulling cables as shown on Drawing 19. The Landfill Perimeter Berm and Pump House, shown on Drawing 23, are designed to provide equipment access, as necessary to install and remove pumps. An aluminum roll-up door, or wide swing doors, allows access to both pump sideslope riser pipes and the Landfill Perimeter Berm top width is designed to allow access for Pump Installation and Removal Equipment (i.e., equipment mounted with boom and winch, with steel cable for attachment to the pumps stainless steel pulling cable).

12.12.1.2.1.2 Force Main Access and Maintenance

Force Mains and Laterals are readily accessible for construction equipment trenching excavation, during the life of the landfill operation. The location of the leachate force mains are shown on Drawings 17 and 18, and the force main profiles are shown on Drawings 24 and 25. A majority of Leachate Force Mains are buried at minimum 3.5 feet depth in the Landfill Perimeter Access Road as shown on Drawings 22 and 23. Leachate Force Mains exceed minimum depth burial as required for crossings at Storm Drains and Landfill Perimeter Channel. Construction equipment access across Landfill Perimeter Channels will be provided by placement of permanent pre-cast concrete spans to provide ready and immediate access to the pump houses.

Force Main cleanouts are provided at minimum 400 feet intervals as noted on Drawings 17, 18, 24 and 25. Flow in the Force Main will be check at each cleanout at a minimum of once per year. The Force Main will be cleaned out at the appropriate cleanouts if flow is observed to be restricted.

Check Valve Vaults and Air Release Valve Vaults (per Details on Drawing 22) are 6 feet minimum from bottom of precast concrete top slab to concrete base slab floor. Steps beneath manhole covers, centered on 2'-0" top slab openings are provided. The vaults will be inspected at least once per year. Any damage to the vault, access, ladder, or brackets shall be repaired at that time. Check valves and Air release valves will be inspected as suggested by the manufacturer or at least once per year, whichever is more frequent. Maintenance, repair, or replacement of the valves as required in the manufacturer's recommendations will be performed at that time.

12.12.1.2.2 Leachate Storage

Leachate from the entire landfill is conveyed to two storage areas, each with two 45-foot diameter, glass coated bolted steel Aquastore Tanks with a storage capacity of 500,000 gallons. The storage tanks are located inside a concrete secondary containment area designed for 500,000 gallons containment capacity, with 1-foot freeboard to top of berm.

The Master Control Panel at each Leachate Storage Facility will monitor and record leachate levels in the storage tanks to prevent storage tank overflow. In the event that the storage tanks become tank filled to near capacity, an alarm is activated and all leachate pumps are automatically shut down.

Each secondary containment structure is equipped with a sump from which uncontaminated rainwater can be pumped. The containment structure is also equipped with a load-out pad where leachate can be transferred from the storage tanks to tank trucks for transport to the wastewater treatment facility. The load-out pad is equipped to drain into the secondary containment in the event of spillage and rainwater that falls on the load-out pad.

Transport and disposal of leachate will be performed on a daily or near-daily basis, while the landfill is in operation. The average daily generation rate for the landfill is projected to be on the order of 75,000 gallons, at its highest production rates. This will equate to an average of 15 truckloads every day. NWM shall maintain normal tank levels below 25% capacity (i.e. at least 750,000 gallons of available capacity), to help ensure that adequate capacity is available to manage spikes in flow associated with heavy rain events.

12.12.1.2.2.1 Leachate Storage Tank Access and Maintenance

Access to the leachate storage facilities is provided via leachate storage facility access roads, as shown in the Drawings 10 and 11.

12.12.1.3 Leachate Disposal

From the leachate storage tanks, the leachate be hauled off-site for disposal. We have received a favorable response from Environmental Recovery Corporation (ERC) of Maryland, located in Baltimore that they do receive rubble landfill leachate and they have provided a preliminary quote for disposal of the leachate, up to 75,000 gallons per day from our site.

Depending on the nature of the waste disposed, the levels of contaminants in the leachate, and the volume of leachate produced (which is directly linked to the amount of rainfall), the owner may choose, in the future to develop an on-site wastewater treatment plant to treat leachate and obtain a NPDES discharge permit.

12.12.2 Leachate Record Keeping

Records will be kept on the amount of leachate being generated in each sump and the amount of leachate being loaded onto tanker trucks for off-site disposal at the storage tank locations. The generation rate of leachate from the collection sumps will be recorded by means of a flow meter incorporated into the discharge line for the collection sump leachate pumps. Quantities of leachate load out on tanker trucks will be measured by the number and capacity of tanker loads transported off-site.

12.12.3 Gas Migration Monitoring

Pursuant to 26.04.07.21(5) of the COMAR, solid waste disposal facilities are required to maintain a gas monitoring network capable of detecting the presence of decomposition gas in the vadose zone at the facility property boundary. Methane gas monitoring probes will be located on approximate 500-foot centers near the property line surrounding the facility. Gas probes will be monitored quarterly to ensure that the concentration of landfill gas at the property boundary does not exceed 100 percent of the lower explosive limit, and does not exceed 25 percent of the lower explosive limit in facility structures. In addition, assessment of monitoring data will help determine the effectiveness of the gas system. The Gas Monitoring Plan is provided in Section 11.0 of the Phase III Permit Application.

12.12.3.1 Landfill Gas Collection System

An active landfill gas collection system will be installed at the landfill, if required based on the results of landfill gas monitoring. During construction associated with installation of the landfill gas collection system, there is a potential for the generation of odors. The following preventative measures will be taken as necessary in order to minimize the potential for these odors:

- Drilling and trenching activities will be suspended during adverse weather conditions (i.e., rain conditions);
- Suitable odor control products may be applied directly to and in the general vicinity of all work where the intermediate cover soil layer is breached and the underlying waste is exposed (i.e., well drilling and lateral trenching) to minimize and control any odors associated with the exposed waste;
- At the completion of well installation activities, the well will either be capped or connected to a utility flare (temporary) or to the landfill gas extraction system (permanent). A permanent connection to the landfill gas extraction system will be made as soon as possible; and,
- Trenching may be limited to only that amount which can be completed by the contractor within a day (or less in sensitive areas). All transmission pipelines will be temporarily sealed at the end of the workday.

12.12.3.2 Operation Modifications

The following equipment and working face procedures will be employed to minimize odor migration:

- The amount of exposed waste on the working face will be minimized by applying daily cover to finished areas during the course of the working day;
- Waste vehicles waiting to unload waste and untarp will be queued away from areas adjacent to public roads;
- The facility may use a water truck equipped with water cannons to spray odor control products directly onto the working face during waste disposal, if necessary;
- Vaporization equipment may be used to reduce water consumption as compared to atomization
- A portable / mobile boom trailer using a proprietary natural, carbon-material odor control product may be available to be placed where needed; and,

- A supply of granular odor control products may be maintained on site to provide odor control in localized areas.

12.12.3.3 Response Actions

Upon the identification of an odor outside the property line of the landfill as a result of an inspection or odor complaint, the General Manager or designee, shall take the following actions:

- Landfill staff will attempt to identify the source of the odor that has been detected off-site;
- Upon identifying that the landfill is the odor source, the Staff shall take appropriate action to minimize and control the odor as follows:
    - If the source of the odor is landfill gas, as the situation dictates, the Staff can increase the vacuum to the gas collection system, add additional cover material, repair any leaks to wells or exposed piping, or apply an odor control product; and,
    - If the source is the working face, the Staff can deploy any of the odor control product dispensing equipment that is not in use or increase the concentration of the products already in use. If the source of the odor is identified as a particular waste stream, the Staff can direct the working face operators to bury the waste as quickly as possible. In the latter case, the Staff should contact the generator of the offending waste to coordinate future disposal.

12.12.4 Groundwater Protection and Monitoring

12.12.4.1 Groundwater Protection

Protection of groundwater at the disposal facility is accomplished by the construction of a composite liner system for the Chesapeake Terrace Landfill cells that incorporates a leachate collection system. The liner system consists of, from top to bottom:

- Four feet of Select Waste;
- 10 ounce per square yard (oz./s.y.) nonwoven geotextile for layer separation and visual indicator if breached;
- Two feet of leachate collection layer, comprised of locally mined sandy soils;
- A geocomposite drainage layer (GDL), consisting of a tri-planar drainage net with a minimum 8 oz./s.y. nonwoven geotextile heat-bonded to both sides;
- 60-mil high density polyethylene geomembrane with a permeability less than or equal to 1 x 10^{-10} cm/sec; and,
- 24-inch thick prepared subbase soil layer with permeability <1x10^{-5} cm/sec.

The Chesapeake Terrace Landfill design maintains a minimum three-foot buffer between the bottom of the prepare subbase and the highest predicted/observed groundwater level.

A comprehensive groundwater monitoring program has been developed for the facility. The monitoring program involves collecting and analyzing samples of groundwater semi-annually from wells strategically placed at the site, and the monitoring of the groundwater gradient to document the direction of hydraulic movement.

12.12.4.2 Groundwater Monitoring

Groundwater monitoring wells are used to measure groundwater levels and as sampling stations to test groundwater quality. A detailed groundwater monitoring plan is provided in Section 17.0 of the Phase III Permit Application. This plan includes installation of monitoring wells, sampling and testing procedures, and the evaluation program. Monitoring wells remaining in place must be protected and maintained throughout the landfill operation and beyond.

12.13 Records and Measurements

Records shall be kept on a daily basis of the weight of all rubble waste brought to the landfill. These records will be used to monitor the amount of waste being deposited in each cell. They will also be used to project future waste generation rates for projecting the life of future cells.

A record of the nature and quantity of asbestos waste and its source shall be maintained.

Records shall also be kept for the amount of leachate being generated. Copies all groundwater monitoring and landfill gas monitoring results shall be retained. A complete discussion of groundwater monitoring is included in the groundwater monitoring plan section of this application. Copies of all records shall be retained in the main office and at the scale house. Appropriate copies shall be sent to the required state agencies.

The rubble waste will be measured in place by field and/or aerial survey as required to prepare as-built documents, in compliance with MDE regulations. Each day each delivery of waste will be categorized and measured by the scale house operator. The waste will be weighed at the scale house and will be classified based upon the source of the material. At the end of each day, the scale house operator will summarize the day's deliveries, by category of waste type (based upon source) and the received tonnage of each waste type. This information will be used to provide annual reports and to estimate remaining cell life. The annual report will include the following:

- Quantity of solid waste received each month (c.y.) during the calendar year of the report;
- Percentage of the projected total rubble landfill capacity used annually, and to date;
- Projected rubble landfill completion date, and a description of the basis for this projection; and,
- Type and quantity of materials received each month.

12.14 Closure and Post-Closure Care

For a detailed description of the closure procedure and post-closure care, refer to the Chesapeake Terrace Landfill Closure and Post-Closure Plan.

ATTACHMENT 12A

Equipment and Personnel Requirements

TABLE 12A-1
PERSONNEL LIST
CHESAPEAKE TERRACE RUBBLE LANDFILL, ANNE ARUNDEL COUNTY, MARYLAND

POSITION/TITLE	PERSONNEL	CONTACT INFORMATION
Landfill Supervisor	*TBD (see Note 1)	*TBD (see Note 1)
Landfill Foreman	*TBD (see Note 1)	*TBD (see Note 1)
Scalehouse Operator	*TBD (see Note 1)	*TBD (see Note 1)
Equipment Operators	*TBD (see Note 1)	*TBD (see Note 1)
Truck Drivers	*TBD (see Note 1)	*TBD (see Note 1)

NOTES:

1) Following refuse disposal permit issuance for the facility and prior to beginning rubble waste acceptance, names and phone numbers for personnel listed above will be provided to Maryland Department of the Environment (MDE). Any personnel changes during the life of the cell cosntruction and operation will be provided in writing to MDE.

Table 12A-2
MAJOR LANDFILL EQUIPMENT, PERSONNEL, WORKING FACE SIZE, AND DAILY COVER SOIL BY DAILY TONNAGE

Daily Tonnage Range (tons/day)	Equipment Type and Use	Minimum Operating units Recommended	Personnel Type	Minimum Personnel Recommended	Max. Uncovered Area (Working Face Size) (square feet)	Max. Daily Cover Soil Required (cy)
500-2,500	Water Dispersion Equipment	1	Landfill Supervisor	1	109,000	2,936
	Dozer (spread refuse and cover, compact waste, berm construction)	1	Scale Operator	1		
	Compactor (compaction of waste and cover material)	1	Equipment Operator	3		
	Off-Road Truck or Scraper (haul and discharging cover material)	1	Maintenance Worker	1		
	Excavator (soil excavation loading)	1	Laborer/Truck Driver	1		
2,500 - 5,000	Water Dispersion Equipment	1	Landfill Supervisor	1	118,000	3,168
	Dozer (spread refuse and cover, compact waste, berm construction)	2	Scale Operator	1		
	Compactor (compaction of waste and cover material)	1	Equipment Operator	5		
	Off-Road Truck or Scraper (haul and discharging cover material)	2	Maintenance Worker	1		
	Excavator (soil excavation loading)	1	Laborer/Truck Driver	2		
	Water truck for dust control	1	Laborer/Truck Driver	1		
5,000 - 7,500	Water Dispersion Equipment	1	Landfill Supervisor	1	127,000	3,400
	Dozer (spread refuse and cover, compact waste, berm construction)	3	Scale Operator	1		
	Compactor (compaction of waste and cover material)	1	Equipment Operator	6		
	Off-Road Truck or Scraper (haul and discharging cover material)	2	Maintenance Worker	1		
	Water truck for dust control	1	Laboroer/Truck Driver	1		
	Excavator (soil excavation loading)	1	Laborer/Truck Driver	2		

Notes:

1. Dozer, Compactor, Truck, Excavator (or Loader), and Water Dispersion Equipment sizes will vary to match operating needs.
   Minimum Operating Units calculations based on smallest make and model of each given class of equipment except for the compactor.
   Each piece of equipment is matched with one or more operators to meet personnel needs over the daily operating period.

2. Larger and/or equivalent equipment may be used in place of those units listed above.

3. Other non-major landfill equipment such as a Motor Grader, Utility Pickup Truck, Utility Tractor with Attachments, Tire Splitter, and portable pumps may be used on site for various non-working face activities.

4. Daily Covering of wastes is accomplished with a variety of Alternative Daily Covers approved for use at the site. If soil cover is needed, it is readily available from on-site stockpiles. Soil cover will be transported to the working face by Off-Road Truck or Scraper.

a Montrose Environmental Group company

ATTACHMENT 12B

Asbestos Waste Management

ADVANCED GeoServices
a Montrose Environmental Group company

TABLE OF CONTENTS FOR
ASBESTOS WASTE MANAGEMENT

1.0 DEFINITIONS

"Asbestos" means the asbestiform varieties of serpentinate (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite-tremolite.

"Asbestos-containing waste materials (ACM)" means mill tailings or any waste that contains commercial asbestos. This term includes filters from control devices, friable asbestos waste material, and bags or other similar packaging contaminated with commercial asbestos. As applied to demolition and renovations operations, this term also includes regulated asbestos-containing waste material and materials contaminated with asbestos including disposable equipment and clothing.

"Asbestos waste generator" means any owner or operator of a source covered by the Code of Federal Regulations (CFR), Title 40, Part 61 (40 CFR 61), *National Emission Standards for Hazardous Air Pollutants (NESHAP),* Subpart M, *National Emission Standard for Asbestos* whose act or process produces asbestos-containing waste material.

"Category I nonfriable asbestos containing material (ACM)" means asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos as determined using the polarized light microscopy method specified in 40 CFR 763, Subpart E, Appendix E.

"Category II nonfriable asbestos-containing material (ACM)" means any material, excluding Category I nonfriable ACM, containing more than 1 percent asbestos as determined using the polarized light microscopy methods specified in 40 CFR 763, Subpart E, Appendix E, that when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

"Commercial asbestos" means any material containing asbestos that is extracted from ore and has value because of its asbestos content.

"Friable asbestos" means any material containing more than one percent asbestos as determined using the polarized light microscopy methods specified in 40 CFR 763, Subpart E, Appendix E, which is capable of being crumbled, pulverized or reduced to powder by hand pressure.

"Leak-tight" means that solids or liquids cannot escape or spill out. It also means dust-tight.

"Natural barrier" means a natural object that effectively precludes or deters access. Natural barriers include physical obstacles such as cliffs, lakes or other large bodies of water, deep and wide ravines, and mountains. Remoteness by itself is not a natural barrier.

"Regulated asbestos containing material (RACM)" means:

- Friable asbestos material;
- Category I nonfriable ACM that has become friable;
- Category I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading; and,
- Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations.

For the purposes of this definition **"renovation"** means altering an installation, structure or building or any part of such installation, structure or building in any way, including the stripping or removal of RACM. Operations in which load-supporting structural members are wrecked or taken out are **"demolitions."**

"Resilient floor covering" means asbestos-containing floor tile, including asphalt and vinyl floor tile, and sheet vinyl floor covering containing more that 1 percent asbestos as determined using polarized light microscopy according to the method specified in 40 CFR 763, Subpart E, Appendix E.

"Waste shipment record" means the shipping manifest, required to be originated and signed by the asbestos waste generator, used to track and substantiate the disposition of asbestos-containing waste material.

2.0 APPLICABLE ASBESTOS WASTE GENERATION PROCESSES

The standards contained herein apply to the management of all asbestos-containing materials (ACM) generated by asbestos mills, by manufacturing, fabricating, and spraying operations, and ACM generated in the course of demolition and renovation of installations, structures or buildings, or other waste generating activities.

3.0 PRE-ACCEPTANCE PROCEDURES

In order for ACM to be accepted for disposal site at the Chesapeake Terrace Rubble Landfill site, the asbestos waste generator shall follow the pre-acceptance procedures described in this section.

3.1 PACKAGING

The generator shall conform to all packaging requirements contained in 40 CFR 61.149 and 40 CFR 61.150.

All ACM generated in a manufacturing, fabrication, or spraying operation and all regulated ACM generated in a demolition or renovation operation shall be placed in leak-tight containers while wet. Materials that will not fit into containers without additional breaking shall be put into leak-tight wrapping, consisting of 6-mil double “bladder” for bulky wastes, taped shut. The containers shall meet federal DOT standards 49 CFR 173.216. Materials placed in double, 6-mil thick plastic bags and sealed will conform to the above requirements when transported in motor vehicles that are loaded by and for the exclusive use of the consignor and unloaded by the consignee. To ensure that the personnel at the disposal facility can verify that the material has been placed in double bags, the outer bag should be transparent.

The containers or wrapped materials specified in 9 VAC 20-80-640, Section C.1.a shall be labeled using warning labels specified by Occupational Safety and Health Administration (OSHA) under 29 CFR 1910.1001(j)(3) or 1926.1101(k)(7). The labels shall be printed in letters of sufficient size and contrast so as to be readily visible and legible and shall contain the following information:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

For materials transported off-site, label containers or wrap materials with a name of the waste generator and the location at which the waste was generated.

Category I nonfriable ACM and Category II nonfriable ACM generated in a demolition or renovation operation that do not meet the definition of regulated ACM need not meet the requirements of 9 VAC 20-80-640, sections C.1.a, b, and c.

3.2 MARKING

Conform to all marking requirements contained in COMAR 26.11.15.04 for vehicles used to transport ACM during loading and unloading of wastes.

3.3 IDENTIFICATION

As part of identification of ACM transported to the disposal facility, the generator shall submit to National Waste Managers, Inc. (NWM) the appropriate Waste Characterization Data Forms and a copy of the waste manifest shipment record described above at the same time the ACM is delivered to the disposal site. The Waste Characterization Data Forms shall contain the following information:

- The name, address, and telephone number of waste generator;
- The name and address of the state NESHAP office; Maryland Department of the Environment, Air & Radiation Management Administration; Division of Asbestos Licensing & Enforcement; 1800 Washington Blvd., Suite 725 Baltimore MD 21230-1720
- The approximate quantity in cubic meters (cubic yards);
- The name and telephone number of the disposal site operator;
- The date transported;
- The name, address, and the telephone number of the transporters; and,
- A certification that the contents of the consignment are fully and accurately described by proper shipping name and classified, packed, marked, and labeled, and in all respects in proper condition for transport by highway according to applicable international and government regulations.

4.0 TRANSPORTATION OF ASBESTOS RELATED MATERIAL

NWM requires the transporter of asbestos related material to conform to the requirements set forth in COMAR 26.11.15.04. All asbestos-containing materials shall be properly packed for transportation in accordance with these requirements. Asbestos-containing waste materials shall be accompanied by the waste shipment manifest record.

5.0 DISPOSAL OF ASBESTOS-CONTAINING MATERIALS

NWM shall comply with the requirements of this section at the Chesapeake Terrace Rubble Landfill site. All asbestos-containing materials generated in a manufacturing, fabrication, or spraying operation and all regulated ACM generated in a demolition or renovation operation shall be disposed in a designated area of the Chesapeake Terrace Rubble Landfill. When Category I and Category II nonfriable ACM is disposed in the landfill advanced notice shall be required and other pertinent requirements of this part shall be met.

5.1 UNLOADING OF ACM

Upon arrival at the Chesapeake Terrace facility, the vehicles used to transport ACM shall be marked during the unloading process so that the signs are visible. The markings shall:

- Be displayed in such a manner and location that a person can easily read the legend;
- Conform to the requirements for 20 inches by 14 inches upright format caution signs specified in 29 CFR 1910.145(d)(4);
- Display the following legend with letter sizes and styles of a visibility at least equal to those specified in the following table. Spacing between any two lines shall be at least equal to the height of the upper two lines.

Legend	Notation
DANGER	1-inch Sans Serif, Gothic or Block A
ASBESTOS DUST HAZARD	1-inch Sans Serif, Gothic or Block A
CANCER AND LUNG DISEASE HAZARD	3/4-inch Sans Serif, Gothic or Block A
Authorized Personnel Only	14-point Gothic

5.2 PLACEMENT OF ACM

Asbestos-containing waste materials shall be segregated in designated areas and not disposed of on the active work face with other solid wastes. An initial lift of 10 feet of rubble waste will be placed in the designated asbestos disposal area. The boundaries of the asbestos area will then be clearly marked and signs posted in the appropriate manner. Prior to receipt of asbestos containing waste shipment, an excavator will dig a trench in the solid waste that will be able to contain all the asbestos waste scheduled for that day plus the one-foot of soil cover. The depth of the trench will be approximately six feet but no greater than 8 feet. Once the first lift in the designated asbestos area is completely full and the 1 foot of soil cover applied, an additional 10 feet of solid waste will be placed over the designated disposal area for the future placement of asbestos waste. This process will continue until the maximum height of the landfill is achieved. Asbestos containing waste will not be placed within 15 feet of the intermediate cover or of the cell's final elevation.

The waste shall either be hand placed in the excavated trench or deposited by means of slowly unloading the asbestos containing wastes. Either placement method will ensure that the integrity of bags, wrapping or containers are not punctured or damaged.

The waste shall not be compacted until a sealing layer of soil has been placed over the waste and great care is taken to prevent the breaking of bags or wrapping. All accidentally broken materials shall be covered with 12 inches or more of soil immediately. A cell that has been completely covered with soil, at least one foot thick may be compacted.

All waste shall be covered with at least one foot of soil at the end of each day of operation. A final cover of 3 feet of soil shall be placed over all areas that have not been in use or will not be used for more than 30 days. Areas that will not or have not been used for one year, in addition to final soil cover, shall be graded for erosion prevention and revegetated.

5.3 ACCESS CONTROL

The entire landfill will have access control and site security. As such an internal fence is not required. The entrance and asbestos waste boundary line shall be clearly marked. Permanent warning signs shall be provided at all entrances and at intervals of 330 feet or closer around the waste boundary line. The warning signs shall:

- Be posted in such manner and location that a person can easily read the legend;
- Conform to the requirements for 20 inches by 14 inches upright format caution signs specified in 29 CFR 1910.145.d.4;
- Display the following legend with letter sizes and styles of a visibility at least equal to those specified in the following table. Spacing between any two lines shall be at least equal to the height of the upper two lines.

Legend	Notation
ASBESTOS WASTE DISPOSAL AREA	1-inch Sans Serif, Gothic or Block
DO NOT CREATE DUST	3/4-inch Sans Serif, Gothic or Block
Breathing Asbestos is Hazardous to Your Health	14-point Gothic

The asbestos area within this secure sanitary landfill will not be located closer than 50 feet to the property boundary or occupied building or structure.

5.4 RECORDKEEPING AND REPORTING

5.4.1 Waste Shipment Records

For all ACM received, NWM shall follow the following requirements regarding waste shipment records:

- Complete each waste shipment record submitted by the asbestos waste generators for each shipment received by the Chesapeake Terrace facility by noting shipment discrepancies and dating and signing the waste shipment record. The discrepancies will include:
  - The presence of improperly enclosed or uncovered waste, or any ACM not sealed in leak-tight containers or wrappings; and,
  - A discrepancy between the quantity of waste designated on the waste shipment record and the quantity actually received.
- Send a copy of the signed waste shipment record to the waste generator as soon as possible and no longer than 30 days after receipt of the waste;
- Upon discovering the discrepancy in the shipment quantity, attempt to reconcile such discrepancy with the generator. If the discrepancy is not resolved within 15 days after receiving the waste, immediately report it in writing to the Maryland Department of the Environment, Air & Radiation Management Administration; Division of Asbestos Licensing & Enforcement; 1800 Washington Blvd., Suite 725 Baltimore MD 21230-1720 at the above address. Describe the discrepancy and the attempts to reconcile it, and submit a copy of the waste shipment record along with the report; and

- Retain a copy of all records and reports required at least two years.

5.4.2 Disposal records

NWM shall follow the following requirements regarding disposal records:

- Initiate and maintain, until closure, records of the location, depth and area, and quantity in cubic yards of ACM within the Chesapeake Terrace site on a map or diagram of the disposal area;
- Submit to the Director of the MDE, upon closure of the facility, a copy of records of asbestos waste disposal locations and quantities; and,
- Furnish upon request by the director of the MDE, and make available during normal business hours for inspection, all records required by the regulations.

5.4.3 Safety and Health Program

NWM shall institute an occupational safety and health program required under 29 CFR 1910.1001 or 29 CFR 1910.1101, as applicable.

5.4.4 Closure and Post-Closure Care

In addition to the closure and post-closure care requirements for the facility, NWM shall follow the following requirements if the facility receives ACM materials:

- Within 60 days of the closure of the Chesapeake Terrace site, record with the Anne Arundel County Clerk's office a notation on the deed to the facility property or any other document that would normally be examined during a title search that will in perpetuity notify any purchaser of the property that:
    - The property has been used for the disposal of ACM; and,
    - The copy of the survey plat and the record of location and quantity of ACM disposed are attached to the notation.

ATTACHMENT 12C

Safety Plan

TABLE OF CONTENTS FOR
SAFETY PLAN

1.0 EMERGENCY PROCEDURES

A. Posting of Procedures -- All emergency procedures must be updated as appropriate and after each emergency. All emergency procedures should be posted in the landfill site office, in conspicuous places at the site, and at the gate house.

B. Emergency Contact Information -- The name, location, and telephone number of the nearest police, fire department, doctors, medical treatment facilities, and ambulance service should be posted in the scale house and maintenance buildings.

C. Instructions of Procedures -- All new personnel should be instructed on the emergency procedures used at the landfill. All employees should be informed of any changes in emergency procedures.

D. Responsibility of Employee -- It is the responsibility of every employee to know and remember his role in each emergency procedure at the site.

2.0 GENERAL SAFETY PROCEDURES

A. Access to the site should be limited only to those authorized to use the site

B. Knowledge of Procedures -- All employees at the landfill will know the proper procedures for reporting accidents, injuries, and fires.

C. Posting of Information -- Landfill rules, roadway limits and speed limits on each road will be clearly posted. Direction of travel and location of curves will be posted. The location of disposal areas should be clearly indicated.

D. Dumping -- For safe operations, the dumping area will be only slightly sloped at all times and equipment maintained in good repair.

E. Safety Devices -- Proper safety devices, such as rollover protective cabs will be installed on all equipment and kept in good repair.

F. Fire Extinguishers -- Fire extinguishers will be provided in the scale house, maintenance building and on all heavy equipment. Each extinguisher will be appropriate for the types of fires likely and they will be checked or serviced as appropriate. Discharged fire extinguishers will be removed and replaced with fully charged units.

G. Employee Alertness -- All employees will be alert for hazards at the landfill. Potential hazards will be reported to the supervisor.

H. Safety Meetings -- Safety meetings will be regularly scheduled. Situations that can cause accidents and ways to prevent them will be discussed. Also, the effectiveness of corrective action will be discussed. Records will be maintained including attendance of the safety meetings and the subjects discussed.

I. **NO SMOKING** near flammable materials, methane extraction facilities, or other designated areas.

J. Inspect incoming waste. This inspection should determine the nature of the waste to ensure that materials detrimental to health and safety are not allowed. Only waste specifically specified by the owner, this manual and the MDE Permit requirements is allowed.

K. Arrange for response agreements with local emergency personnel, such as police, firefighters and hospital staff.

L. An adequate stock of first aid supplies should be maintained on site, and at least one person with first aid training should be on duty during the operational hours.

M. Establish a communication system using two-way radios (hand held) or cell phones that are capable of summoning outside emergency assistance.

N. Train personnel to respond to emergencies and familiarize them with emergency procedures, emergency equipment and emergency systems.

O. Operational personnel shall, on a periodic basis, receive instructions in the principles of first aid and operational safety.

P. Operational personnel will be trained to recognize and identify prohibited and hazardous waste.

Q. The Owner should conduct a periodic review and evaluation of safety procedures and provide modifications as needed.

2.0 SAFETY PROCEDURES FOR HANDLING ASBESTOS WASTE

A. All asbestos containing waste shall be disposed in the specially-designated asbestos waste daily disposal area.

B. Asbestos is a known human carcinogen for which no level of exposure is known to be without risk. Single exposures may even present a health risk to some individuals.

C. As discussed in the Asbestos Management and Disposal Plan (Appendix C in Section 12 of the Phase III Report), asbestos waste materials require special handling, bagging and sealing requirements. In the event that asbestos containers are broken or damaged such that asbestos fibers may come in contact with operating personnel, the precautions listed below regarding protective equipment and clothing shall be utilized.

D. The maximum feasible level of respiratory protection shall be used by workers engaged in work with or in close proximity to asbestos-containing material, when such workers are, or could reasonably be expected to be, occupationally exposed to airborne asbestos. "Occupationally exposed" means exposed to any detectable level of airborne asbestos at or above the lowest limit of reliable quantification as determined by the Transmission Electron Microscopy Method (Code of Federal Regulations Title 40, Part 763, Subpart E, Appendix A).

E. An air purifying type respirator approved for use with asbestos shall be worn by all employees involved in the handling of asbestos waste.

F. An effective respirator program shall be established to include:
   1. Written standard operating procedures governing the selection and use of respirator.
   2. Medical examination of workers to determine whether or not they may be assigned an activity where respiratory protection is required.
   3. User training in the proper use and limitations of respirators (as well as a way to evaluate the skill and knowledge obtained by the worker through training).
   4. Respirator fit testing.
   5. Regular cleaning and disinfecting of respirators.

6. Routine inspection of respirators during cleaning, and at least once a month and after each use for those respirators designated for emergency use.
7. Storage of respirators in convenient, clean, and sanitary locations.
8. Surveillance of work area conditions and degree of employee exposure.
9. Regular inspection and evaluation of the continued effectiveness of the program.
10. Recognition and resolution of special problems as they affect respirator use (e.g., facial hair, eye glasses, etc.)
11. Proper respirator use (procedures for donning and doffing respirators when entering and exiting the disposal area).

3.0 SAFETY PRECAUTIONS FOR EQUIPMENT OPERATORS

A. Check Equipment -- Check equipment for defects before operating. This can best be done by completing check-out lists prior to starting equipment in the morning. Do not start or operate defective equipment.

B. Use Stepping Points -- To prevent slipping, use stepping points and hand holds when mounting and dismounting equipment.

C. Keep Debris from Cab -- Keep operator's compartment, stepping points, and handholds free from oil, grease, mud, loose objects, and solid waste.

D. Look All Ways Before Moving -- Protect personnel and other equipment in the area by looking to the front, rear, and sides before moving equipment. If unsure of the surrounding conditions, dismount and inspect area.

E. Control Equipment Properly -- The operator should control his equipment only from the driver's seat. Always have equipment under control.

F. Wear Safety Belts and Hard Hats -- Always wear seat belts while operating equipment to provide support and security in the operator's compartment. A hard hat will reduce the potential for head injuries and should be worn while outside of any equipment.

G. Do Not Mount Moving Equipment -- Never mount or dismount from moving equipment. Wait until equipment has come to a complete stop and the brake is set before mounting or dismounting.

H. Carry Only Authorized Passengers -- Persons other than the operator should not normally be allowed on landfill equipment. If it is necessary to carry a passenger, he should sit in a safe location. The passenger should be performing official duties only.

I. Carry blades and attachments low when equipment is traveling.

J. Check Blind Areas -- Never push waste until sure that no person or equipment is in the blind area ahead of the machine, the blade, or the solid waste. If the operator is not sure of the surrounding conditions, he should get off the equipment and personally inspect the area. When operating in reverse, turn around to look in the direction of travel.

K. Maintain Adequate Clearance -- When pushing waste, maintain adequate clearance from other vehicles or obstructions to assure that any falling objects will not strike other equipment or persons. Equipment should be kept clear of solid waste vehicles.

L. Operate Up and Down Slope -- Avoid side-hill travel to reduce the chance of rolling over.

M. Avoid Excessive Speed -- Operating conditions generally determine the speed of heavy equipment. Under no circumstances should heavy equipment be driven at excessive speed or operated recklessly.

N. Move Cautiously Over Bulky Objects -- When compacting or traversing bulky items the operator should proceed with extreme caution to avoid tipping or sudden lurching movements.

O. Constantly Check Work Area -- The operator should constantly check the work area for the location of other persons or equipment.

P. Define and establish vehicular routes.

Q. Use traffic control signs to direct traffic.

R. Keep speed limits low. Speed limits along entrance roads should not exceed 10 mph. In landfill cells, speed limits should be reduced to 5 mph.

S. Do not mix heavy traffic with light trucks.

5.0 SAFETY EQUIPMENT

Certain Safety equipment is specified for equipment operator protection. It is the responsibility of each employee to be sure his safety equipment is in good repair. Each employee must use his equipment at appropriate times. The proper safety equipment for equipment operators is listed below.

<u>OPERATOR PROTECTIVE EQUIPMENT</u>

Equipment: Each piece of heavy equipment should be provided with:
- Rollover bars
- Backup warning system
- Fire Extinguisher

Personal: Equipment operators should have available personal protective clothing:
- Earmuffs or earplugs
- Face shields or goggles
- Dust mask
- Rubber or leather (steel toe) boots
- Work gloves
- Hard hats

6.0 FIRE PREVENTION AND CONTROL PLAN

A fire prevention plan will be prepared for review by local fire prevention officials and periodic inspection visits will be scheduled with the local fire company. Additionally, recommended fire prevention equipment will be available on-site.

Supervisors and key personnel will be trained in fire prevention and fire fighting techniques. Training must be recognized by the Anne Arundel County Fire Department, and personnel will maintain and update their skills on an annual basis.

Operators will carefully screen incoming waste for fires, hot ashes and volatile liquids to reduce the risk of starting fires. Fuels will not be stored or placed near the landfill operation and refueling of equipment shall take place away from the placing zone.

Inspection and preparedness are the best protection against fires. By inspecting incoming waste, and waste as it is placed, the potential for fires can be greatly reduced. Being prepared to fight fires eliminates any response delay between detection and proper action.

Each piece of landfill operating equipment assigned to placing and covering rubble waste shall be equipped with a fire extinguisher of the type recommended by the manufacturer.

Equipment operators will carefully operate their equipment to avoid suspicious containers and aerosol containers. Compaction will not begin until the rubble to be compacted has been inspected and cleared of containers that may contain volatile substances.

6.1 WHEN FIRE OCCURS

Surface fires are usually detectable at the working face where they start or are brought in. Small fires are usually extinguished with portable extinguishers or by simply covering with soil. Another method of extinguishing small fires on the working face is to take out the burning or smoldering mass from the working face and cover it until the fire is out.

At least two (2) fire extinguishers will be available to landfill personnel at the working face for use in dousing small fires that start or appear in the rubble. One of the extinguishers will be suitable for extinguishing fires from petroleum and solvent products and the other extinguisher will be suitable for use on wood, paper and brush. Additionally, a stockpile of cover material will always be available for fire fighting and a water truck will be on-call as a back-up for fighting fires.

Underground fires are difficult to detect and control. Subsurface fires are usually indicated by unusual or rapid settlement, venting of smoke and elevated subsurface temperatures. The presence of carbon monoxide can also indicate the existence of a fire below the surface. Settlement resulting from subsurface combustion is rapid and usually followed by collapsing of upper waste layers into a void space created by the combustion. Settlement may not be apparent when fires are deep within the fill. Smoke will confirm the existence of subsurface fire but not the location. Cracks and fissures are usually present in a fire zone as the fires draw air through these openings.

Subsurface fires may require a drilling program to locate the combustion area. Drilling is, however, dangerous due to the potential presence of high temperature gas and burning waste. Placement of borings should begin away from the fire where normal temperatures prevail. Usually a series of borings in a grid pattern will be required to determine temperature gradients which can be used to locate the fire.

Fires 30 feet or less in depth should be extinguished by excavation and the application of water. Excavation must proceed with caution and personnel must be protected from toxic and explosive gases. Fires below a reasonable level of excavation can be saturated with water by injecting water in a well system (installed with steel pipe) that encircles the fire zone. As deep fires are usually fed by convection, all surface cracks and openings should be sealed. Additionally, a layer of compacted cover material should be added over the fire zone and adjacent areas.

A. Extinguish small fires with fire extinguisher or smother with soil. Do not remain near large fires or explosive materials.
B. Determine location, extent, type and if possible cause of fire or explosion.
C. Notify on-site personnel and implement safety and fire control procedures.
D. Notify facility emergency coordinator if the fire cannot be immediately controlled.
E. Notify fire department if necessary. Clearly state:
   1. Location of landfill.
   2. Location of fire or explosion in landfill.
   3. Extent of fire or explosion.
   4. Type of fire or explosion.
   5. Actions now being taken.
   6. Injuries.
F. Notify Rescue Squad, if necessary.
G. Notify health care facility, if necessary.
H. Notify Police Department if necessary.

6.2 "HOT LOAD" PROCEDURES

A "hot load" is a load of burning solid waste in an incoming truck. It may be actively burning, but more likely will be just smoldering. When a "hot load" is discovered in a vehicle, the driver should be directed to dump the material in an area located away from the actual fill face and cleared of vegetation and debris. After the "hot load" is dumped, the equipment operator should spread the material, and then cover it with soil to smother the fire.

After the fire has been extinguished, the material should remain in the cleared area until no evidence of fire remains. At the end of that day, check to make sure no fire or smoldering remains, and then place it into the fill.

6.3 FIRE EXTINGUISHERS

Fire extinguishers should be installed in the following locations:
A. Scale House
B. Maintenance Building
C. Selected on-site Vehicles and Equipment

7.0 INCLEMENT WEATHER

Site personnel shall be ever vigilante regarding the weather forecast for their day’s work. Site personnel shall cease all operations in the event of the following inclement weather:
- High winds, associated with low-pressure events;
- Intense Rain;
- Lightening; and,

- Snow/Ice.

The following paragraphs describe the precautions to be taken for each form of inclement weather.

7.1 HIGH WINDS

High winds may be associated with localized, low pressure cells (e.g., tornadoes) or regional low pressure events. The choice to continue work activities will be based upon the safety of the personnel and the ability to effectively operate the landfill, as determined by the Landfill Manager.

7.2 INTENSE RAIN

In the event of intense rain, the choice to continue to operate the landfill will be dependent upon the following:

- Visibility;
- Stability of the equipment in the operating face; and,
- Ability of the equipment to maneuver on the site access road between the scale house and the operating face.

If any of these items is in question, as determined by the Landfill Manager, landfill operation activities will cease, unless the operation can be altered to accommodate these issues. Means of altering the operation may include but are not limited to:

- Temporarily relocating the working face to a better protected or more stable location;
- Placing stone or other natural material to stabilize the access roads; and/or,
- Allowing the delivery of material to the working face, but restricting activities on the working face until the area is better stabilized.

In the event of reduced visibility, equipment shall cease mobile activities until conditions improve and visibility is restored.

7.3 LIGHTNING

At the first strike of lightening within sight of the landfill, equipment shall shutdown. All personnel outside shall seek immediate shelter in the site buildings and, where immediate shelter of buildings is precluded (e.g., personnel in heavy equipment during lightening), these personnel shall remain in their equipment until the storm has cleared the area. Landfilling activities may continue 15 minutes after the last strike of lightening or rumble of thunder has passed.

7.4 SNOW/ICE

In circumstances where snow or ice is present at the site, having occurred overnight or during the course of the day, landfill operations will cease if the equipment cannot safety maneuver the access roads or the working face, as determined by the Landfill Manager. The Landfill Manager may direct site personnel to implement safety measures to address snow or ice accumulation on site roads by plowing and/or spreading salt/sand.

8.0 COMMUNICATIONS SYSTEM

Telephone communications will be available at the scale house and administration building. Radio, cellular, and/or other types of communication will be available between the scale house, administration building, landfill manager, operations manager, lead mechanic, lead operator(s) and other key personnel. A CB radio will also be available to communicate with truck drivers.

9.0 CONFINED SPACE

A confined space is defined as any space not currently used for human occupancy, having a limited means of exit, which is subject to the accumulation of toxic contaminants, a flammable or oxygen deficient atmosphere, or other hazards such as engulfment or electrical or mechanical hazards should equipment be activated while a employee is in the space. Confined spaces include but are not limited to storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, air pollution control devices, smoke stacks, underground utility vaults, sewers, septic tanks, landfill pump houses and open top spaces more than four feet deep such as pits, trenches or vats.

Confined space entry requires special training. At no time is a NWM employee to enter into a confined space or a trench without first receiving explicit training and authorization from the Landfill Manager. When entering a confined space the personnel shall follow all requirements prescribed under OSHA regulations for confined space entry (29 CFR 1910.146) as applicable.

a Montrose Environmental Group company

ATTACHMENT 12D

Emergency Response Plan

ADVANCED GeoServices
a Montrose Environmental Group company

EMERGENCY RESPONSE PLAN

TABLE OF CONTENTS

This written plan has been developed to assist the Chesapeake Terrace Rubble Landfill in the management of emergencies that might reasonably be expected to occur at the landfill site located at (*insert landfill street address here*). This plan is written and designed to place the Chesapeake Terrace Rubble Landfill in compliance with OSHA 1910.38.

1.0 EMERGENCY RESPONSE PROCEDURES

A. Evacuation routes are posted throughout the facility and all personnel are advised during safety meetings as to the shortest route to take from their particular work area. In the event of an emergency that requires the immediate evacuation of the entire building, the decision to evacuate will be made by the Safety Manager and/or the Landfill Manager. In their absence, the decision will be made by the Operations Manager on site who is best able to evaluate the situation. Decision to evacuate should be made with considerations of the following factors:
   1. Is there immediate danger to life?
   2. Can the emergency be safely managed without a complete evacuation?
   3. Is there enough time to evaluate the emergency without allowing the situation to become life threatening?

B. Fire Response
   1. A minor fire that can be extinguished with one fire extinguisher in one minute.
   2. Attempt to fight the fire only if you are not endangering yourself.
   3. If in an enclosed area and fire is creating heavy smoke, evacuate the area immediately.
   4. A major fire is any fire that requires more than one minute or more than one fire extinguisher to extinguish.
   5. Contact 911 immediately.
   6. Evacuate the immediate area of the fire.
   7. If in an enclosed area and fire is creating heavy smoke, evacuate the area immediately, proceed to the employee parking lot and stay there.

C. Toxic Agent Release
   1. In the event of a toxic agent release, the Safety Manager or Landfill Manager will order the immediate total evacuation of the facility, and should immediately ensure that all personnel move to a point upwind from the site, and begin personnel accountability procedures as soon as practicable.
   2. The Safety Manager will ensure that the proper emergency authorities are notified of the situation immediately and are aware that there has been a toxic agent release.
   3. Since there are no chemicals or agents used or stored at the landfill that pose such a great threat, the primary avenue by which such agent could be released would most likely be one of the following:
      i. Transport into the facility in a located solid waste vehicle as a result of improper disposal of water from a pick-up point.
      ii. Transport into the facility in a non-NWM vehicle, such as a delivery truck or other vendor vehicle.

2.0 SPECIAL PROCEDURES

A. Critical operations requiring shutdown:
   1. The main power to the facility will be shut off by the Operations Manager.

B. Removal of Equipment
   1. Equipment that can be moved quickly and safely out of the hazard area will be moved to safe locations around the site.
   2. The responsibility of making the determination of whether or not to move equipment is assigned to the Landfill Manager or Operations Manager.
   3. Decisions to move vehicles should be made with personnel safety as the top priority. No truck or piece of equipment is worth an injury or death, but we should make an effort to remove our equipment to safety only when it is practical.
   4.

3.0 MUSTER LOCATIONS

After evacuation of the building is determined to be necessary, all employees must gather in a safe location. This will be the employee parking lot.

4.0 PERSONNEL ACCOUNTABILITY

The following system will be used to ensure that employees are accounted for after an evacuation:

A. Once safely at the gathering point in the parking lot, all employees should group themselves together. A head count will be taken by the Safety Manager or Landfill Supervisor.

B. Once a head count has been taken, the zone leader will report to the Safety Manager with all information pertinent to their assigned zone (i.e., missing, injured, etc.).

5.0 MEDICAL/FIRST AID

A. In case of life-threatening injuries, call 911 for ambulance service immediately.

B. Serious or minor injuries that are not life threatening must be taken to the nearest emergency medical care facility.

C. First aid may be rendered by any employee that has been certified in Standard First Aid by the National Safety Council and/or the American Red Cross.

6.0 NOTIFICATION OF AUTHORITIES

A. It is the responsibility of the Safety Manager to ensure that all emergency authorities are notified. This notification will be done in the form of a phone call placed from the District Office or cellular phone if available.

B. **Call 911** in an emergency.

C. Emergency phone numbers are posted throughout the Landfill.

7.0 CONTACT LIST

A. Key Personnel

Landfill Supervisor	*[1]
Safety Manager	*
Environmental Manager	*

8.0 EMERGENCY PHONE LIST

Ambulance, Fire and Rescue	911
Poison Control Center	1-800-222-1222
Nearest Hospital Emergency Room	Baltimore Washington Medical Center
	South Gate, MD 410-787-4000
	Anne Arundel Medical Center
	Parole, MD 443-481-1000
	Clifton T. Perkins Hospital Center
	Jessup, MD 410-724-3000

Following refuse disposal permit issuance for the facility and prior to beginning rubble waste acceptance, phone numbers for the above will be inserted and provided to Maryland Department of the Environment.

9.0 CRITIQUE OF RESPONSE

After each incident involving the application of an Emergency Procedure, the Safety Manager will review the response to ascertain efficient application and inform the Landfill Supervisor of the effectiveness of the response.

[1] Following refuse disposal permit issuance for the facility and prior to beginning rubble waste acceptance, more phone numbers for the above will be inserted and provided to Maryland Department of the Environment.

10.0 EMERGENCY RESPONSE PHONE NUMBER/CHECKLIST

In case of emergency, all employees are responsible for immediately contacting the appropriate individuals and/or authority listed below. Additionally, following notification, each employee should attempt to record the following information for any accident or emergency:		
We need to know who (driver, employee, other parties): What (system type & equipment involved): When (time of accident): Where (exact location): Complete the AIG accident form if possible and call the AIG # Notify the following as appropriate:		
EMERGENCY AMBULANCE	911	
POLICE DEPARTMENT	911	(NON-EMER.)
FIRE DEPARTMENT	911	(NON-EMER.)
STATE POLICE	Insert Number	Insert Number
TELEPHONE COMPANY	Insert Number	Insert Number
UTILITY COMPANY	Insert Number	
OIL SPILL, TOXIC CHEMICAL RELEASE POLLUTION	Insert Number	
Maryland MDE	Insert Number	Dept. of the Environment
KEY CONTACTS		
POSITION	**NAME**	**PHONE NUMBER**
INSURANCE CARRIER	Insert Name	Insert Number
LANDFILL SUPERVISOR	Insert Name	Insert Number
SAFETY MANAGER	Insert Name	Insert Number

Following refuse disposal permit issuance for the facility and prior to beginning rubble waste acceptance, phone numbers for the above will be inserted and provided to Maryland Department of the Environment.

ADVANCED GeoServices

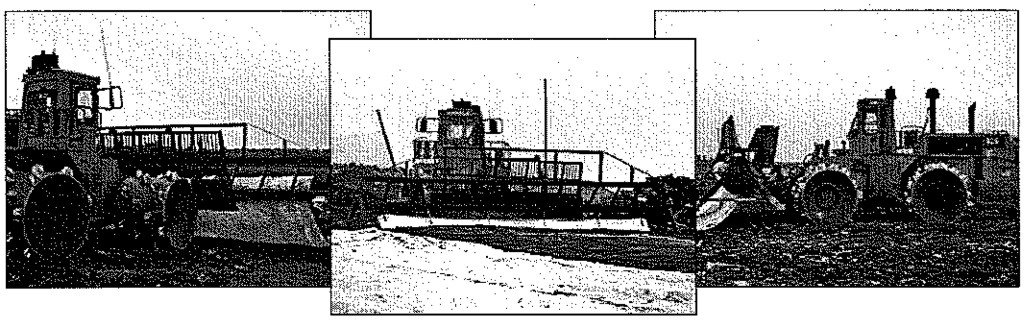
a Montrose Environmental Group company

ATTACHMENT 12E

Alternative Daily Cover Fabric – Manufacturer's Information

1-888-222-0124

Our Clients



We take great pride in offering the best products and services to our customers. You can see what a few of our customers have had to say by clicking on the following links:

- Jeff McGown and Sherwood McKenney, Crossroads Landfill in Norridgewock Maine
- Greg Hannah, Botetourt Country Landfill in Troutville, Virginia

The following is a partial list of our customers throughout the United States and Canada. For more information, please contact our sales team at 1-888-222-0124.

- Alabama
- Canada
- Florida
- Georgia
- Hawaii
- Illinois
- Iowa
- Maine
- Maryland
- Massachusetts
- Michigan
- Mississippi
- New Hampshire
- New York
- Ohio
- Pennsylvania
- South Carolina
- Tennessee
- Virginia
- Washington

Alabama

City of Scottsboro
Solid Waste Department
27150 John T. Reed Parkway
Scottsboro, AL 35768

Canada

Municipality District of Guysborough
Guysborough Waste Management Facility
151 Waste Management Road
P.O. Box 85 Boylston, Nova Scotia
BOH 1G0

City of Ottowa
Trail Road Landfill Facility
4309 Trail Road
Ottowa, Ontario Canada K0A 2Z0

Florida

Hernando County
Northwest Solid Waste Facility
14450 Landfill Road
Brooksville, FL 34614

Brevard County Solid Waste
Central Disposal Facility
2250 Adamson Road
Cocoa, FL 32926

Charlotte County
Municipal Solid Waste Mgmt. Div.
Dept of Environmental Services
29751 Zemel Road
Punta Gorda, FL 33955

Georgia

Pine Grove Landfill
7160 Sacerdote Lane
Columbus, GA 31907

Telfair County Landfill
98 Landfill Lane
McRae, GA 31055

Hawaii

County of Kauai
Public Works - Solid Waste Division
Kekaha Landfill
6900-A Kaumualii Highway
Kekaha, HI 96766

Illinois

Land & Lakes Company
Solid Waste Department
2100 South Central Ave.
Matteson, ILL 60443

Iowa

City of Muscatine
Muscatine County Landfill
1000S Houser Street
Muscatine, IA 52761

Maine

Crossroads Landfill
Waste Management
P.O. Box 629
327 Mercer Rd.
Norridgewock, ME 04957

City of Bath, Public Works
450 Oak Grove Ave
Bath, Maine 04630

Maryland

Carroll County
Northern Landfill
1400 Baltimore Blvd.
Westminster, MD 21157

Solid Waste Frederick County Landfill
9031 Reich's Ford Road
Frederick, MD 21701

Solid Waste - Forty West Landfill
12630 Earth Care Road

Hagerstown, Maryland 21740

Massachusetts

Northampton Landfill
170 Glendale Road
Northampton, MA 01060

Waste Management Middleboro Landfill
207 Plympton Street
Middleboro, MA 02346

Michigan

Environmental Services Department
6779 Smiths Creek Road
Smiths Creek, Michigan 48074

Mississippi

Allied Waste Services
Big River Landfill
1035 Old Brandon Road
Jackson, MS 39232

New Hampshire

City of Lebanon Landfill
370 Plainfield Road
Lebanon, NH 03766

New York

DANC - Development Authority of North County
Solid Waste Management Facility
23400 NYC Rt. 177
Rodman, N.Y. 13682

Oneida-Herkimer Solid Waste Management Authority
Oneida Herkimer Regional Landfill
7044 State Route 294
Boonville, NY 13309

Ohio

Erie County Landfill
10102 Hoover Road
Milan, Ohio 44846

Central Waste Inc.
12003 Oyster Road
Alliance, Ohio 44601

Pennsylvania

SECCRA – Southeastern Chester County Refuse Authority
219 Street Road
West Grove, PA 19390

South Carolina

Georgetown Public Works Dept.
Georgetown County Landfill
2242 Browns Ferry Road
Georgetown, SC 29440

Tennessee

Hardeman County Landfill
75 Landfill Way
Bolivar, TN 38008

Allied Waste Services
550 Aaron Long Road
Jackson, TN 38301

Virginia

Botetourt County Landfill
259 Landfill Road
Troutville, VA 24175

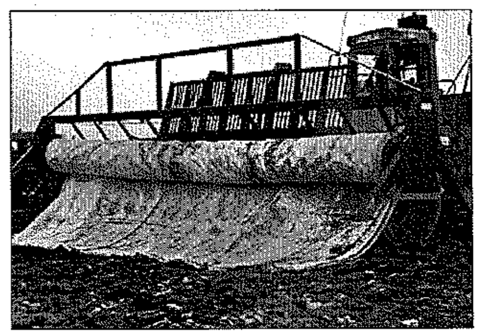
Rockingham County Landfill
2400 Grassy Creek Road
Harrisonburg, VA 22803

Washington

Engineered Compost Systems
4211 24th Avenue West
Seattle, Washingion

1-888-222-0124

Tarp Deployment System for Landfills



Mercer Motor Works, LLC currently manufactures two Tarp Deployment Systems for use in landfills, the TDS-30 and the TDS-30 HC. You can learn more about these systems by reading the product information presented on this page. In addition, you can download our product information in PDF format using the following links:

- TDS-30 Spec Sheet
- TDS-30 HC Spec Sheet

Mercer Motor Works

TDS-30 Automatic Tarping System

Frame:

The frame is made of heavy-duty gauge steel and able to support at least (3) 30ft. wide by 100ft. long ballasted 6.5 oz. coated polypropylene tarps, with 5/16" chain sewn in pockets. Frame legs have shoes welded on to support the TDS-30 in soft or muddy ground conditions.

Weight:

The TDS-30 weighs around 3,000 lbs. and can easily be used in landfills with high sludge content.

Engine and Hydraulics System:

The engine (5 1/2hp Honda gas powered) and hydraulic system is of adequate size to operate the TDS-30 spool that supports the specified tarps and capable to operate in all weather conditions.

The TDS-30 comes with a manual control and a heavy-duty remote control unit for retracting and extending controls for rolling and unrolling the tarp covering system.

Tarp:

The size of the tarp on the TDS-30 is 30ft. wide and can hold up to (3) ballasted tarps up to 100ft. in length. There is 5/16" chain in pockets around perimeter and webbing reinforced edges and corners. However, tarp size can be of custom order to a shorter width depending on the working face. Also, the tarps can be ordered unballasted if working face is not subjected to high winds and the operator prefers to use a couple of tires to weigh down the tarp.

Quick Attaching To Existing Landfill Equipment:

The TDS-30 is manufactured so no fixtures or brackets need to be added to your equipment. The brackets are manufactured right on the TDS-30. The blade of your equipment hooks under the bracket on the TDS-30 unit and you are then simply ready to deploy or retrieve for your daily operation. It's attaching simplicity enables the operator to place the TDS unit anywhere on site and also out of the way so he can continue using his landfill equipment elsewhere.

Existing Landfill Equipment:

The TDS-30 can be moved and operated from D4 to D8 class bulldozers or CAT 826 to CAT 836 class compactors.

Remote Control Unit:

The remote control unit has a maximum operating distance of 150 feet from the tarp machine. The TDS-30 is easily operated by the operator inside his cab.

Warranty:

12 months on TDS-30 only. Tarps cannot be warranted. However, the tarps we use have a very high UV resistance and are of 21-mil thickness that make them very durable and should last with proper operator observation while deploying and retrieving over the working face.

TDS-30 HC Automatic Tarping System

Frame:

The frame is made of heavy-duty gauge steel and able to support (4) 30ft. wide x 100ft. long ballasted 6.5 oz. coated polypropylene tarps, with 5/16" chain sewn in pockets. Frame legs are adjustable and have shoes welded on to support the TDS-30 HC in soft or muddy ground conditions.

Weight:

The TDS-30 HC weighs around 4,000 lbs. and can easily be used in landfills with high sludge content.

Engine and Hydraulics System:

The engine (5 1/2hp Honda gas powered) and hydraulic system is of adequate size to operate the TDS-30 HC spool that supports the specified tarps and capable to operate in all weather conditions.

The TDS-30 HC comes with a manual control and a heavy-duty remote control unit for retracting and extending controls for rolling and unrolling the tarp covering system.

Tarp:

The size of the tarp on the TDS-30 HC is 30ft. wide and can hold up to (4) ballasted tarps up to 100ft. in length. There is 5/16" chain in pockets around perimeter and webbing reinforced edges and corners. However, tarp size can be of custom order to a shorter width depending on the working face. Also, the tarps can be ordered unballasted if working face is not subjected to high winds and the operator prefers to use a couple of tires to weigh down the tarp.

Quick Attaching To Existing Landfill Equipment:

The TDS-30 HC is manufactured so no fixtures or brackets need to be added to your equipment. The brackets are manufactured right on the TDS-30 HC. The blade of your equipment hooks under the bracket on the TDS-30 HC and you are then simply ready to deploy or retrieve for your daily operation. It's attaching simplicity enables the operator to place the TDS-30 HC anywhere on site and also out of the way so he can continue using his landfill equipment elsewhere.

Existing Landfill Equipment:

The TDS-30 HC can be moved and operated from D5 to D8 class bulldozers or CAT 826 to CAT 836 class compactors.

Remote Control Unit:

The remote control unit has a maximum operating distance of 150 feet from the tarp machine. The TDS-30 HC is easily operated by the operator inside his cab.

Warranty:

12 months on TDS-30 HC only. Tarps cannot be warranted. However, the tarps we use have a very

high UV resistance and are of 21-mil thickness that make them very durable and should last with proper operator observation while deploying and retrieving over the working face.

a Montrose Environmental Group company

SECTION 13

CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

CONSTRUCTION QUALITY ASSURANCE PLAN

FOR CHESAPEAKE TERRACE RUBBLE LANDFILL ANNE ARUNDEL COUNTY, MARYLAND

PREPARED FOR:

National Waste Managers, Inc.
2900 Linden Lane
Silver Spring, MD 20910

PREPARED BY:

ADVANCED GeoServices
a Montrose Environmental Group company
1055 Andrew Dr, Suite a
West Chester PA 19380

PROJECT NO. 2018-3854
July 2020
Revised September 3, 2021

TABLE OF CONTENTS

Section Page No.

a Montrose Environmental Group company

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

13.0 CONSTRUCTION QUALITY ASSURANCE PLAN

13.1 Introduction

13.1.1 Purpose and Scope

This Construction Quality Assurance Plan (CQA Plan) describes the procedures associated with the implementation of the construction quality assurance (CQA) monitoring of activities associated with the construction of soil and geosynthetic components of the containment and final cover closure systems for the Chesapeake Terrace Rubble Landfill (Site) in Anne Arundel County, Maryland. This CQA Plan is the implementation document for CQA monitoring personnel. The plan does not address design guidelines, construction specifications, or the contractor's construction means and methods.

13.1.2 References

This CQA Plan references test procedures of the American Society for Testing and Materials (ASTM) and the American Association of State Highway and Transportation Officials (AASHTO). Preparation of this CQA Plan also referenced the following documents:

EPA/600/R-93-182, Technical Guidance Document, "Quality Assurance and Quality Control for Waste Containment Facilities", September 1993;

- EPA/600/2-88/052, "Lining of Waste Containment and Other Impoundments";
- Chesapeake Terrace Rubble Landfill Construction Specifications, prepared by AGC Montrose., dated July 2020, and revised September 3, 2021 (hereafter referred to as the "Specifications"); and,
- Chesapeake Terrace Rubble Landfill Permit Drawings prepared by AGC Montrose, dated July 2020 and revised September 3, 2021, (hereafter referred to as the "Permit Drawings").

13.1.3 Project Design

The project involves construction of a composite containment liner system, composite cover system, and related support facilities, including storm water controls, for the Chesapeake Terrace Rubble Landfill (Site) in Anne Arundel County, Maryland.

The proposed composite containment liner system consists of, from top to bottom in accordance with COMAR 26.04.07.16.C.:

- Protective layer of four feet of select waste;
- 10 ounce per square yard (oz./s.y.) nonwoven geotextile for layer separation and visual indicator, if breached;
- Two feet of leachate collection layer, comprised of locally-mined sandy soils;
- A geocomposite drainage layer (GDL), consisting of a tri-planar drainage net with a minimum 8 oz./s.y. nonwoven geotextile heat-bonded to both sides, to work in conjunction with the leachate collection layer soils;
- 60-mil high density polyethylene geomembrane with a permeability less than or equal to 1 x 10^{-10} cm/sec; and,
- A two feet thick prepared soil subbase with a minimum permeability less than or equal to 1 x 10^{-10} cm/sec.

When landfilling activities are complete, the landfill must be closed. Following the requirements of COMAR 26.04.07.21 for rubble landfills, the proposed cap system will consist of the following, from top to bottom:

- A 24-inch thick soil layer (with 6-inch thick surface layer capable of supporting vegetation that is subsequently seeded and 18-inch thick uniform protective soil layer);
- A geocomposite drainage layer (GDL), consisting of a tri-planar drainage net with a minimum 8 oz./s.y. nonwoven geotextile heat-bonded to both sides;
- 40-mil textured Linear Low Density Polyethylene (LLDPE) Geomembrane; and,
- A 24-inch thick compacted soil Final Cover layer.

13.2 Definitions

This Section defines terms used throughout this CQA Plan.

- Construction Quality Assurance (CQA) refers to the means and actions employed by the Quality Assurance Consultant to assess whether the Contractor's or Installer's work complies with the Contract Drawings, Construction Specifications, and contractual and regulatory requirements.
- Quality Assurance Consultant (QAC) refers to an organization independent of the CONTRACTOR, contracted by the OWNER to provide on-site monitoring services and perform CQA services.
- Resident Manager (RM) refers to the on-site representative of the QAC.
- Contractor Quality Control (CQC) refers to actions taken by the Contractor, or Installer, to determine and demonstrate compliance with the requirements for materials and workmanship as stated in the Permit Drawings and Construction Specifications.
- Manufacturer Quality Control (MQC) refers to measures taken by the Manufacturer to determine and demonstrate compliance with the requirements for materials and workmanship as stated in the Permit Drawings and Construction Specifications.
- DESIGNER refers to:

  Advanced GeoServices Corp,
  A Montrose Environmental Group company
  1055 Andrew Drive, Suite A
  West Chester, PA 19380

  DESIGNER refers to the individual, partnership, firm, corporation, or any combination thereof, authorized by OWNER to represent OWNER on contract and payment issues. The DESIGNER shall also observe construction activities for compliance with the Contract Documents and shall perform specified engineering functions including, but not limited to, review of submittals, including CQC documentation and confirmatory sampling activities, as outlined in the Contract Documents. The DESIGNER may also serve the role of QAC.

  OWNER refers to:

  National Waste Managers, Inc.
  2900 Linden Lane
  Silver Spring, Maryland 20910

CONSTRUCTION SPECIFICATIONS refers to those portions of the Bidding Documents consisting of written descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

CONTRACT DOCUMENTS include the Bid Form, the Technical Specifications, all Addenda, the Agreement, General Conditions, Supplemental Conditions, Permits, and Drawings.

13.3 Project Participant Responsibilities and Qualifications

13.3.1 Owner

National Waste Managers, Inc. (NWM) (OWNER) is responsible for construction of the Chesapeake Terrace Rubble Landfill and for the Site. The OWNER will appoint an individual to act as the "point of contact" for all issues related to construction.

13.3.2 Designer

13.3.2.1 Responsibilities

Advanced GeoServices Corp., a Montrose Environmental Group Company (AGC Montrose) is the DESIGNER retained by the OWNER to design the landfill liner and cover systems for the Chesapeake Terrace Rubble Landfill. The DESIGNER's Project Manager is a licensed P.E. in the State of Maryland and has experience on solid waste landfill design and closure projects. During the construction phase, DESIGNER will:

- Assist the OWNER in the selection of a CONTRACTOR;

  Review design and specification change and modification requests, as necessary;

  Submit design and specifications changes or modifications to the Maryland Department of the Environment (MDE) for their review;
- Provide clarifications to the Permit Drawings and Construction Specifications; and,
- Respond to requests for information from the Contractor.

The DESIGNER, OWNER, and the MDE shall review and approve or deny all design and specification change requests. DESIGNER shall document that MDE has reviewed and approved any design and specification changes or modifications to the plan. All design changes shall be documented in the final report and the design engineer will certify that the changes did not diminish the pollution control systems or materials. DESIGNER will appoint an individual approved by the OWNER to act as the point of contact for issues related to the construction of the containment and cover systems.

13.3.3 General Contractor

13.3.3.1 Responsibilities

The General Contractor (CONTRACTOR) is responsible for the preparation of the Site, construction of the containment and cover systems, and maintenance of the quality of materials and workmanship employed by himself and all Subcontractors. The CONTRACTOR shall have the responsibility to protect completed work and materials (including deployed geosynthetics) during the project. The CONTRACTOR shall meet the qualification requirements stipulated in the

Specifications. The CONTRACTOR will assign a Project Manager as the responsible "person in charge" of all aspects of the project. The Project Manager will have a background in engineering or construction management, with significant experience in construction and contract administration.

The CONTRACTOR shall also designate a Site Superintendent (SS) who will be the full-time, on-site representative for the CONTRACTOR. The SS will oversee the daily Site operations for the CONTRACTOR, and interface with the QAC regarding status of daily and upcoming activities. The SS shall have experience with performing in this capacity for other comparable projects on behalf of the CONTRACTOR.

Finally, the CONTRACTOR will assign a Project Administrator (PA) who will be responsible for preparing the submittals for proposed materials and substitutions and providing these submittals to the DESIGNER for review. The submittals shall be of the format and completed as outlined in the Specifications. This person may be the Project Manager or SS; however, the PA shall have sufficient experience with engineering and construction to compile complete submittals, and shall have experience serving in this capacity on other comparable projects.

13.3.4 Maryland Department of Environment (MDE)

13.3.4.1 Responsibilities

The MDE staff will be responsible for evaluating compliance with the landfill permit, including the Construction Quality Assurance Plan and for reviewing proposed design changes that could affect pollution control systems or materials. The MDE staff will have the opportunity to attend the preconstruction meeting, the geosynthetics kick-off meeting, and progress meetings and will do so as agency resources allow.

13.3.5 Geosynthetics Manufacturer

The Geosynthetics Manufacturer (MANUFACTURER) of the geotextile, geocomposite, and geomembrane, shall meet the qualification requirements stipulated in Sections 02595, 02418, and 02597/02598, respectively, of the Specifications. The MANUFACTURER is responsible for the production and MQC testing of the geosynthetic materials used on this project. The MANUFACTURER is responsible for providing copies of the MQC Certificates of Compliance to the CONTRACTOR in a timely manner. It is possible that the CONTRACTOR will propose different manufacturers for each component. The reference to MANUFACTURER includes the manufacturers for the geosynthetic components for the project.

13.3.6 Geosynthetics Installer

13.3.6.1 Responsibilities

The Geosynthetics Installer (INSTALLER) is responsible for the deployment, seaming, non-destructive testing, and all other aspects of the geosynthetics installation. The INSTALLER shall provide a full-time, on-site, field supervisor who will oversee the activities of the installation crew.

13.3.6.2 Qualifications

The OWNER shall only approve a pre-qualified INSTALLER. The INSTALLER shall provide qualified personnel to meet the demands of the project. The INSTALLER shall have a minimum of five (5) years continuous experience in installation of HDPE and/or LLDPE geomembrane or experience totaling a minimum 5,000,000 sq. ft. of installed HDPE and/or LLDPE geomembrane for a minimum of five (5) completed facilities. Personnel performing seaming operations shall be qualified by experience or training. At least one seamer shall have experience seaming a minimum of 2,000,000 sq. ft. of HDPE and/or LLDPE geomembrane using the same type of seaming apparatus in use at the site. The most experienced seamer, or Master Seamer, shall provide direct supervision, as required, over less experienced seamers. In addition, the INSTALLER shall provide a Superintendent for the project.

The Superintendent shall oversee the activities of the installation crew. The Superintendent must have a minimum documented experience of fifty (50) acres of successful landfill, or comparable, geosynthetic systems installation on a minimum of five (5) different projects. The personnel performing seaming operations for the geomembrane installation shall be qualified by experience and by successfully passing on-site trial seaming tests.

13.3.7 Quality Assurance Consultant (QAC)

13.3.7.1 Responsibilities

The Quality Assurance Consultant (QAC) is responsible for implementation of the CQA Plan, including monitoring, testing, and documentation of all aspects of the containment system construction. The team leader for the QAC shall be the Project Manager (PM), who will be a licensed Professional Engineer in Maryland, and will provide supervision of the field team. The QAC will assign a Resident Manager (RM), who will be responsible for field implementation of the CQA Plan and will remain on-site throughout construction. Additional quality assurance (QA) Monitor(s) shall assist the RM as required by the number and type of construction activities in progress. The QAC will:

- Review the Permit Drawings, Construction Specifications, and related work plans;
- Review schedule of construction activities with the CONTRACTOR;
- Coordinate CQA testing activities;
- Monitor and document CQC activities performed by the CONTRACTOR and Subcontractors;
- Monitor and document CQA activities as required by this CQA Plan and the Contract Documents;
- Review corrective measures to be employed in the event of deviation from the Contract Documents;
- Evaluate the soils and geosynthetics laboratories to be used during this project; and,
- Prepare and submit a Final Record Documentation Report as required by the Contract Documents.

13.3.7.2 Qualifications

The QAC shall be experienced with geosynthetic liner systems with an emphasis on polyethylene geomembranes. The QAC shall be experienced in the preparation of quality assurance documentation including quality assurance forms, reports, certifications, and manuals.

13.3.7.2.1 Resident Manager and Quality Assurance Monitors

The RM is the on-site representative of the QAC and is responsible for field implementation of the CQA Plan. The RM shall be thoroughly familiar with the project, Permit Drawings, and Construction Specifications. Quality Assurance Monitors (QA Monitors) shall assist the RM in performance of the CQA tasks required by this CQA Plan. The RM shall document that the project has been completed in substantial conformance with the Contract Documents. The RM responsibilities include the following:

- Act as the on-site representative of the OWNER;
- Attend and record project meeting minutes;
- Observe and document that required CQC testing has been performed in accordance with the Construction Specifications;
- Review shop drawings and other material submittals provided by the CONTRACTOR to verify that materials are in conformance with the Construction Specifications;
- Schedule and coordinate CQA activities;
- Obtain soil and geosynthetic samples for CQA laboratory conformance testing;
- Monitor, test, and document earthwork construction;
- Monitor and document the unloading and storage of geosynthetic materials;
- Monitor and document activities associated with geomembrane installation including deployment, welding, repair, destructive testing, and non-destructive testing;
- Monitor and document all activities associated with non-woven geotextile installation;
- Mark, obtain, and ship geomembrane seam destructive test samples;
- Monitor the methods used to protect completed work and materials (including deployed geosynthetics);
- Direct and oversee activities of the QA Monitor(s);
- Review CQA field data and daily reports of the QA Monitor(s);
- Prepare daily reports describing construction progress, testing performed, and results of testing;
- Coordinate requests for design/specification clarifications and modifications with the design DESIGNER and OWNER;
- Maintain on-site CQA records; and,
- Assist in the preparation of the Final Record Documentation Report.

The QA Monitor(s) will:

- Assist in performance of CQA activities as directed by the RM; and,
- Prepare written daily reports describing construction progress, sketches showing the locations of tests, testing performed, and results of testing.

Appointment of the RM and QA Monitor(s) shall be subject to the approval of the OWNER.

13.3.7.2.2 Qualifications

The Resident Manager either shall hold a B.S. or higher degree in Engineering or have performed such duties on at least five (5) other projects of similar nature and difficulty. The Resident Manager shall be specifically experienced in the installation of geosynthetic liner systems with an emphasis on polyethylene geomembrane.

The QA Monitors shall have specifically trained in the quality assurance of geosynthetic and/or soil liner systems.

13.3.7.3 Soils CQA Laboratory

The Soils CQA Laboratory shall be an experienced, accredited (ASTM, AASHTO), independent geotechnical-testing laboratory approved by the OWNER, responsible for performing tests in accordance with the applicable standards on samples of soil materials used during construction of the containment system. The Soils CQA Laboratory will be capable of providing test results to the CQA Consultant in a timely manner in accordance with Section 01410 of the Specifications.

13.3.7.4 Geosynthetics CQA Laboratory

The Geosynthetics CQA Laboratory shall be an independent geosynthetics testing laboratory responsible for conducting tests in accordance with applicable standards on samples of geosynthetic materials used during construction of the containment system. The Geosynthetics CQA Laboratory will be an experienced geosynthetics-testing laboratory approved by the OWNER, will be accredited by the Geosynthetics Accreditation Institute-Laboratory Accreditation Program (GAI-LAP), (GSRI-GSI Accreditation), and will be capable of providing test results in a timely manner in accordance with the Specifications. Geomembrane destructive seam test results will be provided to the CQA Consultant within 24 hours of receipt of the sample at the laboratory throughout the project.

13.4 Documentation

13.4.1 Introduction

The purpose of this Section is to describe the CQA reports that shall be prepared during the construction of the site containment system. Documentation must be thorough and sufficiently detailed to allow individuals who are not on Site on a daily basis to make informed judgments concerning the quality of the materials and work performed.

13.4.2 Daily Reports

13.4.2.1 QA Monitors

QA Monitor(s) shall prepare daily written field monitoring reports describing the work performed, area of work, tests, and observations made, and the adequacy of the work. These reports shall be submitted to the RM no later than the beginning of the work or business, day after the work was performed.

13.4.2.2 Resident Manager

The RM shall prepare a field monitoring summary report on a daily basis. This report shall incorporate the information provided by the QA Monitor(s). The RM may incorporate his own monitoring activities and observations into this summary, and is not required to prepare a separate field monitoring report. The field-monitoring summary shall contain at a minimum:

- Project identification;

- Description of weather conditions;
- Description of work performed, including area, personnel and equipment involved;
- Description of off-site material received, including any quality control data;
- Description of CQA monitoring activities, including tests performed, and observations made;
- Description of any damage observed on installed pollution control systems and materials and corrective actions taken to repair the damage;
- Description of any problems encountered and corrective action taken;
- Summaries of meetings held and actions recommended or taken;
- Summary of the quantities of geosynthetic materials installed; and,
- Summary of the quantities and types of soil materials installed (alternately, tonnage of the material delivered if not all deployed should also be included).

13.4.3 Monitoring and Test Logs and Reports

Observations and results of field and laboratory tests shall be recorded on data sheets, in a format acceptable to the QAC PM. These data sheets shall include at a minimum:

- Project identification;
- Description or title of the monitoring activity;
- Location of monitoring activity or location from which the sample was obtained;
- Type of monitoring activity and procedure used;
- Recorded observation of test data;
- Results of monitoring activity; and,
- Personnel involved in the monitoring.

13.4.4 Issue Identification and Resolution Reports

The RM shall prepare a report describing any issue associated with materials or workmanship that fails to meet project plans or specifications and corrective actions taken to resolve it. This report shall contain at a minimum:

- Project identification;
- Location of the issue;
- Description of issue;
- Probable cause;
- How and when the issue was identified;
- Time frame of the issue (where applicable);
- Any disagreement noted by the Monitor between the Monitor and the CONTRACTOR concerning the Issue;
- Corrective measures taken to resolve the issue; and,
- Suggestions to prevent similar issues (if applicable) in the future.

13.4.5 Record Drawings

Record Drawings shall be prepared by the QAC as required by Section 01564 of the Specifications and be included in the Record Documentation Reports.

13.4.6 Record Documentation Report

At the conclusion of the construction project or phase, the QAC shall prepare a Record Documentation Report as required by the Contract Documents and MDE regulations. The Record Documentation Report shall certify that the construction of any cells or closure of any cells was constructed in substantial compliance with the CQA Plan, construction and material specifications, and permit drawings. The Record Documentation Report shall be certified by a Professional Engineer (QAC Engineer's Certification) registered in the State of Maryland, and shall be submitted to MDE within 90 calendar days of the completion of the construction activities covered by the report.

The Record Documentation Report shall contain a narrative describing the work performed, problems encountered, and measures taken to resolve those problems, and the CQA field and laboratory activities conducted during the construction phase. The Report shall include summaries of the field and laboratory CQA data and copies of the Record Drawings. A list of responsible parties involved with the construction, including pertinent contact information, shall be provided. The report shall be submitted in a general format that simplifies the review by the MDE. This standard format includes a dated title page stating the name and location of the facility, table of contents, and numbered pages, sections, and paragraphs.

The phase or cell will not be considered closed until MDE has provided its written notification that the closure construction and the final report meet the requirements of the solid waste permit and applicable COMAR regulations.

The Record Documentation Report for the construction of new containment system (for a Cell or part of a Cell) will include the following documentation:

- A narrative of the construction activities
- The QAC Engineer's certification
- CQA documentation for any subgrade and low permeable liner preparation and testing including:
    - Subgrade Acceptances Documentation
    - Laboratory testing results
    - Field testing results
- CQA documentation for the geomembrane liner material and installation including:
    - Material inventory
    - Manufacture material certifications
    - CQA material conformance testing
    - Geomembrane installation documentation including:
        - Documentation of deployment logs
        - Documentation of trial seams
        - Documentation of field seams
        - Documentation of non-destructive testing, including liner leak testing
        - Documentation of geomembrane repairs
        - Documentation of destructive testing
- CQA documentation for the leachate collection layer installation including:
    - Leachate drainage material conformance testing
    - Documentation of the leachate drainage material installation observations
    - Documentation of leachate pipe material conformance submittals
    - Filter geotextile documentation including:
        - Material inventory
        - Manufacture material certifications
        - CQA material conformance testing

Documentation of the filter geotextile installation observations

- CQA Documentation of the Liner Leak Testing
- CQA documentation for any other ancillary construction such as the construction of leachate collection tanks and secondary containment areas, sediment basins, leachate-pumping systems, and the abandonment of any piezometers or groundwater monitoring wells required for the construction of the phase.
- Documentation of any design modifications
- Resumes for the geosynthetic installer and the QAC Certifying Engineer
- Record drawings including:
    - A site plan
    - A base record drawing
    - A geomembrane record drawing including panel locations, destructive test locations, and repair locations.
    - A leachate collection layer record drawing including the location of all leachate collection piping and sumps.
    - A thickness map illustrating the thickness of the leachate collection layer.

The Record Documentation Report for the construction of final cover system (for a Cell or part of a Cell) will include the following documentation:

- A narrative of the construction activities
- The QAC Engineer's certification
- CQA documentation for any subgrade preparation and testing including:
    - Subgrade Acceptance Documentation
    - Laboratory testing results (if required)
    - Field testing results (if required)
- CQA documentation for the geomembrane cover material and installation including:
    - Material inventory
    - Manufacture material certifications
    - CQA material conformance testing
    - Geomembrane installation documentation including

        Documentation of deployment logs
        Documentation of trial seams
        Documentation of field seams
        Documentation of non-destructive testing
        Documentation of geomembrane repairs
        Documentation of destructive testing
- CQA documentation for the geocomposite drainage layer installation including:
    - Material inventory
    - Manufacturer material certifications
    - CQA material conformance testing
    - Documentation of the geocomposite installation observations
- CQA documentation for the terrace drainage system installation

- CQA documentation protective cover soils and vegetative support layer installation including:
  - Laboratory testing results
  - Field testing results
- CQA documentation for storm water controls such a downchutes and scour holes
- Documentation of any design modifications
- Resumes for the geosynthetic installer and the QAC Certifying Engineer
- Record drawings including:
  - A site plan
  - A base record drawing
  - A geomembrane record drawing including panel locations, destructive test locations, and repair locations.
  - A record drawing of the top of the final closure surface including the location of all storm water controls.
  - A thickness map illustrating the thickness of the combination of the protective cover soil and vegetative support layer.

13.4.7 Document Storage

The RM shall maintain on Site, copies of all CQA and Manufacturers QC conformance test results, field reports, and CQA data logs. Originals of all CQA documentation shall be forwarded to the office of the DESIGNER for review and storage. Final disposition of all project related documentation shall be performed in accordance with the Contract Documents.

13.5 Soils CQA

13.5.1 Introduction

The purpose of this section is to describe the CQA monitoring, testing, and documentation requirements for the soil components of the containment cell and cover systems at the Site. During construction of the containment cell and cover systems, the following different classes of soil material will be used:

- Structural Fill - to construct foundations and berms to the design lines and grades;
- General Fill - Material used to backfill anchor trenches, pipe trenches, and foundations for structures such as manholes and vaults;
- Prepared Subbase – to exhibit a permeability less than or equal to 1 x 10^{-5} cm/sec;
- Aggregate - to be used as the leachate collection drainage layer material;
- Coarse Aggregate - for drainage and leachate collection systems, and gravel road upgrades (coarse aggregate used in the leachate collection system sumps must include <15% carbonate content);
- Intermediate Cover – Material used to obtain final slopes and elevations for the geosynthetic capping system subgrade;
- Protective Cover – Material used over the geosynthetic capping system and shall exhibit a permeability less than or equal to 1 x 10^{-5} cm/sec; and,
- Vegetative Support Layer - to provide support for surface vegetation;

13.5.2 Pre-Construction

13.5.2.1 Borrow Selection and Testing

The CONTRACTOR shall identify borrow sources and supplies for the various soil materials to be used during construction of the containment and cover systems. The CONTRACTOR shall arrange for testing of the proposed borrow material by a geotechnical testing laboratory approved by the OWNER in accordance with Section 01410 of the Specifications.

All soil types shall be pre-construction tested at a minimum frequency of one (1) per source. Testing requirements for each material type are as follows:

Soil Type	Test Method
Structural/General Fill & Access Road Subgrade	Grain Size Analysis (ASTM D422) Atterberg Limits (ASTM D4318) Standard Proctor (ASTM D698)
Prepared Subbase	Grain Size Analysis (ASTM D422) USCS Classification (ASTM 2487) Standard Proctor (ASTM D698) Atterberg Limits (ASTM D4318) Specific Gravity (ASTM C128) Hydraulic Conductivity (ASTM D5084) pH
Leachate Collection Layer	USCS Classification (ASTM 2487) Grain Size Analysis (ASTM D422) Hydraulic Conductivity (ASTM D2434) Carbonate Content (ASTM D3042)
Coarse Aggregate	Grain Size Analysis (ASTM D422) Carbonate Content (ASTM D1603) Permeability (ASTM D2434) Carbonate Content (ASTM D3042)*
Protective Cover	Grain Size Analysis (ASTM D422) USCS Classification (ASTM 2487) Standard Proctor (ASTM D698) Atterberg Limits (ASTM D4318) Specific Gravity (ASTM C128) Hydraulic Conductivity (ASTM D2434)
Vegetative Layer	Grain Size Analysis (ASTM D422) Atterberg Limits (ASTM D4318) pH (ASTM D4972) Organic Content (ASTM D2974) Soil Fertility (LaMotte or Baker Test)

**Note: Coarse Aggregate carbonate testing only required for materials used in the leachate collection system sumps.*

A minimum of ten business days prior to the use of the proposed material, the CONTRACTOR shall submit to the QAC, two 5-gallon bucket samples of the material, for CQA laboratory testing. The DESIGNER shall review the test results to verify compliance with the Specifications. This documentation shall be included in the Record Documentation Report. Requirements and pre-construction testing frequencies for each material type are discussed below. If, in the opinion of the QAC, the proposed material is unsuitable for the proposed application, the CONTRACTOR shall submit the above certification for material of another type, or from another source, for consideration by the QAC. Material samples submitted by the CONTRACTOR become the property of the OWNER. No soil shall be placed prior to approval by the QAC of the material and the underlying surface.

13.5.2.2 Material Requirements

13.5.2.2.1 General Requirements

General requirements for materials are as follows:

- Contain no frozen soil, organic materials, wood, trash, or other objectionable materials which may be compressible or which cannot be properly compacted;
- Contain no rock fragments, broken concrete, masonry rubble, or similar material; and,
- Be readily spread and compacted (structural fill and prepared subbase layer) to the specified density.

13.5.2.2.2 Structural Fill

Requirements for structural fill materials are contained in Section 02223 of the Specifications.

13.5.2.2.3 Prepared Subbase Soil

Requirements for prepared subbase soil materials are contained in Section 02225 of the Specifications.

13.5.2.2.4 Leachate Collection Layer

Requirements for leachate collection layer soil materials are contained in Section 02232 of the Specifications.

13.5.2.2.5 Coarse Aggregate

Requirements for coarse aggregate are contained in Section 02233 of the Specifications. Coarse Aggregate shall be used in three separate applications: Leachate collection system (refer to Section 02650), drainage system for the cap (refer to Section 02231), and for the road surface (refer to Section 02223).

13.5.2.2.6 Intermediate Cover

Requirements for intermediate cover materials are contained in Section 02224 of the Specifications.

13.5.2.2.7 Final Cover

Requirements for Final Cover materials are contained in Section 02229 of the Specifications.

13.5.2.2.8 Protective Cover

Requirements for protective cover materials are contained in Section 02234 of the Specifications.

13.5.2.2.8 Vegetative Support Layer

Vegetative support layer material requirements are contained in Section 02235 of the Specifications.

13.5.3 Construction

13.5.3.1 Subgrade Preparation

Prior to structural fill placement, the CONTRACTOR shall proof roll the subgrade surface to verify that the underlying soil is firm and does not contain excessively moist or soft areas. The RM shall visually inspect the condition of the subgrade. Areas determined by the RM to be unsuitable, shall be excavated and the removed material shall be replaced with structural fill, as required. No soil shall be placed on the subgrade without the approval of the RM.

13.5.3.2 Structural Fill

Structural fill shall be placed as indicated in the Permit Drawings. Structural fill shall not be placed until the subgrade or other component has been observed in place and approved by the RM.

Structural fill shall be placed in relatively horizontal uniform lifts not exceeding 12 inches in loose thickness throughout the fill area. Structural fill shall be compacted to a minimum of 95 percent of the maximum dry density as determined by the Standard Proctor Test (ASTM D 698). Hand-operated plate type vibratory, or other suitable, equipment may be used in areas not accessible to larger rollers or compactors as long as the density criteria is met. The RM, or QA Monitors, shall continuously monitor and document the placement of structural fill materials.

RM shall conduct field density/moisture testing (ASTM D2922/D3017). Refer to Section 02223 in the Construction Specifications for laboratory and field-testing. If, during placement of structural fill, the RM has reason to suspect that the material has changed from that previously tested and approved, he shall immediately notify the CONTRACTOR's on-site representative and arrange for additional laboratory testing. Material determined to be unsuitable by the RM shall be removed and replaced at the CONTRACTOR's expense. The CONTRACTOR shall also reimburse the QAC for the additional testing and monitoring of removing and replacing the unsuitable material. Grading tolerance for structural fill shall be -0.1 to + 0.2 feet for elevations, and -0.0 to +0.1 feet for thickness.

13.5.3.3 Prepared Subbase Layer

Prior to Subbase placement, the CONTRACTOR shall proof-roll the subgrade with heavy equipment to verify that the underlying soil is firm and does not contain excessively moist or soft areas. The RM shall visually inspect the condition of the subgrade. Areas determined by the RM to be unsuitable shall be excavated and the removed material replaced with prepared subbase material as required. No soil shall be placed above the subgrade without the approval of the RM.

The Subbase shall be placed in relatively horizontal uniform lifts not exceeding 9 inches in loose thickness and compacted to a maximum of 6 inches. A pad or sheep's-foot compactor shall be used to compact the Subbase with a minimum of four passes to a minimum of 95% of the maximum dry density as determined by the Standard Proctor test (ASTM D698). Hand-operated cleat-foot or other suitable equipment may be used in areas not accessible to larger rollers or compactors as long as the density criteria are met. Refer to Section 02224 in the Construction Specifications for laboratory and field testing requirements.

13.5.3.4 Leachate Collection Layer

Leachate collection layer shall be constructed in those areas specified in the Permit Drawings. The leachate collection layer shall be placed with minimum handling and in a manner that will result in minimal compaction.

Placement of the leachate collection layer shall meet the following requirements:

- Avoid damage to the underlying geosynthetics. Any damage shall be repaired in accordance with Section 02597/2598 of the Specifications at no additional cost to the OWNER;
- Minimize wrinkles to avoid creases and wrinkles in the geomembrane. Repair or walkout wrinkles as described in Section 02597/02598.

The RM shall continuously monitor and document the placement of all leachate drainage material and shall perform thickness checks at a minimum frequency of five locations per acre. Refer to Section 02232 in the Construction Specifications for laboratory and field-testing.

If, during placement of the leachate drainage layer, the RM should have any reason to suspect that the leachate collection layer material has changed from that previously tested and approved, they shall immediately notify the CONTRACTOR's on-site representative and arrange for additional testing. Material determined to be unsuitable by the RM shall be removed and replaced at no additional cost to the OWNER. Grading tolerance for the leachate drainage material shall be –0.0 to +0.3 feet for elevations.

Leachate collection layer material shall be transported within the cell over temporary haul roads constructed of the same drainage material. Haul roads constructed over geosynthetics shall have a minimum of 36-inch (3-feet) thickness between the geosynthetics and the transporting equipment. Leachate collection layer material shall be placed at the toe of the slope by transporting equipment, and pushed up slope by low ground pressure (LGP) bulldozers. A minimum of 12-inches shall be maintained between geosynthetics and LGP equipment. Transporting equipment shall, under no circumstances, be allowed on the slopes. The RM shall monitor and document the placement of leachate drainage material. Refer to Section 02232 in the Construction Specifications for laboratory and field-testing.

13.5.3.5 Coarse Aggregate

Coarse aggregate shall be used for drainage, leachate collection systems, and gravel road upgrades. Coarse aggregate material shall be clean, sound, tough, durable, subangular, subrounded, or round stone, not lumpy, and free from slag, cinders, ashes, rubbish, or other deleterious material. Coarse aggregate used in the Leachate Collection sumps shall have a maximum carbonate content of 15%. The CONTRACTOR shall maintain a uniform gradation of coarse aggregate.

Aggregate shall be stored in designated areas approved by the RM. The CONTRACTOR is responsible for maintaining the aggregate free of contamination. The DESIGNER or RM may at any time inspect the coarse aggregate in the on-site stockpile for contamination and, if necessary, reject all or portions of the coarse aggregate.

Coarse aggregate shall be placed to the lines, depths, and grades as shown on the Permit Drawings. The RM shall continuously monitor and document the placement of all coarse aggregate. No material shall be placed unless approved by RM. Refer to Section 02233 in the Construction Specifications for laboratory and field-testing.

13.5.3.6 Intermediate Cover

Intermediate cover shall be used to placed over the waste fill surface as specified in the Design documents. A minimum of 12-inches of compacted intermediate cover shall be placed for each cover layer.Refer to Section 02224 in the Construction Specifications for quality control (QC).

13.5.3.7 Final Cover

Final cover shall be used to obtain final slopes and elevations for the closure subgrade. A minimum of 24-inches of compacted Final Cover shall exist between the rubble waste and the final subgrade. Refer to Section 02229 in the Construction Specifications for quality control (QC).

13.5.3.8 Protective Cover Soil Layer

Prior to the placement of the protective cover for the closure cap system, laboratory testing shall be performed to develop an acceptable moisture-density-permeability "window," which will define the pass/fail criteria for field moisture-density tests. Refer to Section 02234 in the Construction Specifications for laboratory and field testing requirements.

Eighteen (18) inches of protective cover shall be placed in a single lift over the geosynthetic components of the closure system cap. A smooth-drum roller compactor shall be used to compact protective cover soil. The RM shall conduct field density/moisture testing (ASTM D2922/D3017). Failing areas shall be reworked by the CONTRACTOR until passing results are obtained at no additional cost to the OWNER.

Protective cover material shall be transported to the closure area over temporary haul roads constructed of material approved by the RM. Haul roads constructed over geosynthetics shall have a minimum of 36-inch (3-feet) thickness between the geosynthetics and the transporting equipment. Protective cover shall be placed at the toe of the slope by transporting equipment, and pushed up slope by low ground pressure (LGP) bulldozers. A minimum of 12-inches shall be maintained between geosynthetics and LGP equipment. Transporting equipment shall, under no circumstances, be allowed on the slopes.

On steep slopes, compaction may be obtained through tracking with the placement equipment instead of a smooth-drummed roller, as a smooth-drummed roller may not be stable, particularly under conditions of excess moisture.

The RM shall monitor and document the placement of protective cover. Refer to Section 02234 in the Construction Specifications for laboratory and field-testing.

13.5.3.9 Vegetative Support Layer

Vegetative support layer shall be used in those areas specified in the Permit Drawings. No vegetative support layer shall be placed until placement of underlying soil layer is complete and approved by the RM. Vegetative support layer shall be placed in all areas indicated on the Permit Drawings and as directed by the DESIGNER to a minimum thickness of 6 inches. The vegetative soil layer shall be tracked perpendicular to the toe of slope with a low ground pressure tracked dozer (< 5 psi) prior to seeding. Heavy equipment transporting vegetative support layer material shall, under no circumstances, be allowed on slopes. Vegetative material shall be placed at the toe of the slopes by transporting equipment and pushed up slope by LGP equipment.

The RM shall continuously monitor and document the placement of the vegetative support layer. Soil shall be graded to blend in with existing grades and to prevent surface ponding or erosion. Mixing of underlying soil with the vegetative support layer during installation shall be avoided. Mixing excessive amounts of gravel sized or larger material from the substrate into the vegetative support layer, which may restrict growth of vegetation, shall be avoided. The minimum thickness of soil is as shown on the permit drawings. The vegetative support layer thickness tolerance is 0.0 to +0.3 feet. Refer to Section 02235 in the Construction Specifications for laboratory and field-testing.

13.5.3.10 Temporary Berms

Temporary runoff containment soil berms shall be constructed in accordance with Section 02125 of the Specifications, titled, "Temporary and Permanent Erosion and Sedimentation Control", the Maryland Specifications for Soil Erosion and Sediment Control (1994, or newer version), and as required by the sequencing of the construction activities.

13.5.3.11 Excavations

The extent of excavations left open shall be kept to a minimum. Unless otherwise directed, excavations shall be backfilled as soon as possible after the Work is observed, tested as required and accepted, and permission to backfill has been given by the RM. Immediately prior to backfilling, all rubbish, debris, forms and similar materials shall be removed from the excavations.

13.6 Geotextile

13.6.1 Introduction

The purpose of this section is to describe the CQA monitoring, testing, and documentation requirements for the geotextile components of the containment cell and closure system at the site. Geotextile requirements are contained in Section 02595 of the Specifications.

13.6.2 Pre-Installation

13.6.2.1 Manufacturer's QC Certification

The CONTRACTOR shall provide the QAC with copies of the Manufacturer's QC Certificates for the material supplied to the project prior to delivery of the material to site. The QAC shall review these certificates to verify that the material's properties comply with the Specifications. Material properties and Manufacturer's Quality Control testing frequencies for woven and non-woven geotextile are contained in Section 02595 of the Specifications.

13.6.2.2 Labeling

The Manufacturer shall identify each roll of geotextile with the following:

- Manufacturer' s name;
- Product identification;
- Lot number;
- Roll number;
- Roll weight; and,
- Roll dimensions.

The RM shall examine rolls upon delivery and any deviation from the above requirements shall be reported to the CONTRACTOR and DESIGNER.

13.6.2.3 Inventory, Storage, and Handling

The CONTRACTOR shall be responsible for the proper storage and handling of the material. The CONTRACTOR shall designate and prepare a geosynthetics storage area prior to the arrival of the material. This area should be readily accessible, and shall provide the geotextile with adequate protection against dirt, mud, sharp objects, impact, and other possible sources of damage. Upon arrival, the CONTRACTOR shall unload the geotextile in such a manner as to minimize the risk of damage to the material, and place the rolls in the prepared storage area.

The RM shall verify that the geotextile storage area is adequate. The RM shall perform a physical inventory of all geotextile delivered to the site for use in the containment and cover systems, and shall record the project identification, the date of arrival, the method of transport, the manufacturer's roll number, the condition of each roll on arrival, and all damage caused during unloading. The RM shall verify that the material delivered corresponds to the Manufacturer's QC Certificates.

13.6.2.4 CQA Conformance Testing

The RM shall collect and ship samples of the geotextile for CQA geosynthetics laboratory testing as soon as practicable after delivery. Samples shall be 3 feet long in the machine direction by the width of the roll, and shall not be taken from the first 3 feet of the roll. The RM shall mark each sample with the Manufacturer's roll number and an arrow indicating the machine direction. Conformance testing of geotextile shall be performed in accordance with the Construction Specifications. Material properties and Quality Assurance conformance testing frequencies for the non-woven geotextile are summarized in the tables contained in Section 02595 of the Construction Specifications.

Upon receipt of CQA test results, the RM shall verify that the material meets project specifications. Should the material fail to meet project specifications, the RM shall notify the DESIGNER. The CONTRACTOR shall remove rejected material from the site, or store it at a location separate from accepted rolls until they can be removed from site. The RM shall obtain and ship additional conformance test samples from the closest numerical rolls to the rejected material. Should either or both of these samples fail to meet project specifications, the CONTRACTOR shall continue to test the next closest numerical rolls until passing conformance tests bound the failed material. The cost of all-additional testing and replacement of all non-conforming material shall be borne exclusively by the CONTRACTOR.

13.6.3 Installation

13.6.3.1 Deployment

Prior to deployment of the geotextile, the RM shall verify that the manufacturer's QC certification and CQA Geosynthetics Laboratory conformance test results have been received, and that the material meets the project specifications.

The geotextile shall be placed in such a manner as to minimize the risk of damage to the material. It shall be laid smooth and free of tension, stress, folds, wrinkles, or creases. In the presence of wind, geotextile shall be weighted with sandbags or the equivalent. Refer to Section 02595 in the Construction specifications for specific installation procedures.

13.6.3.2 Seams and Overlaps

Filter geotextile shall be sewn. All sewing shall be done using a polymeric thread with chemical and ultraviolet light resistance properties equal to or exceeding that of the geotextile. In general, no horizontal seams shall be allowed on steep slopes (i.e., slope greater than 8%), except as part of a repair. Seams should be along, not across the line of maximum slope. The RM shall visually inspect each seam to verify continuity of stitching. The INSTALLER shall repair any sewing discontinuities at no additional expense to the OWNER.

13.6.3.3 Repair

The RM shall visually inspect the geotextile for damage. Damage shall be repaired by placing a piece of geotextile over the damaged area. The patch shall overlap the defect for a minimum of three (3) feet in each direction, and shall be continuously leistered (heat tacked) around the edges.

13.7 Geomembrane

13.7.1 Introduction

The purpose of this section is to describe the CQA monitoring, testing, and documentation requirements for the geomembrane component of the Chesapeake Terrace Rubble Landfill containment cell liner system and the final closure system. The geomembrane component of the containment liner system consists of a single 60-mil High Density Polyethylene (HDPE) textured geomembrane layer, while the final closure system utilizes a 40-mil, Linear Low Polyethylene (LLDPE) textured geomembrane. The requirements for both of these geomembranes are contained in Sections 02597 and 02598, respectively, of the Specifications.

13.7.2 Pre-Installation

13.7.2.1 Manufacturer's QC Certification

The CONTRACTOR shall provide the PM and RM with copies of Quality Control Certificates for the material supplied to the project. The PM and RM shall review these certificates to verify that the material properties comply with Section 02597 and 02598 of the Specifications. Material properties and Manufacturers' Quality Control testing frequencies for geomembrane are summarized in the table included in the Construction Specification Sections 02597 and 02598.

13.7.2.2 Inventory, Storage, and Handling

The CONTRACTOR shall be responsible for the proper storage and handling of the material. The CONTRACTOR shall designate and prepare a geosynthetics storage area prior to the arrival of the material. This area should be readily accessible, and shall provide the geomembrane with adequate protection against dirt, mud, sharp objects, impact, and other possible sources of damage. On arrival, the CONTRACTOR shall unload the geomembrane in such a manner as to avoid the risk of damage to the material, and place the rolls in the prepared storage area.

The RM shall verify that the geomembrane storage area is adequate. The RM shall perform a physical inventory of all geomembrane delivered to the site for use in the containment and cover systems, and shall record the project identification, the date of arrival, the method of transport, the manufacturer's roll number, the condition of each roll on arrival, and all damage caused during unloading. The RM shall verify that the material delivered corresponds to the previously submitted Manufacturer's Quality Control Certificates.

13.7.2.3 CQA Conformance Testing

The RM shall collect and ship samples of the geomembrane for CQA Geosynthetics Laboratory testing as soon as practicable after delivery. Samples shall be three (3) feet long in the machine direction by the width of the roll, and shall not be taken from the first three (3) feet of the roll. The RM shall mark each sample with the manufacturer's roll number and an arrow indicating the machine direction. Geomembrane conformance testing shall be performed in accordance with Sections 02597 and 02598 of the Specifications. Material properties and Quality Assurance conformance testing frequencies are summarized in the tables included in the Construction Specification Sections 02597 and 02598.

Upon receipt of CQA Geosynthetics Laboratory test results, the RM shall verify that the material meets project specifications. Should the material fail to meet project specifications, the RM shall notify the DESIGNER. The CONTRACTOR shall remove rejected material from the site, or store at a location separate from accepted rolls until they can be removed from site. The RM shall obtain and ship additional conformance test samples from the closest numerical rolls bracketing the rejected material. Should either or both of these samples fail to meet project specifications, the

CONTRACTOR shall continue to test the next closest numerical rolls until passing conformance tests bound the failed material. The cost of all additional testing, and replacement of all non-conforming material shall be borne exclusively by the CONTRACTOR.

13.7.3 Installation

13.7.3.1 Deployment

Prior to deployment of a roll of geomembrane, the RM shall verify that the Manufacturer's QC certification and CQA Geosynthetics Laboratory conformance test results have been received and that the material meets the Construction Specifications.

Immediately prior to panel deployment, the INSTALLER and the RM shall confirm that the subgrade layer has a smooth surface, free of stones, sharp objects, debris, or excessive moisture that could damage the geomembrane or adversely affect seaming operations.

Any portion of the subgrade deemed unsuitable by either the INSTALLER or the RM shall be repaired or reworked by the CONTRACTOR at no additional costs to the OWNER, until it meets the specifications. During each day of geomembrane deployment, a subgrade certification will be completed and signed by the geosynthetic installation superintendent and the RM.

Geomembrane deployment shall not proceed when the ambient air temperature measured 6-inches above the geomembrane are below 32^0F or above 104^0F, unless otherwise directed by the DESIGNER. Geomembrane deployment shall not be performed during precipitation, or when winds exceed 20 mph, unless the Contractor pre-submits acceptable evidence (to be approved by the DESIGNER) that performance standards can be maintained under these conditions.

During deployment, the INSTALLER shall write the panel and manufacturers roll numbers on each panel. Unique panel numbers shall be marked, on each panel, numerically in the order they are installed. The RM, or his designee, shall maintain a log indicating the correlation between the panel number and the manufacturer's roll number. The RM shall complete a panel deployment log containing the panel number, the manufacturers roll number, the deployment date, the panel condition on deployment, the observed overlap, and the deployed length. The RM shall maintain a field sketch indicating the relative location of deployed panels.

The INSTALLER shall only deploy panels that can be welded during the same day. Panels deployed on side slopes shall be oriented along the maximum line of slope. Panels shall be deployed with the fewest possible wrinkles or fishmouths. The INSTALLER shall ensure that the deployment method avoids potential damage to the geomembrane, and that deployed panels are adequately protected against wind uplift and associated damage.

13.7.3.2 Field Seaming

For the geomembrane components of the containment and cover systems, field seams shall be of the following type:

- Fusion weld – A seam produced by melting the two intimate surfaces by running a hot metal wedge between the surfaces followed immediately by pressure to form a homogeneous bond. This seam has an integral air channel for non-destructive testing.
  - All areas to be seamed shall be free of dust, dirt, and excessive moisture.
  - In general, the geomembrane panels shall be aligned to have a nominal overlap of 6 inches.
  - No solvent or adhesive

- Extrusion weld – A seam produced by extruding molten parent HDPE resin between or at the edge of two overlapped HDPE panels. A bonded seam is completed when extruded hot resins melt adjacent sheet resins to form a homogeneous bond.
    - All areas to be seamed shall be free of dust, dirt, and excessive moisture.
    - In general, the geomembrane panels shall be aligned to have a nominal overlap of 3 inches.
    - Grinding shall be performed no more than 1 hour prior to seaming.
    - Clean dry welding rod shall be used for seaming.
    - Exposed grinding adjacent to extrusion seams shall be kept to a minimum, and shall at no point exceed ¼-inch.
    - No solvent or adhesive shall be used during seaming.

13.7.3.3 Trial Seam Testing

Prior to production welding, each Seamer shall produce a trial seam. Trial seams shall be made at the beginning of each shift, following restart of welding equipment, upon a change of seamers, and at least once each five (5) hours of seaming that day.

Fusion and extrusion trial seams shall be a minimum of five (5) feet long. Trial seams shall be welded under the same field conditions as production welding. Seamers shall produce trial seams for each machine. The Seamer shall mark each trial seam with the machine number, temperature, speed, date, and time the trial seam was produced, and the Seamer's initials or other means of identification.

The INSTALLER shall cut and test six 1-inch wide coupons from each trial seam. Three coupons shall be tested for peel adhesion and three coupons shall be tested for bonded seam strength (also known as "shear"). Both the inside and outside weld of fusion welds shall be tested for peel adhesion. Testing of coupons must meet project specifications for geomembrane seam destructive test samples as indicated in the table included in the Construction Specification Sections 02597 and 02598.

If a trial seam fails to meet project specifications, the Seamer will weld a second trial seam. If the second trial seam fails to meet project specifications, the INSTALLER shall investigate the cause of the failures and take the necessary corrective action. Once the deficiency is corrected, the Seamer must produce two consecutive passing trial seams before being permitted to begin or resume production welding. If, at any point during the day, a seamer fails three trial welds prior to acceptance for production welding, the seamer and/or the seaming apparatus shall not be used for seaming that day.

The RM shall observe trial seam testing, and maintain a log containing the project identification, the date and time the trial seam was produced, ambient temperature, machine and Seamer identification, the machine temperature and speed, and the strength and mode of failure of each coupon.

13.7.3.4 General Seaming

The Master Seamer, as defined in Sections 02597 and 02598 of the Specifications, shall be on-site at all times during production welding. Only Seamers that have produced trial welds meeting Construction Specifications shall perform production welding. Welding at night shall be avoided unless approved in writing by the DESIGNER.

Welding of geomembrane seams will not be performed during inclement weather. Emergency seams welded in unsuitable weather conditions will be removed and replaced, or capped. Welding in temperatures less than 32° F or greater than 104° F shall be permitted only with the approval of the OWNER, or DESIGNER, and after the INSTALLER has demonstrated that welding can be successfully performed in those conditions.

Seams shall be lapped to produce a "shingle" effect. Temporary rub sheets may be used as conditions warrant; however, no rub sheet shall be left below the geomembrane. At the beginning of each seam, the Seamer shall record the date, start time, machine, and Seamer identification on the geomembrane. All seams shall be welded through the anchor trench.

Fishmouths, or wrinkles at the seam overlaps, shall be cut along the ridge of the wrinkle to achieve a flat overlap. Cut wrinkles shall be overlapped a minimum of three (3) inches and seamed, or patched, and any area where the overlap is inadequate shall be patched.

Geomembrane panels shall be staggered such that cross seams between panels are not continuous throughout the geomembrane area. Panel layouts shall be such that no horizontal seams (cross Seams) are constructed on slopes steeper than eight percent (8%). No horizontal seams (cross seams) shall be within five (5) feet from the toe or crest of the slope or areas of potential stress concentrations unless approved by the RM.

The INSTALLER shall mark, on the starting end of the seam, the machine, the seamer identification, the date, and the start time. The RM shall monitor and document welding operations. The RM shall employ a method of uniquely identifying each geomembrane seam. The RM shall maintain a log for each seam noting the project identification, the machine and Seamer identification, the start time, the machine start and end points, the approximate ambient temperature, and the length of the seam.

13.7.3.5 Defects and Repairs

The RM shall observe the geomembrane panels and seams for any damage or deficiency that may adversely affect the performance of the geomembrane. The RM shall mark each defect with a unique identification code, and maintain a log noting at a minimum the defect location, and type.

Any portion of the geomembrane containing a defect or failed seam (destructive or non-destructive) shall be repaired by the INSTALLER at no additional cost to the OWNER. Available repair techniques include the following:

- Patching – used to repair all holes, intersections, tears, and contaminated areas in the geomembrane.
- Capping – used to repair a failed seam length area with either fusion or extrusion welding.
- Removal of bad seam and replacing area with new material welded into place.

Only those Seamers completing a successful trial weld with the extrusion welder shall perform repairs. All holes in the geomembrane shall be patched. Failed fusion or extrusion seam lengths shall be removed or capped. All panel "T" intersections shall be capped. Use of the "grind and weld" repair technique shall be minimized to very small defects in the geomembrane as approved by the RM. Temporary repairs (e.g. emergency patches welded in the rain) shall be marked "Temp." For each repair, the Seamer shall record the date, start time, and machine and seamer identification on the geomembrane.

General Practices for performing repairs shall be as follows:

- Surface to be repaired shall be clean and dry.
- Surface to be extruded shall be abraded (ground) no more than 1 hour prior to seaming.
- Patches shall extend a minimum of 6 inches beyond the edge of the defect on all sides with the corners of the patch rounded.

The RM shall monitor and document the repair of each defect. Repair documentation shall include at a minimum the project identification, the date, approximate time, type, and size of the repair, and identification of the welding machine and Seamer.

13.7.3.6 Non-Destructive Testing

13.7.3.6.1 Introduction

This section discusses the non-destructive testing of fusion and extrusion welds. All production welds and repairs shall be non-destructively tested over their entire length. Non-destructive testing shall be performed as soon as possible after completion of the weld. Air pressure testing shall be performed prior to the removal of seam destructive test samples. Welds failing to meet the non-destructive test specifications shall be removed and replaced or capped at no additional cost to the OWNER.

13.7.3.6.2 Pressure Testing

All dual track fusion seams shall be non-destructively tested using the air pressure test method as described in Sections 02597 and 02598 of the Construction Specifications. Both ends of the weld shall be sealed and the air channel pressurized to approximately thirty (30) psi. After stabilization, the initial pressure shall be recorded. The pressure shall be monitored for a period of five (5) minutes, and the final pressure recorded. The test is considered to be passing if the pressure drop is less than or equal to three (3) psi for HDPE and four (4) psi for LLDPE during the five (5) minute interval. If the pressure test fails to meet project specifications, the INSTALLER shall determine the cause of the failure and correct the deficiency. The affected weld may be retested, removed, or capped.

At the conclusion of the test, the air channel shall be cut at the end opposite from the point of pressurization and the air channel depressurization noted. If the air channel does not depressurize, the INSTALLER shall identify and remove the source of the blockage, and retest the affected seam.

The INSTALLER's Technician performing air pressure testing shall mark the date, the initial and final pressures, the test start and end times, and technician identification on the geomembrane.

The RM, or his designee, shall monitor and document all pressure testing. The RM shall maintain a pressure test log containing at a minimum the project identification, the date of the test, identification of the seam or portion of seam being tested, test start and end times, the initial and final test pressures, and the identification of the technician performing the test.

13.7.3.6.3 Vacuum Testing

All extrusion welds shall be non-destructively tested using the vacuum test method described in Sections 02597 and 02598 of the Construction Specifications. The weld shall be wetted with a soapy water solution and an approved vacuum testing apparatus capable of producing a minimum vacuum pressure of 5 psi. The vacuum shall be maintained for a minimum of 10 seconds. If no leaks (as indicated by a stream of bubbles) are detected, the vacuum will be released and the vacuum box advanced. A minimum overlap of 3 inches between tests shall be maintained. The procedures described in specification sections 02597 and 02598 shall be followed where vacuum testing is not feasible.

The INSTALLER's Technician performing vacuum testing shall mark the date, technician identification, and a notation of the test result (e.g. VT OK for a passing test) on the geomembrane for all vacuum tests performed.

The RM, or his designee, shall monitor vacuum testing. The RM shall record at a minimum the project identification, the date, the repair number, the seam, or portion of seam, the technician identification and the test results for all vacuum testing.

13.7.3.6.4 Leak Testing

A geomembrane leak location survey shall be performed in the cell geosynthetic barrier layer as described in Section 02597 of the Construction Specifications.

13.7.3.7 Geomembrane Seam Destructive Testing

Destructive testing of fusion and extrusion welding shall be performed at a minimum rate of one (1) per 500 linear feet of weld for each welding machine, or as directed by the RM, to evaluate seam strength. This minimum frequency shall be determined as an average taken from the total linear footage of seaming, per machine, at the end of the geomembrane installation. Test locations shall be determined during seaming and may be prompted by the suspicion of overheating, contamination, offset welds, or any other potential cause of inadequate welding.

The RM will ensure that sufficient destructive test samples are taken for each machine to meet Specifications. The RM shall assign each destructive test sample with a unique identification number, and mark and document the location of the sample. The sample shall be approximately five (5) feet long, and will be divided into three sections. Each section shall be marked with the destructive sample identification number, the seam number, machine and Seamer identification, the machine temperature and speed, and the date.

The INSTALLER shall remove the sample in a timely manner, and repair the resulting defect. One, 1-inch wide test strip shall be cut from each end of the sample to be tested in the field as specified for peel adhesion. If the test strips pass, the installer shall cut the sample into three sections as indicated. One section will be retained as an archive by the INSTALLER, one section will be shipped to the Geosynthetics CQA Laboratory for testing, and the third will be retained as an archive by the OWNER. If one of the test strips fails, the sample shall be considered a failure and the seam should be repaired in accordance with 13.8.3.5 of the CQA Plan.

13.7.3.8 Laboratory Destructive Testing

Laboratory destructive testing shall include bonded seam strength (shear) and peel adhesion. The minimum acceptable values for these tests are shown in the table included in the Construction Specification Sections 02597 and 02598. A minimum of five coupons shall be tested for both peel adhesion and shear seam strength, with the coupons being selected alternatively by test from the sample. A passing test shall meet the minimum acceptable values and FTB (Film Tear Bond) in at least four of five coupons for each test method. Seam separation shall not extend more than 25% into the seam. Seam separation greater than 25% into the seam shall be considered failing. In the event of a destructive test failure, the Installer has two options:

- The Installer can cap or remove the failed seam between two passing destructives.
- The Installer can have the RM mark additional samples along the welding path a minimum of 10 feet from the failed test in each direction. These samples shall be

marked, removed, and tested as indicated above. If both tests pass, the failed seam between the passing destructives shall be capped or removed. If one or both of the samples fail, the process is repeated until passing tests are achieved on both sides of the original failure to establish the area of failed seam to be capped or removed.

All acceptable repaired seams must be bound by a passing laboratory destructive tests on each end. Laboratory destructive samples must come from field seaming, and shall be tracked back to previous days welding if necessary. Trial welds shall not be used for destructive samples to bind failed seaming.

13.8 Geocomposite Drainage Layer

13.8.1 Introduction

The purpose of this section is to describe the CQA monitoring, testing, and documentation requirements for the geocomposite drainage layer of the containment cell and final cover system at the Site. The geocomposite drainage layer requirements are contained in Section 02418 of the Specifications.

13.8.2 Pre-Installation

13.8.2.1 Manufacturer's QC Certification

The CONTRACTOR shall provide the PM and RM with copies of the Manufacturer's QC Certificates for the material supplied to the project. The PM and RM shall review these certificates to verify that the material properties comply with the Construction Specifications. Material properties and Manufacturers Quality Control testing frequencies for the geocomposite drainage layer are contained in Section 02418 of the Construction Specifications.

13.8.2.2 Inventory, Storage, and Handling

The CONTRACTOR shall be responsible for the proper storage and handling of the material. The CONTRACTOR shall designate and prepare a geocomposite drainage layer storage area prior to the arrival of the material. This area should be readily accessible, and shall provide the geocomposite with adequate protection against dirt, mud, sharp objects, impact, and other possible sources of damage. Upon arrival, the CONTRACTOR shall unload the geocomposite in such a manner as to minimize the risk of damage to the material, and place the rolls in the prepared storage area.

The RM shall verify that the geocomposite storage area is adequate. The RM shall perform a physical inventory of all geocomposite delivered to the site for use in the cell construction and final cover system, and shall record the project identification, the date of arrival, the method of transport, the manufacturer's roll number, the condition of each roll on arrival, and all damage caused during unloading. Each roll shall be marked or tagged with the following information: manufacturer's name; project identification; lot number; roll number; and roll dimensions. The RM shall verify that the material delivered corresponds to the Certificates. Any damaged rolls may be rejected. Rejected material is to be removed from the site or stored at a location separate from accepted rolls until they can be removed from the site. Geocomposite rolls, which do not have proper manufacturer's documentation, must also be stored at a separate location, until all documentation has been received and approved.

13.8.2.3 CQA Conformance Testing

The RM shall collect and ship samples of the geocomposite for CQA geosynthetics laboratory testing as soon as practicable after delivery. Samples shall be 3 feet long in the machine direction by the width of the roll, and shall not be taken from the first 3 feet of the roll. The RM shall mark each sample with the Manufacturer's roll number and an arrow indicating the machine direction. Conformance testing of geocomposite shall be performed in accordance with the Construction Specifications. Material properties and Quality Assurance conformance testing frequencies for the geocomposite are located in Section 02418.

Upon receipt of CQA test results, the RM shall verify that the material meets project specifications. Should the material fail to meet project specifications, the RM shall notify the DESIGNER. The RM shall obtain and ship additional conformance test samples from the closest numerical rolls to the rejected material. Should either or both of these samples fail to meet project specifications, the CONTRACTOR shall continue to test the next closest numerical rolls until passing conformance tests bound the failed material. Failed material shall be removed, by the CONTRACTOR, from the site, or stored at a location separate from accepted rolls until they can be removed from the site. The cost of all additional testing, and replacement of all non-conforming material shall be borne exclusively by the CONTRACTOR.

13.8.3 Installation

13.8.3.1 Deployment

Prior to the installation of the geocomposite, the RM will monitor that all lines and grades have been verified by the contractor and that the geomembrane has been installed in accordance with the specifications and all associated documentation has been completed.

During the placement of the geocomposite, the RM (or his designee) shall observe deployment, record all defects and defect corrective actions (panel rejected, patch installed, etc.). The RM shall verify that corrective actions are performed in accordance with the specifications. The RM shall monitor that equipment used does no damage the geocomposite by handling, equipment transit, leakage of hydrocarbons, or other means. The crews working on the material shall not smoke, wear shoes or engage in activities that could damage the geocomposite. The geocomposite shall be securely anchored to prevent movement by the wind. Adjacent panels shall be installed in accordance with the specifications. The RM shall examine the geocomposite after installation to ensure that no potentially harmful foreign objects are present.

The RM (or his designee) shall inspect the completed work for holes, tears, small defective areas, large wrinkles, bridging, and any other defect and shall verify that repairs are made in accordance with project specifications. The repair procedures for the geocomposite include patching, used to repair large holes, tears, and small defective areas, and removal, used to replace large defective areas where patching is not appropriate.

13.9 HDPE Pipe

13.9.1 Introduction

This section describes CQA procedures for high-density polyethylene (HDPE) pipe installations. Perforated and solid HDPE pipe will be utilized to construct the leachate collection and recovery system. CQA for the HDPE pipe installations shall be performed to verify that HDPE pipe systems are installed in accordance with the design. Construction shall be conducted in accordance with the project permit drawings and specifications.

To monitor compliance, the RM will: (1) review the contractor's quality control submittals; (2) monitor construction testing; and (3) monitor installations. All construction testing shall be conducted in accordance with the project technical specifications.

13.9.1.1 Delivery

Upon delivery of the HDPE pipe, the RM Monitor will:

- Observe pipe for damage during shipping and handling. Identify damaged materials and document that damaged materials are set aside.
- Document that all manufacturing documentation required by the specifications has been received.
- Monitor that pipe out-of-roundness does not occur due to excessive stacking heights when the pipe is stored at the site.

Damaged pipe or pipe sections shall be rejected. If rejected, document that pipe is removed from the site or stored at a location, separate from accepted pipe. Pipe that does not have proper manufacturer's documentation must be stored at a separate location, until all documentation have been received, reviewed, and accepted.

13.9.1.2 Conformance Testing

No conformance testing is required for HDPE pipe. The RM shall review manufacturer's certifications.

13.9.1.3 Pipe Installation and Welding

During pipe installation and welding, the RM will:

- Monitor that the pipe is not damaged during handling operations.
- Monitor that the pipe is not damaged by sharp rocks or excessive abrasion when the pipe is pulled into place during fusion welding and installation operations.
- Before pipe fusion welding operations and installations verify that solid walled pipe, perforated pipe, fittings, and flanged couplings comply with product requirements of the technical specifications.
- Monitor that certified fusion-welding operators will be performing the welding.
- Monitor that caution is taken to prevent water from coming in contact with the pipe and heater plates during welding operations. A shelter may be required for the fusion-welding machine to allow operations to continue in adverse weather conditions.
- Monitor that inside and outside of the pipe ends are cleaned to remove dirt, water, grease, and other foreign material.
- Monitor that pipe ends are squarely faced with the facing tool of the fusion-welding machine.
- Monitor that pipe ends line up in the fusion-welding machine and that the pipe ends meet squarely and completely over the entire surface to be welded. Monitor at this point that the pipe is securely clamped into place so that the pipe does not move during the fusion welding process.
- Monitor that the heater plate is clean and maintains the appropriate temperature. Monitor that the heater plate is inserted between the aligned pipe ends and that the pipe ends are firmly brought into contact with the heater plate. NO PRESSURE shall be applied to achieve the melt pattern.

- Monitor that the pipe ends are allowed to heat and soften. As the pipe heats and softens a melt bead begins to roll back from the contact point of the heater plate and the pipe ends.
- Monitor that the heater plate is removed quickly and cleanly when the appropriate melt bead is achieved and that no melted pipe material sticks to the heater plate. If melted material sticks to the heater plate, Monitor that this joint is discontinued, the heater plate is cleaned, the pipe ends are re-faced, and that the joint is re-started.
- Monitor that the melted pipe ends are rapidly joined together and that enough pressure is applied to the joint to form a melt bead 1/8-inch to 3/16-inch in diameter around the entire circumference of the pipe. Pressure is critical to cause the heated material of each pipe end to flow together.
- Monitor that the joint is allowed to cool and solidify properly before the pipe is released from the fusion-welding machine. Cooling and solidification is completed when your finger can remain comfortably on the bead.
- Examine the joint when the pipe is released from the fusion-welding machine to verify that the weld is completely around the entire circumference of the pipe.

13.9.1.4 Pressure Testing of Joints

The joints of non-perforated HDPE pipes shall be tested by the pipe Installer using the pressure test procedures given in ASTM C924 under the observation of the RM.

13.9.1.4.1 Segment Testing

Prior to the installation of the polyethylene piping, the installer will perform a pressure test using the following procedures:

- Similar sizes of polyethylene piping shall be butt welded together into testing. Segments shall be fitted with a cap on one end and testing apparatus on the other.
- The segment to be tested should be laid on the ground surface and allowed time to reach constant and/or ambient temperature before initiating the test.
- The test should be performed during a period when the pipe segment will be out of direct sunlight when possible, i.e., early morning, late evening, or cloudy days. This will minimize the pressure changes that will occur during temperature fluctuations.
- The test pressure shall be a minimum of 20 psi.
- The allowable pressure drop observed during the test shall not exceed 1 percent of the testing gauge pressure over a period of 1 hour. This pressure drop shall be corrected for temperature changes before determining pass or failure.
- The RM shall be notified before testing procedure and shall have the option of being present during the test.

The CONTRACTOR shall furnish the equipment for this testing procedure. This shall consist of a polyethylene flange adaptor with a PVC blind flange equal in size to the blower inlet valve. Tapped and threaded into the blind flange will be a temperature gauge 32°F to 2l2°F (0 to 100°8C), a pressure gauge 0 to 20 psi (0 to 1 kg/cm^2), a. "tire valve" to facilitate an air compressor hose, and a ball valve to release pipe pressure at completion of test. Polyethylene reducers shall be utilized to adapt test flange to size of pipe being tested.

13.9.1.4.2 Test Failure

- The following steps shall be performed when a pipe segment fails the 1 percent - 1 hour test:
  - The pipe and all fusions shall be inspected for cracks, pinholes or perforations.
  - All blocked risers and capped ends shall be inspected for leaks.
  - Leaks shall be verified by applying a soapy water solution and observing soap bubble formation.
- All pipe and fused joint leaks shall be repaired by cutting out the leaking area and refusing the pipe.
- After all leaks are repaired, a retest shall be performed in accordance with Section 13.10.1.4.

13.9.1.4.3 Test Reporting

All testing shall be reported by the CONTRACTOR to the RM and shall include the following information:

- Date
- Test time start and stop
- Testing pressures at start and stop
- Person performing test
- Test results

13.10 Surveying

Surveying of lines and grades will be conducted in accordance with the requirements of Section 01050 of the Specifications. The CONTRACTOR shall maintain at the Work Site a complete, accurate log of control and survey work as it progresses.

Upon completion of each phase of work requiring services of the Surveyor, the CONTRACTOR shall submit to the PM and RM Record Drawings and survey notes signed by the Surveyor stating that elevations and locations of site-constructed features are in conformance, or non-conformance with Contract Documents.

Upon completion of the work, all Record Drawings must be submitted to the OWNER under provisions of Project Record Documents (Section 01564) by the CONTRACTOR.

13.11 Plan Modification Procedure

Should this CQA Plan require modification, the proposed change shall be submitted in writing to the DESIGNER and the OWNER for review. A letter requesting approval of the change will be submitted to the MDE Solid Waste Program if the proposed modification is deemed appropriate. An addendum shall be attached to copies of the CQAP following receipt of approval from MDE.

a Montrose Environmental Group company

SECTION 14

TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

14.0 CONSTRUCTION SPECIFICATIONS

TABLE OF CONTENTS
(continued)

PART 1 - GENERAL

1.1 Description of Work

Work under this Section includes all surveying services required for accurate location of all features of construction, and for establishing proposed grades and elevations.

1.2 Quality Control

CONTRACTOR is responsible for all surveying necessary for control of its work at the Site. His Surveyor shall be a qualified and Registered Land Surveyor in the State of Maryland. This Surveyor shall also have a minimum of two (2) years experience in Construction Surveying layout, and maintenance of Record Drawings, with a record of performing horizontal and vertical control requirements as stated in the Contract.

1.3 Submittals

A. CONTRACTOR shall submit Name, address, and telephone number of Surveyor to OWNER before starting survey work.
B. CONTRACTOR shall submit to QAC, on request, documentation verifying accuracy of survey work.

1.4 Survey Requirements

A. CONTRACTOR shall utilize existing control points and establish new control points as needed to complete work under this Section.
B. CONTRACTOR shall provide field engineering services, and use recognized engineering survey practices.
C. Establish elevations, lines and levels. Locate and layout by instrumentation and similar appropriate means Site improvements including, roadways, stakes for grading and fill placement, utility locations, slopes, and invert elevations.
D. Periodically verify layouts by same means.

1.5 Survey Tolerances

Grading Tolerances shall be as defined in Division 2 of these specifications.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 Inspection

CONTRACTOR shall verify locations of Site reference and survey control points prior to starting work. QAC must be promptly notified of any discrepancies discovered.

3.2 Survey Reference Points

A. CONTRACTOR shall take measures to protect Site reference and survey control points prior to starting work, and must preserve permanent reference points during construction. Site reference points may not be relocated without prior written notice to OWNER and QAC.
B. The QAC shall be immediately notified of loss, damage or destruction of any reference point, or relocation required because of changes in grades or other reason. CONTRACTOR shall replace disturbed survey control points based on original survey control at no additional cost to the OWNER.
C. X, Y, and Z coordinates of benchmarks and survey control points shall be determined (and recorded) with a maximum permissible error of 0.10 feet (±) in any coordinate direction.
D. All X and Y coordinates are to be referred to the Project coordinate system with an accuracy of 0.10 feet (±).
E. All Z coordinates are to be referred to nearest NGVD benchmark with an accuracy of 0.10 feet (±).

3.3 Survey Requirements

A. CONTRACTOR shall reference survey and data reference points to permanent benchmarks and record locations of survey control points, with horizontal and vertical data.
B. CONTRACTOR shall reverify layouts periodically during construction by same means.

***** END OF SECTION *****

PART 1 - GENERAL

1.1 Description of Work

A. Work under this Section includes all scheduling and administration of pre-construction and progress meetings as herein specified and necessary for the proper and complete performance of this Work.

B. Scheduling and Administration by OWNER and QAC shall include the following:

1. Record minutes, including significant proceedings and decisions.
2. Distribute copies of the Minutes to participants within five (5) working days after each meeting.

C. CONTRACTOR shall make physical arrangements for meetings. Representatives of CONTRACTOR, subcontractors, and suppliers attending the meetings shall be qualified and authorized to act on behalf of the entity each represents. QAC will ascertain that Work is expedited consistent with Contract Documents and the construction schedules.

1.2 Pre-Construction Meetings

A. The OWNER shall schedule the preconstruction conference prior to the issuance of the Notice to Proceed. The geosynthetics pre-installation meeting shall be held as soon as practicable following start of the Work.

B. Representatives of the following parties are to be in attendance at the meetings:

1. OWNER.
2. DESIGNER.
3. Quality Assurance Contractor (QAC)(may be same as DESIGNER)
4. CONTRACTOR, including Superintendent.
5. Major subcontractors.
6. Representatives of governmental or regulatory agencies, when appropriate.

C. The agenda for the preconstruction meeting shall consist of the following as a minimum:

1. Distribute and discuss a list of major subcontractors/suppliers, and a tentative construction schedule.
2. Critical work sequencing.
3. Designation of responsible personnel and emergency telephone numbers.
4. Processing of field decisions and change orders.
5. Adequacy of distribution of Contract Documents.
6. Schedule and submittal of shop drawings, product data, and samples.
7. Pay request format, submittal cutoff date, pay date, and retainage.
8. Procedures for maintaining Record Documents.

9. Use of premises, including office and storage areas, and QAC and DESIGNER requirements.
10. Major equipment deliveries and priorities.
11. Safety and first aid procedures.
12. Security procedures.
13. Housekeeping procedures.
14. Work hours.
15. Site access and laydown/storage areas.

1.3 Progress Meetings

A. Schedule regular weekly meetings as directed by the OWNER.
B. Hold called meetings as the progress of the Work dictates.
C. Representatives of the following parties are to be in attendance at the meetings:
1. OWNER;
2. DESIGNER, if required by OWNER;
3. CONTRACTOR and superintendent;
4. Major subcontractors as pertinent to the agenda;
5. QAC, as appropriate; and.
6. Representatives of governmental or other regulatory agencies, as appropriate.

D. At a minimum, the agenda for progress meetings shall consist of the following:
1. Review and approve Minutes of previous meetings.
2. Review work progress since previous meeting.
3. Note field observations, problems, and decisions.
4. Identify problems which impede Construction Schedule.
5. Review submittal schedule and expedite as required to maintain schedule.
6. Maintenance of quality and work standards.
7. Review changes proposed by CONTRACTOR or OWNER for their effect on the construction schedule and completion date.
8. Complete other current business.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

***** END OF SECTION *****

PART 1 – GENERAL

1.1 Description of Work

A. Wherever submittals are required hereunder, all such submittals by the CONTRACTOR shall be submitted to the QAC.

B. Prior to mobilization onto the Site and within five (5) calendar days after date of commencement, as stated in the Notice to Proceed;

1. CONTRACTOR shall submit final cost estimates, including Schedule of Values (Section 01026).
2. CONTRACTOR shall submit a Construction Schedule using critical path analysis. This schedule shall indicate the start and completion dates of the various stages of the Work. The schedule shall follow the same format as the Schedule of Values, Section 01026.
3. A preliminary schedule of Shop Drawing, sample, and proposed substitutes or "or equal", submittals.
4. Layout data.
5. CONTRACTOR shall submit a Health and Safety Plan (Section 01564).

C. Any details deemed by the CONTRACTOR as required for construction but not indicated on the Contract Drawings shall be submitted for review by the DESIGNER at least 10 calendar days prior to construction. Responsibility for identifying such details is the responsibility of the CONTRACTOR.

1.2 Shop Drawing Submittal

A. Whenever stipulated in the Contract Documents, or where required by the OWNER, CONTRACTOR shall furnish to the QAC, OWNER and DESIGNER for review, 4, 1 and 1 copies of each shop drawing submittal, respectively. The term "Shop Drawings" as used herein shall be understood to include detailed design calculations, shop drawings, fabrication and installation drawings, erection drawings, lists, graphs, operating instructions, catalog sheets, data sheets, and similar items.

B. All Shop Drawing submittals shall be accompanied by a submittal transmittal form.

C. Except as may otherwise be provided herein, the DESIGNER will return prints of each submittal to the CONTRACTOR with its comments noted thereon, within 15 calendar days following their receipt by the DESIGNER.

D. All CONTRACTOR shop drawing submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR, prior to submission to the DESIGNER. Each submittal shall be dated and signed by the CONTRACTOR, as being correct and in strict conformance with the Contract Documents. In the case of shop drawings, each sheet shall be so dated and signed. No consideration for review by the DESIGNER of any CONTRACTOR submittals will be made for any items which have not been so certified by the CONTRACTOR. All noncertified submittals will be returned to the CONTRACTOR without action taken by the DESIGNER, and any delays caused thereby shall be the total responsibility of the CONTRACTOR.

E. The CONTRACTOR shall present Shop Drawings at least one month before work is due to start.

1.3 CONTRACTOR's Progress Schedule Submittals

A. CONTRACTOR's initial construction schedule shall be prepared and submitted to the OWNER within 10 calendar days after date of Award of Contract OWNER-CONTRACTOR Agreement.

B. CONTRACTOR shall revise schedule, as required, and resubmit with each request for payment. Payment requests will not be processed without a revised schedule.

C. CONTRACTOR shall show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.

D. CONTRACTOR shall indicate estimated percentage of completion for each item of Work at each submission.

E. CONTRACTOR shall indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by OWNER and under Allowances.

1.4 Proposed Substitutes of "Or Equivalent" Items:

A. Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular supplier, the naming of the item is intended to establish the type, function, and quality required. If the name is followed by the words "or equivalent" indicating that a substitution is permitted, materials or equipment of other suppliers may be accepted by the DESIGNER if sufficient information is submitted by the CONTRACTOR to allow the DESIGNER to determine that the material or equipment proposed is equivalent or equal to that named, subject to the following requirements:

1. The burden of proof as to the type, function, and quality of any such substitute material or equipment shall be upon the CONTRACTOR.
2. The DESIGNER will determine as to the type, function, and quality of any such substitute material or equipment.
3. The DESIGNER may require the CONTRACTOR to furnish at the CONTRACTOR's expense additional data about the proposed substitute.
4. The OWNER may require the CONTRACTOR to furnish at the CONTRACTOR's expense a special performance guarantee or other surety with respect to any substitution.

5. Acceptance by the DESIGNER of a substitute item proposed by the CONTRACTOR shall not relieve the CONTRACTOR of the responsibility for full compliance with the Contract Documents and for adequacy of the substitute item.
6. The CONTRACTOR shall be responsible for resultant changes and all additional costs which the accepted substitution requires in the CONTRACTOR's work, the work of its subcontractors and of others, and shall effect such changes without cost to the OWNER.

B. The procedure for review by the DESIGNER will include the following:

1. If the CONTRACTOR wishes to furnish or use a substitute item of material or equipment, the CONTRACTOR shall make written application to the DESIGNER.
2. The CONTRACTOR shall certify that the proposed substitute will adequately perform the functions and achieve the results called for by the general design, be similar and of equal substance to that specified, and be suited to the same use as that specified.
3. The DESIGNER will be allowed 20 calendar days within which to evaluate each proposed substitute.
4. As applicable, no Shop Drawing submittals will be made for a substitute item nor will any substitute item be ordered, installed, or utilized without the DESIGNER's prior written acceptance of the CONTRACTOR's substitution request.

C. The CONTRACTOR's application shall contain the following statements and/or information which shall be considered by the DESIGNER in evaluating the proposed substitution:

1. The evaluation and acceptance of the proposed substitute will not prejudice the CONTRACTOR's achievement of substantial completion on time.
2. Whether or not acceptance of the substitution for use in the Work will require a change in any of the Contract Documents to adapt the design to the proposed substitute.
3. Whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty.
4. All variations of the proposed substitute for that specified shall be identified.
5. Available maintenance, repair, and replacement service shall be indicated.
6. Itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including cost of redesign and claims of other contractors affected by the resulting change.

1.5 Manufacturer's Instructions

A. When specified in individual specification sections, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.

B. If, manufacturer's instructions and contract documents conflict, the more stringent shall govern.

1.6 Manufacturer's Certificates

A. When specified in individual specification sections, submit manufacturer's certificate to QAC for review, in quantities specified for Product Data.

B. Indicate if the material or product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product, but must be acceptable to the QAC.

1.7 Construction Photographs

A. Photography

1. The QAC is to provide a set of mounted, dated photographs of Site and construction throughout progress of Work acceptable to the QAC, mounted in albums.
2. Take photographs on date for each Application of Payment and as follows (as is relevant to the active construction phase):

a. Site clearing;
b. Excavation and Backfilling;
c. Access Road
d. Geosynthetics (each type, including seaming/welding);
e. Soils layers in liner system (each type);
f. Sedimentation/Stormwater Management Basin;
g. Protective cover soil;
h. Vegetative layer;
i. Buried piping;
j. Tank construction and,
j. Final completion.

B. Electronic Photographs

1. Photographs shall be chronologically numbered by month/day/year - number of photograph (i.e., 08222021_Photograph No.1).
2. Digital files of photographs shall be provided via thumb drive or CD_ROM or another platform which is readily available at the time of transfer of data.

3. Four sets thumb drives (or other QAC-approved transfer mechanism) of digital photographs shall be provided..

1.8 Soil Erosion and Sedimentation Control Plan (SESCP)

Prior to performing any soil removal or material placement, the CONTRACTOR shall submit a plan for temporary and permanent erosion control in accordance with Section 02125. The erosion control measures shown on the Contract Drawings are the minimum measures. The CONTRACTOR's SESCP shall provide detailed layout information regarding erosion control measures for each phase of construction.

1.9 Daily, Weekly, and Monthly Reports

The CONTRACTOR shall prepare daily reports summarizing on-Site activities. Daily reports shall include, as a minimum, the following:
A. Weather conditions;
B. Active work area;
C. Crew description;
D. Subcontractor activity;
E. Equipment operating;
F. Hours worked;
G. Work performed;
H. Problems;
I. Corrective actions; and,
I. Health and safety issues.
The CONTRACTOR shall also submit monthly reports describing the activity of the period. Daily reports shall be submitted the day following the report day. Monthly reports shall be submitted within 14 days of the report period.

1.10 Health and Safety Plan

The CONTRACTOR shall prepare and submit a Site-Specific Health and Safety Plan to the OWNER and QAC at least 15 calendar days prior to mobilization for construction.

1.11 Layout Data

A. General - The CONTRACTOR is responsible for coordinating work of all trades on the job. He shall confer with OWNER and provide guidance and information to all trades as required for proper progress of the work.
B. Conflicts - Where the work of two (2) trades will be installed in close proximity to each other, or where there is evidence that work of one (1) trade will interfere with another trade, CONTRACTOR shall prepare composite working drawings if directed by QAC. Such drawings shall indicate how all work is to be installed before coordinating with other trades so as to cause interference with work of other trades, shall make necessary

changes in his work to correct conditions to the satisfaction of the QAC without extra charge.

C. Procedures - If requested, by QAC, CONTRACTOR shall provide detailed drawings as required to indicate construction procedures.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

*** END OF SECTION ***

PART 1 - GENERAL

1.1 Description of Work

A. Quality Assurance and the control of construction.
B. Inspection and testing laboratory services.

1.2 Quality Assurance of Installation

A, The Owner shall appoint a Quality Assurance Consultant (QAC) to monitor and report construction activities, and the CONTRACTOR shall monitor quality control over products, services, Site conditions, and workmanship, for conformance with the Contract Documents.
B. CONTRACTOR shall comply fully with manufacturers' instructions, including each step in sequence.
C. Should manufacturers' instructions conflict with Contract Documents, the more stringent shall govern.
D. CONTRACTOR shall comply with specified standards as a minimum quality for the Work, except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. CONTRACTOR shall perform Work by persons qualified to produce workmanship of specified quality.

1.3 References

A. Conform to the reference standard defined in each Specification Section and the Construction Quality Assurance (CQA) Plan in effect as of the date for receiving bids.
B. Obtain copies of standards when required by Contract Documents.
C. Should specified reference standards conflict with Contract Documents, request clarification from QAC before proceeding.
D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by either mention or inference in any reference document.

1.4 Inspection and Laboratory Testing Services

A. The CONTRACTOR is responsible for performing and documenting Quality Control tests. OWNER will appoint, employ, and pay for services of a QAC to perform quality assurance inspection and testing. The site specific CQA Plan contains minimum testing criteria in addition to the testing defined in these Specifications. Where there is a conflict between the CQA Plan and these Specifications, the more stringent requirement will be maintained.
B. The QAC will perform inspections, tests, and services as required by the CQA Plan and the Project Specifications.

C. Reports will be submitted by the QAC to the OWNER, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

D. The CONTRACTOR, when required, shall cooperate with QAC to furnish samples of materials, design mix, equipment, tools, storage, and assistance as requested.

1. Notify QAC 24 hours prior to expected time for operations requiring services.
2. Make arrangements with QAC and pay for additional samples and tests required for CONTRACTOR's use.

E. Retesting or reinspection required because of non-conformance to specified requirements shall be performed by the QAC on instructions by the OWNER.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

***** END OF SECTION *****

PART 1 – GENERAL

1.1 Description of Work

A. The OWNER will select and employ an Independent Testing Laboratory either directly or through the QAC to perform services as required by the supplementary General Conditions and the Specifications.
B. The OWNER shall pay all charges of the Independent Testing Laboratory.
C. CONTRACTOR shall contract his own lab for Quality Control testing services. Contractor's testing laboratory may not be the same and OWNER's testing laboratory. CONTRACTOR shall be responsible for paying all charges from his testing laboratory.

1.2 Laboratory Duties

A. Cooperate with OWNER, DESIGNER, and QAC, to provide qualified personnel promptly on notice. Perform specified inspections, sampling and testing of materials and methods of construction; ascertain compliance with requirements of Contract Documents.
B. Promptly notify OWNER, DESIGNER, and QAC of irregularities or deficiencies of work which are observed during performance of services. Submit two (2) copies of reports of inspections and tests to OWNER, including:

1. Date issued
2. Project title and number
3. Testing Laboratory name and address
4. Name and signature of Inspector
5. Date of inspection or sampling
6. Record of temperature and weather
7. Date of test
8. Identification of product and Specification Section
9. Location in project
10. Type of inspection or test
11. Observations regarding compliance with Contract Documents

C. Laboratory is not authorized to release, revoke, alter or enlarge on requirements of Contract Documents; to approve or accept any portion of work, or perform any duties of the CONTRACTOR.

1.3 Laboratory Reports

A. After each inspection and test, WITHIN 72 HOURS, submit two (2) copies of laboratory report to QACand to the OWNER.
B. Include:

1. Date issued
2. Project title and number

3. Name of inspector
4. Date and time of sampling or inspection
5. Identification of product and Specifications Section
6. Location in the Project
7. Type of inspection or test
8. Date of test
9. Results of tests
10. Conformance with Contract Documents

C. When requested by OWNER or QAC, provide interpretation of test results.

1.4 CONTRACTOR's Responsibility

A. Cooperate with Laboratory personnel and provide access to work.
B. Provide to Laboratory, preliminary representative samples of materials to be tested, in required quantities.
C. Furnish casual labor and facilities to provide access to work to be tested, to obtain and handle samples at the site, and to facilitate inspections and tests.
D. Notify Laboratory sufficiently in advance of operations to allow for his assignment of personnel and schedule of tests.
E. Arrange with Laboratory, and pay for, any additional samples and testing required for CONTRACTOR's convenience.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

*** END OF SECTION ***

PART 1 - GENERAL

1.1 Description of Work

The CONTRACTOR shall furnish temporary construction facilities as required for the use of all trades during the construction period.

1.2 Access and Parking

Provide and maintain adequate and safe access to site and work. All construction personnel must park in designated areas.

1.3 Trash Removal

Provide one (1) or more dumpsters for trash. Each CONTRACTOR, including all subcontractors, shall pick up accumulated trash and debris daily and deposit it in dumpster. CONTRACTOR to empty dumpster as often as necessary, and dispose of all trash and waste materials off Site.

1.4 Temporary Sanitary Facilities

Provide and maintain chemical type self-contained temporary toilet accommodations on the premises for use of workmen employed during the building operation. There shall be one toilet for every five (5) workers in each work zone. After completion of the project, they shall be removed. The temporary toilets shall be enclosed and weather-proof and kept in a sanitary condition at all times.

1.5 Temporary Utilities

The CONTRACTOR shall provide all temporary electric, water and lighting utilities necessary for the proper performance of the Work.

1.6 Construction Field Office

A. The CONTRACTOR shall provide a construction field office with appropriate furnishings, for use by the QAC, OWNER, and regulatory agencies, as needed.
B. The field office for the QAC and OWNER shall include electric power and suitable telephone service.
C. The CONTRACTOR shall provide appropriate ventilation/heating to provide comfortable working conditions for QAC and OWNER personnel.

1.7 Removal of Utilities, Facilities, and Controls

A. Remove temporary above-grade or buried utilities, equipment, facilities, materials, prior to Final application for Payment inspection.

B. Remove temporary underground installations outside of the limit of the landfill to a minimum depth of two (2) feet. Grade site when indicated to promote positive drainage.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

1.8 Protection of Existing Utilities and Facilities

A. Protect and maintain in-service all existing utilities.

B. Do not allow utility and service outages.

C. Provide temporary services, where required, to provide uninterrupted utility services for on-going site operations.

D. Prevent damage to existing facilities structures and buildings - repair damage or replace immediately on direction of OWNER.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

***** END OF SECTION *****

PART 1 - GENERAL

1.1 Barricades, Lights and Signals

A. The CONTRACTOR shall furnish and erect such barricades, fences, lights, and danger signals, and shall provide such other precautionary measures for the protection of persons or property and of the Work, as necessary, and to comply with Federal, State, and local regulations.

B. The CONTRACTOR will be held responsible for all damage to the Work due to failure of barricades, signs, and lights, and whenever evidence is found of such damage, the CONTRACTOR shall immediately remove the damaged portion and replace it, at CONTRACTOR's cost and expense. The CONTRACTOR's responsibility for the maintenance of barricades, signs, and lights shall not cease until the Work has been accepted by the OWNER.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

***** END OF SECTION *****

PART 1 - GENERAL

1.1 Description of Work

A. The CONTRACTOR shall employ construction methods and means that keep airborne particulates to the minimum, and shall provide for the application of water, or employ other appropriate preventive means or methods, to control dust, subject to the approval of the OWNER or QAC.

B. Dust control measures shall be compatible with existing on-site materials and proposed materials, and site operations.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Watering equipment shall be used to minimize airborne concentrations and shall consist of pipelines, tank trucks, or other devices approved by the OWNER or QAC, which are capable of applying a uniform spread of water over the ground surface. A suitable device for a positive shut-off and for regulating the flow rate of water shall be located so as to permit positive operator control. Calcium chloride is not allowed for dust control.

***** END OF SECTION *****

PART 1 - GENERAL

1.1 Description of Work

The intention of this plan is to minimize traffic congestion in the area around the Site. The CONTRACTOR shall comply with all Federal, State, and local laws, and regulations that apply to the Work to be performed, including, but not limited to, all traffic laws, and vehicular weight limitations. Compliance with this Plan does not relieve the CONTRACTOR from any liability associated with traffic issues, including but not limited to accidents and fines.

1.2 Site Access

All truck traffic for the operating landfill accesses the Site from Conway Road. Temporary construction access also will be via Conway Road.

PART 2 - TRAFFIC PLAN

2.1 Limits on Volume

To minimize traffic congestion in the area around the Site, the CONTRACTOR shall limit the number of trucks entering the Site and shall not disrupt Site operations.

2.2 Off-Loading

The CONTRACTOR, in conjunction with the OWNER, shall select the areas to be used for off-loading and temporary storage of materials. These areas shall be located so that trucks can exit the public roads into the area with no delay, so that there is no impact to local traffic flow. To reduce tracking of soils back on to the roads, dumping of soils should be done in a manner that minimizes wheel contact with the soils.

2.3 Covering of Materials

All trucks used for transport of soils shall be covered with a well secured tarp before transportation on public roads. The CONTRACTOR shall take such steps as necessary to prevent spillage, wind blown deposits on the roads, and damage to other vehicles. After dumping the load at the Site, the CONTRACTOR shall inspect the truck bed for residual materials and shall remove or cover residual material before the truck is allowed to leave the Site on public roads.

2.4 Street Cleaning

The CONTRACTOR is responsible for removing soils, dirt, rock, asphalt and other deposits that accumulate on the public roads, or paved areas within the limits of the landfill that are a result of the CONTRACTOR's hauling operation. This includes windblown deposits, spillage, and trackage of materials onto the roads. Inspection of the roads is to be performed at least daily during hauling operations. When the inspection determines that cleaning is required, it shall be performed immediately. The OWNER or QAC will verify compliance with this requirement. CONTRACTOR shall maintain a street sweeper (or equal) on-site.

2.5 Flagmen

Hauling, dumping, and other operations shall be performed in such a manner that public roads and traffic flow on the roads are not impacted. If the CONTRACTOR finds, in planning and scheduling of the work, that there will be a requirement to restrict traffic flow or temporarily stop traffic, a flagman will be required.

2.6 On-Site Transportation

Movements of trucks and equipment within the Site boundary are not limited in volume. However, the work is to be performed in a manner such that public streets and the business operations on-site are not adversely impacted. The CONTRACTOR shall coordinate via the OWNER with business operations on-site to stage the work such that on-site business activities are not adversely impacted. The control of traffic is the CONTRACTOR's sole responsibility and shall be performed in a safe and orderly manner. A speed limit of 12 MPH shall be enforced by the CONTRACTOR on all vehicles and equipment performing work on the Site.

PART 3 - EXECUTION

Not Used

*** END OF SECTION ***

PART 1 – GENERAL

1.1 Description of Work

A. The work under this Section includes, but is not necessarily limited to, the maintenance, recording, and submittal of Project Record Documents, as herein specified.

B. The CONTRACTOR shall maintain in designated locations at the Site for the OWNER one record copy of:

1. Drawings and Addenda.
2. Specifications and Addenda.
3. Change orders and other modifications to the Contract.
4. OWNER/QAC field orders or written instructions.
5. Reviewed shop drawings, product data and samples.
6. Field test records.
7. Manufacturer's certificates.
8. Daily work activity reports, including:

    a. Field test records;
    b. Photographs;
    c. Reports on emergency response actions;
    d. Records of all site work;
    e. Chain-of-custody documents;
    f. Laboratory test records;
    g. Meteorological records;
    h. Daily inspection records;
    i. Reports on all safety and accident incidents;
    j. Reports on all spill incidents;
    k. Air monitoring reports and data;
    l. Manifest documents, truck-load tickets and shipping papers;
    m. Security records;
    n. Other items that may be required by OWNER;
    o. Log of control and survey work.

C. Other Documents: Manufacturer's certifications, inspection certifications, field test records required by individual Specifications Sections.

D. The CONTRACTOR shall keep and maintain at the Site, one (1) set of progress drawings. On these, it shall mark all project conditions, locations, configurations, and any other changes or deviations from the details represented on the original Contract Drawings, including buried or concealed construction and utility features which are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Contract Drawings. The Record Drawings shall be supplemented by any detailed sketches, as necessary or directed, to fully indicate, the Work as actually constructed. These progress drawings of the CONTRACTOR's representation of as-built conditions, including all revisions made necessary by addenda, change orders, and the like shall be maintained up-to-date during the progress of the Work. Progress plans shall be accurate and certified by a Registered Land Surveyor and a Professional DESIGNER licensed to practice in the State of Delaware.

E. Progress drawings shall be accessible to the QAC at all times during the construction period and shall be delivered to the QAC upon completion of the Work.

F. Upon Substantial Completion of the Work and prior to final acceptance, the CONTRACTOR shall complete and deliver twelve (12) complete sets of record drawings to the QAC, conforming to the construction records of the CONTRACTOR. This set of drawings shall consist of corrected drawings showing the reported location of the Work. The information submitted by the CONTRACTOR and incorporated by the QAC into the Record Drawings will be assumed to be reliable, and the QAC will not be responsible for the accuracy of such information, nor for any errors or omissions which may appear on the Record Drawings as a result.

1.2 Maintenance of Documents and Samples

A. Storage

1. Store documents and samples in CONTRACTOR's field office apart from documents used for construction.
2. Provide files and racks for storage of documents.
3. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with format of these Specifications.

C. Maintenance

1. Maintain documents in a clean, dry, legible condition and in good order.
2. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by OWNER, QAC, and DESIGNER.

1.3 Recording

A. Label each document "PROJECT RECORD" in neat, large printed letters.

B. Recording

1. Record information concurrently with construction progress.
2. Do not conceal any work until required information is recorded.

C. Drawings: Progress drawings shall be reproducible, shall have a title block indicating that the drawings are record drawings, the name of the company preparing the progress drawings and the date the progress drawings were prepared. The CONTRACTOR will be provided paper sepias of the Contract Drawings, at the cost of reproduction, or he may elect to provide reproducible drawings via another method. Legibly mark drawings to record actual construction:

1. Field changes of dimension and detail.
2. Changes made by Requests for Information (RFI), field order or by change order.
3. Details not on original Contract Drawings.

D. Specifications: Legibly mark each section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
2. Changes made by Requests for Information (RFI), field order or by change order.

1.4 Submittal

A. At Contract closeout, deliver record documents in the form of a Final Construction Report to the OWNER.
B. Accompany submittal with transmittal letter, in duplicate, containing:

1. Date
2. Project title and number
3. CONTRACTOR's name, address, and telephone number
4. Title and number of each record document
5. Signature of CONTRACTOR's authorized representative.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

***** END OF SECTION *****

PART 1 - GENERAL

1.01 Description of Work

A. Furnish all labor, materials, tools, equipment and appurtenances required for the cleaning and testing of piping for the landfill gas headers and laterals, compressed air lines, landfill gas condensate sump, leachate force main, and other piping systems installed by the CONTRACTOR as specified herein and in other Sections of these Specifications.

1.02 References

A. National Fire Protection Association (NFPA)

1. NFPA 54 - National Fuel Gas Code
2. American Water Works Association Standard C600-77.

1.03 Submittals

A. Submittals shall include proposed cleaning and testing procedures, including test medium and pressure, line segments and equipment included in the test, methods of isolating sections of the system, pressure monitoring techniques, and the testing certification form to be submitted to the QAC.

PART 2 - PRODUCTS

2.01 General

A. Detergents, solvents, and other cleaning or testing materials shall be compatible with the materials of fabrication of the systems in which they are used. They shall not adversely affect the materials or mechanisms in the systems, and they shall be acceptable to equipment manufacturers/vendors. Detergents, solvents, and other cleaning agents shall also be non-flammable and compatible with the process streams to be handled by the systems in which they are used and shall not contain any chlorinated solvents.

B. Materials including blinds, gaskets, bolts, flanges, caps, gauges, valves, and other equipment used in isolating segments of systems shall be compatible with the systems being cleaned or tested.

2.02 Test Mediums

A. The CONTRACTOR shall furnish all equipment, necessary piping, required labor and expenses to test piping systems. Test medium shall be as specified herein.

2.03 Test Equipment

A. The CONTRACTOR shall furnish all labor and equipment, including required pumps, vacuum pumps and compressors with regulated bypass meters, valves, blind flanges, plugs, chart recorders, and gauges, for conducting of the piping tests. Gauges and chart recorders shall be calibrated to a National Bureau of Standards traced standard. Gauges and chart recorders shall have divisions not exceeding 2 percent of the test pressure.

PART 3 - EXECUTION

3.01 Cleaning

A. The CONTRACTOR shall provide and install temporary connections, strainers, and other equipment to thoroughly clean the piping systems before start-up in accordance to the Plan submitted in Part 1.03 of this section. The QAC shall visually observe a clean piping system free of shavings and/or other debris prior to start-up. The CONTRACTOR shall collect and dispose of all shavings, debris and other materials as directed by the QAC and shall remove all temporary connections and strainers after cleaning is complete.

B. Piping shall be cleaned just prior to installation and again prior to start-up. Cleaned piping material shall be protected against contamination by sealing open ends with clear plastic sheets, metal foil, or other approved materials.

3.02 Testing

A. Upon completion of piping installation, but prior to covering concealing or burying piping, the CONTRACTOR shall test all newly installed landfill gas piping, landfill gas condensate sump, compressed air lines, landfill gas condensate piping systems, and leachate force mains.

B. The timing and sequence of testing shall be scheduled by the CONTRACTOR, subject to the favorable review by the QAC. The CONTRACTOR shall provide the QAC two (2) working days notice prior to testing.

C. Utilize vacuums, media, and test duration as specified herein.

D. Isolate equipment, which may be damaged by the specified test conditions.

E. Perform vacuum / pressure tests using calibrated pressure gauges. Select each gauge so that the specified test vacuum falls within the upper half of the gauge's range.

F. Unless otherwise specified, completely assemble and test new piping systems prior to connection to existing piping systems.

G. All piping (in a completed system) shall be vacuum / pressure tested to 1.5 times the maximum pressure / vacuum that can be applied by the blower / compressor / pumps in place, in the presence of the QAC, in accordance with the method approved in Part 1.03(A), for a period of 1 hour with less than 10 percent loss of pressure / vacuum.

H. No pipe installation will be accepted should there be evidence of exterior surface damage to the pipe that, in the option of the QAC, may compromise the integrity of the piping system, even though it may pass the testing requirements

I. All tests shall be made before piping is painted, covered, or otherwise concealed. The CONTRACTOR, at the CONTRACTOR's own expense, shall uncover and retest any piping not satisfactorily tested in the presence of the QAC. Testing shall be conducted after laying or modifying of the piping systems and prior to backfilling and then repeated after final grading.

J. The testing requirements for the respective systems shall include all those of NFPA 54, and applicable Laws and Regulations. All code-required inspection certificates shall be furnished to the QAC.

K. The CONTRACTOR shall collect and dispose liquids used for testing in accordance with Section 02402 of these Specifications.

3.03 Pipe Test Schedule

A. Upon completion of each piping system or sub-system, clean and test the lines. All piping shall be tested:

1. After completion of a section or subsection prior to backfilling of trench
2. After completion of entire system after installation of any heat tracing and insulation cover.

B. Repair and retest any piping system found to be leaking until results are satisfactory to the QAC.

3.04 Repairs

A. The point or points of leakage shall be sought out and remedied by the CONTRACTOR at the CONTRACTOR's expense.

B. All repairs will be observed by the QAC.

C. Repair methods must be satisfactory to the QAC.

3.05 Final Acceptance

A. No pipeline installation or hydraulic structure will be accepted until all leaks have been repaired and retested in accordance with Section 3.02 of this Specification. All repairs will be observed by the QAC.

B. The CONTRACTOR shall provide the QAC with written certification and test charts clearly identifying location of pipe being tested of equipment/system cleaning and testing in accordance with this Section. All test data and documentation shall be provided to the QAC as part of the written certification.

*****END OF SECTION*****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all materials, labor, equipment, tools and appurtenances required to complete the work as described below. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. This Section describes materials and equipment to be utilized, and requirements for their use, in preparing the work site for construction.

C. Comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State or Federal authorities having jurisdiction.

D. Remove and dispose of all debris, bulky items, waste materials, etc., existing in the area to be constructed and encountered on the surface. All bulky items such as large debris, stumps, cars, old fencing, etc. are to be disposed off-site at CONTRACTOR's expense.

E. Protect and maintain benchmarks, monuments, and other reference points. Re-establish, at no cost to the OWNER, any such reference points disturbed or destroyed. The CONTRACTOR's surveyor shall conduct a survey of all monuments and property markers within proposed work areas prior to any disturbance such that they can be re-established by the CONTRACTOR after completion of the Work.

F. Remove, demolish, excavate, haul, and dispose of any on-site structures, pavement, roads, drainage pipes, utilities, etc. per Section 1.1D, above.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all materials, labor, equipment, tools and appurtenances required to complete the work as described below. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. Site clearing and grubbing includes, but is not limited to, removing from within the limits of work and disposing of trees, stumps, roots, brush, structures, abandoned utilities, trash, asphalt, debris, and all other materials found on or near the surface of the ground in the construction area. Precautionary measures that prevent damage to existing features that are to remain are part of the work.

C. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

D. No clearing and grubbing will be allowed without adequate erosion and sedimentation control measures in place and to the satisfaction of the DESIGNER.

1.2 Job Conditions

Location of the Work: The area to be cleared and grubbed includes all areas designated for cell, access road, channel, and sedimentation basin construction, excavation, and required construction access areas.

PART 2 PRODUCTS

The CONTRACTOR shall furnish equipment of the type normally used in clearing and grubbing operations, including, but not limited to, dozers, shears, skidders, loaders, root rakes, chipping equipment, and stump grinders.

PART 3 EXECUTION

3.1 Scheduling of Clearing

A. The CONTRACTOR shall install all temporary elements and features required by the CONTRACTOR's Soil Erosion and Sedimentation Control Plan, as approved by the DESIGNER, prior to start of clearing operations.

B. The CONTRACTOR shall maintain all survey controls.

3.2 Clearing and Grubbing

A. Materials to be cleared, grubbed, and removed from the construction areas include, but are not limited to, trees, stumps, roots, brush, trash, organic matter, miscellaneous structures, debris, and abandoned utilities.

B. Grubbing shall consist of completely removing roots, stumps, trash, and other debris from all graded areas so that surface material is free of these materials. Surface material is to be left sufficiently clean so that further picking and raking will not be required.

C. All stumps, roots, foundations, and other debris in the ground shall be removed and disposed in a manner and at locations approved by the DESIGNER.

D. Surface rocks and boulders shall be grubbed from the soil and removed to an on-site disposal area designated by the OWNER.

E. All construction areas shall be grubbed.

F. Where tree limbs interfere with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the utility. The CONTRACTOR shall be responsible for damages to utilities, and shall replace/repair damaged utilities at no cost to OWNER.

G. Any work pertaining to utility poles and guy wires shall comply with the requirements of the appropriate utility.

H. Stumps and roots shall be grubbed and removed to a depth not less than 2-feet below grade. All holes or cavities extending below the subgrade surface elevation in the proposed work shall be filled with crushed rock or other suitable material and compacted to a similar density as the surrounding material.

I. The CONTRACTOR shall exercise special precautions for the protection and preservation of trees and shrubs situated adjacent to the limits of the construction area. The CONTRACTOR shall be held liable for any damage the CONTRACTOR's operations have inflicted on such property.

J. The CONTRACTOR shall be responsible for all damages to existing structures and/or improvements resulting from CONTRACTOR's operations.

3.3 Disposal of Debris

A. All wood debris (stumps, roots, branches, and leaves) resulting from the clearing and grubbing operation shall be disposed by either landfilling or processing and on-site staging, i.e., chipping to produce mulch, or by other methods, as approved by DESIGNER, in accordance with the Specifications and placed in an on-site location designate by the OWNER. No open burning is allowed unless authorized by the Maryland Department of the Environment or Anne Arundel County.

B. All large debris, pipe, large metal objects, and bulky items will be removed and hauled to an off-site disposal facility approved by the OWNER. Debris consistent with the waste materials that are approve for placement in the proposed landfill cell, may be staged at a location acceptable to the OWNER until disposal space in a lined waste disposal area becomes available.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall provide all materials and promptly take all actions necessary to achieve effective erosion and sedimentation control in accordance with all applicable Federal, State, and local enforcing agency guidelines, and these Specifications. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The work shown on the Permit Drawings shall be considered a minimum requirement. The CONTRACTOR shall take all steps necessary to control soil erosion and sedimentation resulting from the Work.

C. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

D. CONTRACTOR shall repair any material or existing surface conditions damaged by erosion or covered with sedimentation at the CONTRACTOR's expense.

E. Erosion control measures shall be provided by the CONTRACTOR for all construction activities in the Chesapeake Terrace Rubble Landfill area, as well as other related work throughout the Site. The CONTRACTOR shall maintain on-site at least 20% overstock of erosion control materials for the active construction phase, to replace or repair installed erosion and sedimentation control features, as necessary.

F. The CONTRACTOR shall maintain installed temporary erosion control features until no longer needed, as determined by the DESIGNER, or until permanent erosion control features are completed and accepted by the OWNER.

G. It shall be the sole responsibility of the CONTRACTOR to properly schedule and coordinate all necessary labor, equipment, and materials, such that the specified work is performed in accordance with the project schedule and the Contract requirements. At the discretion of the DESIGNER, the DESIGNER may reject, or direct the CONTRACTOR to repair (at the CONTRACTOR's sole expense), those items which are detrimental to the project or not in compliance with the Contract Documents. Such direction or rejection by the DESIGNER shall not relieve the CONTRACTOR of his obligation to properly schedule and perform other specified work items in conformance with the Contract Documents.

1.2 Submittals

At the preconstruction meeting, the CONTRACTOR shall submit for the DESIGNER's approval, a Soil Erosion and Sedimentation Control Plan which will include, but is not limited to a schedule and construction drawing(s) for installation and construction of temporary and permanent erosion control work, as are applicable for clearing and grubbing, grading, structures at watercourses, and general construction. No work shall be started until the erosion control schedules and methods of operation for each phase of construction have been accepted by the DESIGNER. This plan will be referred to as the CONTRACTOR's Soil Erosion and Sedimentation Control Plan. The CONTRACTOR's Soil Erosion and Sedimentation Control Plan shall conform to the requirements of "Maryland Erosion and Sedimentation Control Handbook".

PART 2 PRODUCTS

2.1 Silt Fence

Silt fence shall be Filter X, Mirafi 100X, Stabilinka T140N, or approved equal.

2.2 Bales

Bales shall be oat or wheat straw that are clean and seed free.

2.3 Seed

Seed type shall meet the requirements of Section 02936 "Seeding".

2.4 Temporary Erosion Control Mat

Temporary Erosion Control Mat shall be Landlok BonTerra CS2, Erosion Control Systems, Inc.'s High Impact Excelsior Mat, or approved equivalent.

2.5 Riprap

Stone riprap shall consist of hard, durable, subangular material as specified in section 02271-Stone Riprap. It shall be free from any considerable amount of flat, laminated or elongated particles; and shall be free from cracks, overburden shells, clay, organic matter, or other deleterious matter.

PART 3 EXECUTION

3.1 General

A. Conduct earthwork and excavation activities in such a manner to fit the topography, and soil type and condition.
B. Minimize the area being disturbed, and the exposure duration of features subject to erosion.
C. Stabilize disturbed areas immediately.

D. Retain sediment generated on-site. Place sediments under cover, after dewatering, during construction, and dispose of unsaturated sediments as daily cover at the landfill.

E. Prevent silt and sedimentation from entering any watercourse, if soil erosion cannot be prevented.

F. Prevent silt and sediment from migrating downstream, in the event it cannot be prevented from entering a watercourse.

G. Where provisions of pertinent rules and regulations conflict with these specifications, the more stringent provisions shall govern.

H. The DESIGNER has the authority to limit the surface area of erodible material exposed by clearing and grubbing, and to direct the CONTRACTOR to provide immediate temporary or permanent control measures to prevent sediment impact on adjacent watercourses, and off-site property.

I. Where erosion is likely to be a problem, clearing and grubbing operations should be scheduled and performed so that grading operations and permanent erosion control features can follow immediately thereafter, if the project conditions permit; otherwise, erosion control measures may be required between successive construction stages. Under no conditions shall the total aggregate erodible surface area (such as exposed soil or erodible material without vegetation or erosion protection) resulting from clearing and grubbing be exposed for more than 30 calendar days without approval by the DESIGNER.

J. The CONTRACTOR will limit the area of active operations commensurate with their ability to maintain temporary and permanent Sedimentation and erosion control measures.

K. In the event that additional temporary erosion and sedimentation control measures are required due to the CONTRACTOR's negligence, carelessness, or failure to install permanent controls as a part of the work schedule, and are ordered by the DESIGNER, such work shall be performed by the CONTRACTOR at the CONTRACTOR's expense, and no time extension shall be given.

3.2 Temporary Erosion and Sedimentation Control

A. Temporary erosion control measures shall be used to correct conditions which develop during construction that lead to soil erosion or deposition of waterborne sediments, are needed prior to installation of permanent erosion control features, or are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the Project.

B. Temporary erosion and sedimentation control devices shall be installed and maintained prior to the initial land disturbance activity until the satisfactory completion and establishment of permanent erosion control measures. At that time, temporary devices shall be removed.

C. The CONTRACTOR shall coordinate the installation of temporary erosion and sedimentation control provisions contained herein with the permanent erosion control features, to ensure economical, effective, and continuous erosion control throughout the construction and post-construction period.

D. Temporary erosion and sedimentation control procedures should be initially directed toward preventing silt, and sediment from entering the watercourses. The preferred method is to provide an undisturbed natural buffer, extending a minimum of 5-feet from the top of the bank, to filter the run-off.

E. Silt fences, barriers, temporary sedimentation basins and other temporary measures and devices shall be installed, and shall be maintained until no longer needed, as determined by the DESIGNER. The CONTRACTOR shall remove temporary erosion and sedimentation control features, when no longer required. All temporary items and devices must be removed, with the DESIGNER's approval, prior to final demobilization from the Site.

F. Where permanent vegetation is not appropriate, and where the CONTRACTOR's temporary erosion and sedimentation control practices are inadequate, the CONTRACTOR shall provide temporary vegetative cover. The CONTRACTOR shall provide temporary vegetative cover, in compliance with Section 02936 "Seeding" of these Specifications.

G. All erosion and sedimentation control devices shall be inspected by the CONTRACTOR at least weekly, and after each rain event, and cleaned out and repaired by the CONTRACTOR, as necessary.

3.3 Temporary Erosion and Sediment Control Techniques

A. *Temporary Diversion Berms*

1. A temporary diversion berm is constructed of compacted soil, with or without a shallow ditch, at the top of fill slopes.
2. These diversion berms are used temporarily at the top of newly constructed slopes to prevent excessive erosion until permanent controls are installed or slopes stabilized.
3. A temporary diversion berm shall be constructed of compacted soil, with a minimum width of 24-inches at the top and a minimum height of 12-inches with or without a shallow ditch. Side slopes shall be three horizontal to one vertical (3H:1V) or flatter.

B. *Temporary Slope Drains*

1. A temporary slope drain may consist of stone downchutes, fiber mats, plastic sheets, half-round pipe, metal pipe, plastic pipe, sod or other material acceptable to the DESIGNER that may be used to carry water down slopes to reduce erosion prior to installation of permanent facilities or growth of adequate ground cover on slopes.

2. Fiber matting and plastic sheeting shall not be used on slopes steeper than 4H:1V, except for short distances of 20-feet or less.
3. All temporary slope drains shall be adequately anchored to the slope to prevent disruption by the force of the water flowing in the drains. The base of temporary slope drains shall be compacted and concavely formed to channel water or hold the slope drain in place. The inlet end shall be properly constructed to channel water into the temporary slope drain.
4. Energy dissipators, sediment basins, or other approved devices shall be constructed at the outlet end of the slope drains to reduce erosion downstream.

C. *Sediment Control Structures*

1. Sediment basins, ponds and traps, are prepared storage areas constructed to trap and store sediment from erodible areas in order to protect stream channels below the construction areas from excessive siltation.
2. Sediment structures shall be utilized to control sediment where slope drains outlet. All sediment structures shall be at least twice as long as they are wide.
3. When use of temporary sediment structures is to be discontinued, all sediment accumulation shall be removed and all excavation backfilled and properly compacted. The existing ground shall be restored to its natural or intended condition.

D. *Riprap*

Unless shown otherwise on the Permit Drawings, riprap shall be placed where ordered by the DESIGNER and at all points where banks of streams or drainage ditches are disturbed by excavation. Fill or backfill shall be carefully compacted and riprap placed to prevent subsequent settlement and erosion. This requirement applies equally to construction along side a streams or drainage ditches as well as crossing a stream or drainage ditch.

E. *Straw Bales*

1. Straw bales are temporary measures to control erosion and retain the suspended silt particles in the runoff water leaving disturbed areas. Bales shall contain five cubic feet or more of material.
2. Straw bales shall be embedded in the ground 4 to 6-inches to prevent water flowing under them. The bales shall also be anchored securely to the ground by wooden stakes driven through the bales into the ground. Bales shall be removed after they have served their purpose, as determined by the DESIGNER.

3. The CONTRACTOR shall keep the bales in good condition by replacing broken or damaged bales immediately after damage occurs. Normal debris clean-out will be considered routine maintenance.
4. Straw bales shall be used at the toe of fill slopes, in ditches, or other areas where siltation, erosion or water run-off is a problem.

F. *Silt Fences*
1. Silt fences are temporary measures utilizing woven wire or other approved materials attached to posts with filter cloth attached to the upstream side of the fence to retain the suspended silt particles in the runoff water.
2. Temporary silt fences shall be placed on the natural ground, at the toe of fill slopes, in ditches or other areas where siltation is a problem. Temporary silt fences shall be anchored as indicated on the Permit Drawings.
3. The CONTRACTOR shall be required to maintain the silt fence in a satisfactory condition for the duration of the Project or until its removal is requested by the DESIGNER. The silt accumulation at the fence must be removed and placed on Site, as directed by the DESIGNER.

G. *Temporary Vegetation*
1. Temporary vegetation are measures consisting of seeding, mulching, fertilizing, and matting utilized to reduce erosion. All cut and fill slopes shall be seeded when and where necessary to eliminate erosion. Disturbed or bare soil areas shall not be left without stabilization for more than 30-days.
2. Seeding, mulching and fertilizing shall be performed in accordance with Section 02936 "Seeding" of these Specifications.
3. If germination does not occur due to late autumnal weather conditions, the CONTRACTOR shall winterize disturbed areas by mulching without application of seed, as a minimum.

3.4 <u>Permanent Erosion and Sediment Control</u>

A. The CONTRACTOR shall incorporate all permanent erosion control features into the Work at the earliest practicable time, as outlined in the CONTRACTOR's Soil Erosion and Sediment Control Plan, accepted schedule, or as land disturbance for each segment of the Project has been completed.
B. Restore the work site to its original contours, unless shown otherwise on the Permit Drawings, or directed by the DESIGNER.

C. All references to permanent vegetation, unless noted otherwise, shall relate to establishing permanent vegetative cover, in accordance with Section 02936 "Seeding" of these Specifications.

D. When final grade has been established, all bare soil shall be seeded, fertilized, and mulched in an effort to restore to a protected condition, unless otherwise required by the Contract Documents. Areas that are not stabilized with seed and mulch shall be sodded, as approved or directed by the DESIGNER.

E. Specified permanent vegetation shall be established in the first appropriate season following establishment of final grading in each section of the Site.

F. Where sod is removed or damaged, such areas shall be replanted using sod of the same species of grass in the first appropriate season.

G. Permanent vegetative cover activities shall comply with local soil and water conservation guidelines.

H. Where permanent vegetative cover cannot be immediately established (due to season or other circumstances) the CONTRACTOR shall provide temporary vegetative cover.

3.5 Permanent Erosion and Sediment Control Techniques

A. *Permanent Vegetation*

All references to permanent vegetation, unless noted otherwise, shall relate to establishing permanent vegetative cover and be in accordance with Section 02936 "Seeding" of these specifications.

B. *Riprap*

1. Riprap used for permanent stabilization of channels, slopes and culvert outlets shall be installed in accordance with the Permit Drawings and Section 02271 "Stone Riprap" of these Specifications.
2. Placing of riprap at locations other than those specified on the Permit Drawings shall be done only with approval or by the direction of the DESIGNER.
3. The ground surface upon which the riprap is to be placed shall be brought in reasonably close conformity to the correct lines and grades before placement is commenced.
4. Unless otherwise shown or specified, riprap shall begin in a toe ditch constructed in original ground around the toe of the fill or the cut slope. The toe ditch shall be two (2) feet deep in original ground, and the side next to the fill or cut shall have that same slope. After the riprap is placed, the toe ditch shall be backfilled and the excess soil spread neatly within the construction area.

5. Geotextile shall be placed in all areas to receive riprap, unless otherwise required by the Contract Documents. The surface to receive geotextile shall be prepared to a relatively smooth condition free from obstructions, depressions and debris. The geotextile shall be placed with the machine (long) direction running up the slope, and shall be placed to provide a minimum number of seams. Geotextile shall be overlapped a minimum of 6-inches prior to seaming. All geotextile seams shall be continuously sewn. Spot sewing or thermal bonding are not allowed. The geotextile shall be anchored in place with securing pins of the type recommended by the geotextile manufacturer. The geotextile shall be placed loosely to provide sufficient slack to avoid stretching and tearing during placement of riprap. Riprap shall be dropped no more than three (3) feet during construction. The geotextile shall be protected at all times during construction from runon containing clay, silts, chemicals or other substances. Any geotextile damaged during installation or during placement of riprap shall be removed and replaced with undamaged geotextile at no expense to OWNER.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall provide all labor, materials, equipment, tools and appurtenances required to complete the work of furnishing and performing all operations in connection with the installation of cellular concrete mattresses as shown, specified or required. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 Submittals

A. The CONTRACTOR shall submit Manufacturer specification for block height, block weight, and minimum shear resistance to the DESIGNER at least 3 weeks prior to delivery of material to the Site.

B. The CONTRACTOR shall submit Shop Drawings showing proposed construction methods.

PART 2 PRODUCTS

2.1 Material

A. The cellular concrete mattress shall be Bethlehem Precast, or approved equivalent. Equivalent materials must be approved by the DESIGNER a minimum of thirty (30) days prior to delivery to the Site. Two (2) integral vertical cables per block are required, as well as one (1) integral horizontal cable. If a proposed system does not have an integral horizontal cable, all vertical cables shall be increased in size to provide additional equivalent horizontal restraint. Additionally, no partial or “half” blocks will be allowed without a horizontal cable. The final revetment system must be tied continuously throughout with cables in both directions. The OWNER or the DESIGNER reserves the right to accept or reject any proposed equal cellular concrete mattress system for reasons including, but not limited to, previous performance record, appropriate and applicable testing, and qualified technical support.

B. Aggregate shall meet the requirements of ASTM C33. Aggregate grading shall be reasonably consistent and shall be well graded from the maximum size that can be conveniently handled with available equipment.

C. Cellular concrete blocks shall be either wet cast using concrete as specified herein, or formed by a vibratory block forming machine. In the latter case, Manufacturer QC testing of the concrete shall be conducted on 2-inch cubes cut from the core of the sample block. Compressive strength testing shall be done in general accordance with ASTM C 42, with one cube tested at 7 days, and two cubes tested at 28 days. Cellular concrete blocks shall be interlocking; and penetrations shall be included for revetment cables as necessary to bind the individual blocks into mattresses both vertically and horizontally. The blocks shall be open cell and capable of articulation when formed into mattresses.

D. The concrete blocks shall remain stable when subjected to the below noted shear stresses determined by test methodology developed by the Federal Highway Administration testing protocol, FHWA-RD-89-199, "Hydraulic Stability of Articulated Concrete Block Revetment Systems During Overtopping Flow".

Block Height	Block Weight	Open/Closed Cell	Minimum Shear Resistance
4"	65-72 lbs.	Closed	40 psf
6"	101-108 lbs.	Closed	60 psf

E. The assembled mattresses shall have a range of 18 to 23 percent open areas to be achieved by penetrations within the block for open cell applications. For closed cell applications, the amount of open area shall be 7 percent.

F. The cellular concrete blocks and cables and fittings shall be fabricated at the manufacturer's plant, or another approved location, into mattresses with a width of up to 8-feet and a length that is capable of being transported without special permitting.

G. The concrete blocks shall be bound into mats by the use of polyester revetment cable fittings.

H. Polyester revetment cable shall be constructed of high tenacity, low elongation, and continuous filament polyester fibers. Cable shall consist of a core construction comprised of parallel fibers contained within an outer jacket or cover. The weight of the parallel core shall be between 65 to 70 percent of the total weight of the cable. Vertical cables shall be sized to provide a minimum cable strength to mat weight ratio of 5:1 for safe material lifting/handling. Additionally, all revetment cable shall have the following minimum physical characteristics:

Location	Nominal Cable Diameter	Approx. Avg. Strength lbs.	Weight/100ft (lbs.)
Vertical	5/32"	3300	2.2
Horizontal	1/8"	2100	2.2

I. Elongation Requirements: Specified below are based upon stabilized new, dry cable. Stabilization shall be accomplished in accordance with the manufacturer's standard procedures.

J. The revetment cable shall exhibit good to excellent resistance to most concentrated acids, alkalis, and solvents. Cable shall be impervious to rot, mildew, and degradation associated with marine organisms. The materials used in the construction of the cable shall not be affected by continuous immersion in fresh or salt water.

K. Selection of cable and fittings shall be made in a manner that ensures a minimum of 5:1 design safety factor for mattresses being lifted from both ends, thereby forming a catenary. Consideration shall be taken for the bending of the cables around hooks or pins during lifting. Revetment cable splicing fittings shall be selected so that the resultant splice shall provide a minimum of 75% of the minimum rated cable strength. Fittings such as sleeves, stops, and washers shall be in accordance with manufacturer's recommendations unless otherwise shown on the drawings.

L. A minimum 8 oz/sy, non-woven geotextile bonded to the bottom of the articulating concrete mats is preferred. However, a separate layer of non-woven geotextile can be placed on the cap closure surface prior to the placement of the articulating concrete mats. For this case, a minimum 10 oz/sy non-woven geotextile shall be placed.

M. The CONTRACTOR shall submit to the DESIGNER for approval of a sample of each type and size of earth anchor to be used.

PART 3 EXECUTION

3.1 Installation

A. Areas on which the articulating concrete mats and geotextile are to be placed shall be constructed to the lines and grades shown on the drawings. The subgrade for the cellular concrete mats shall be free of voids, pits, or depressions shall be brought to grade by backfilling, in accordance with the applicable portions of the project Specifications.

All obstructions, such as roots and projecting stones larger than 1-inch remaining on the surface, shall be removed and all of the soft or low density pockets of material removed must be filled with selected material and compacted to a minimum of 90% of the ASTM D 698 (standard Proctor) density.

B. Immediately prior to placing the articulating concrete mattresses and geotextile, the prepared area shall be inspected by the RM. No mats or geotextile shall be placed prior to approval of subgrade materials by the RM.

C. The cellular concrete mats or blocks shall be placed on the filter fabric in such a manner as to produce a relatively planar surface. No more than 200 linear feet of filter fabric shall be laid before being covered with concrete mattresses, and any fabric installed more than 2-days shall be lifted, and the surface of the slope inspected by the RM for any defects. The DESIGNER may require any uncovered fabric to be lifted after heavy rainfall to inspect for slope damage. The CONTRACTOR shall hold the OWNER harmless from liability of any kind arising from the use of any patented or unpatented invention used in the performance of the Work.

D. Placement of prefabricated mattresses shall be done with mats attached to a spreader bar or other approved device to aid in the lifting and placing of the mats in their proper position by the use of a crane or other approved equipment. The mats shall be placed side by side and/or end to end so that the mats abut each other. The maximum space or gap between mattresses shall be 3-inches, except that local wider gaps may be accepted if the length of the gap is grouted. No overlapping of mats will be accepted and no blocks shall project vertically more than one inch beyond the adjacent blocks. All placement of mats shall be in accordance with the manufacturer's recommendations.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools, and appurtenances to complete the work of locating, abandoning and sealing designated groundwater monitoring wells located within the limits of Work and identified in the Permit Drawings.
B. All wells shall be abandoned by a well driller (DRILLER), certified in the State of Maryland.

1.2 Submittals

The DRILLER shall provide a well abandonment report, as required by the State of Maryland, at the completion of each monitoring well abandonment. The DRILLER will submit copies of the well abandonment report to the DESIGNER and RM.

1.3 Applicable Laws

Monitoring wells shall be abandoned in accordance MDE Monitoring Well Guidelines. CONTRACTOR shall be responsible notifying appropriate agencies, as required.

PART 2 PRODUCTS

2.1 Cement

Type II Portland Cement shall be used in the grout mixture.

2.2 Bentonite

Bentonite used in the grout mixture shall be 30 mesh granular bentonite, or finer.

PART 3 EXECUTION

3.1 Installation

A. Locate all groundwater-monitoring wells using visual means.
B. If possible, pull the well casing from the well. The CONTRACTOR shall supply the appropriate equipment to remove the well casings, including overdrilling of the well casings, if they are grouted in place.

3.2 Monitoring Well to be Abandoned

In the event of abandonment of any water well, or other type of well, as indicated in the Permit Drawings, the following procedure and materials shall be used:

A. The well shall be plugged to prevent the entrance of surface water, circulation of water between or among producing zones, or any other process resulting in the contamination or pollution of groundwater resources.

B. In the event of temporary abandonment or discontinuance of the use of any well, the well shall be sealed with a watertight cap or seal.

C. All abandoned monitoring wells or piezometers shall be over drilled to a depth of one (1) foot greater than the original well depth.

D. The well shall be checked from land surface to the entire depth of the well before it is sealed, to ensure against the presence of any obstruction that will interfere with sealing operations. Silt deposit shall be removed from silted-in wells, to ensure an adequate seal.

E. The well bore shall be filled and sealed with a mixture of 95% Portland cement and 5% bentonite.

F. The grout material shall be placed through a tremie pipe extending to the bottom of the well, which shall be raised as the well is filled.

G. Any well constructed in a consolidated rock formation may be filled with fine sand in the zone or zones of consolidated rock. The top of the sand fill shall be at least 10-feet below the top of the consolidated rock and the remaining portions of the well shall be filled with any of the materials specified in subsection D, above.

  Note: Impermeable grout shall be used, rather than sand, at sites with dense organic chemical contamination. Any screen or sandpack in the rock zone shall be removed.

  Note: Boreholes, which intersect multiple yielding zones, shall also be grouted to preclude cross-contamination.

H. Any test well or bore shall be abandoned in such a manner that it does not become a channel for the vertical movement of water or other substance to potable groundwater resources.

  Note: Older monitoring wells may require special abandonment efforts to meet this requirement, especially if they are screened/sandpacked for long vertical intervals or inadequately grouted above the screened interval (see subsection F, above).

I. Upon completion of abandonment of the well, the top of the casing or grout material shall be terminated at least 4-feet below the ground surface.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. This Section specifies the requirements for handling and management of dewatering activities.

B. The CONTRACTOR shall design, construct, and maintain all dikes, sumps, diversions, and drainage channels, as necessary, to complete the construction, and to protect the areas to be occupied by permanent work from water damage. The CONTRACTOR shall remove temporary works after they have served their purpose.

C. The CONTRACTOR shall be responsible for removing water from the construction area during construction.

D. The CONTRACTOR shall be responsible for the stability of all temporary and permanent slopes, grades, foundations, materials, and structures during the course of the Contract. Repair and replace all slopes, grades, foundations, materials, and structures damaged by water, both surface and subsurface, to the lines, grades, and conditions existing prior to the damage, at no additional cost to OWNER.

E. The CONTRACTOR shall provide a “Competent Person” to implement and supervise all Work.

F. The CONTRACTOR shall submit a description of its methods for accomplishing construction dewatering to OWNER and DESIGNER for approval.

G. CONTRACTOR shall provide measures to minimize accumulation of surface water in the work area.

H. CONTRACTOR will segregate all surface runoff, and waters from perched groundwater and seeps encountered during excavation filling operations. Perched groundwater and seeps encountered by CONTRACTOR will be collected, pumped, transferred, and hauled to an on-site discharge point as designated by DESIGNER.

PART 2 PRODUCTS

Piping, pumping equipment, and all other equipment and materials required for dewatering shall be suitable for the intended purpose. Standby pumping units shall be maintained at the Site to be used in case of failure of the primary pumping units.

PART 3 EXECUTION

3.1 Handling of Water

A. Design, furnish, install, maintain, monitor, operate, and remove necessary pumping and other equipment for dewatering the various parts of the Work, and for maintaining the work areas free from water, as required for constructing each part of Work.

B. Install all drainage ditches, sumps, and pumps to control excessive seepage on excavated slopes, to drain isolated zones with perched water tables, and to drain impervious surfaces at final excavation elevation.

C. Dewater by means that will enable completion of the Work and preserve final lines and grades. Do not disturb or displace adjacent soil.

D. All pumping and drainage shall be done with no damage to property or structures, and without interference with the rights of the public, owners of private property, pedestrians, vehicular traffic, or the Work of other contractors, and in accordance with all Federal, State, and local laws, ordinances, and regulations.

E. Do not overload or obstruct existing drainage facilities.

F. Separate all surface runoff water, and segregate and collect all water from perched groundwater and seeps that may be encountered during excavation or site grading. Collect, hold, and dispose of water collected from perched groundwater and seeps separately from surface runoff.

G. After they have served their purpose, remove all temporary protective work at a time, and in a manner, approved by the DESIGNER. All temporary diversion channels and other temporary excavations in areas where the compacted fill or other structures will be constructed shall be cleaned out, backfilled, and processed in accordance with Section 02223 “Structural/General Fill of these Specifications.

H. When the temporary works will not adversely affect any item of permanent work, or the Site operations, CONTRACTOR may be permitted by the DESIGNER to leave such temporary works in place. In such instances, breaching of dikes and other temporary works may be required.

3.2 Dewatering

A. By the use of pumps, tile drains or other approved methods, CONTRACTOR shall control the flow and accumulation of water in excavated areas, to prevent excessive softening and disturbance of exposed soils in excavations, as necessary for completion of the Work.

B. The system used shall not cause settlement damage to adjacent structures. The CONTRACTOR shall carry out the Work by the use of techniques that will not endanger adjacent structures. All such Work shall be done at the CONTRACTOR’s expense.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of shoring, bracing, and sheeting or sheet piling, necessary to complete the construction, protect structures, and prevent the loss of ground or caving of embankments, excavations, or cut slopes, as shown, specified or required, and shall meet all applicable building and safety codes. The CONTRACTOR shall provide a "Competent Person" to implement, supervise, and inspect all shoring and bracing. The OWNER, DESIGNER, or QAC personnel shall not be the "Competent Person" on the Site.

B. CONTRACTOR shall be solely responsible for proper excavation procedures including, but not limited to, safe slope angles and the design and use of properly designed and installed shoring and bracing systems, in accordance with OSHA and other applicable standards and requirements. As required, shoring and bracing shall be designed by the CONTRACTOR's engineer who is a registered Professional Engineer in the State of Maryland. Remove all shoring and bracing without disturbing backfill, bedding, haunching, pipes, or structures. The presence of the QAC shall not relieve the CONTRACTOR of his responsibility to properly design, install, and maintain, shoring and bracing.

C. Pressures on sheeting and the stability of the sheeting and bottom of the excavation are dependent not only on soil conditions, but upon many procedures and options available to the CONTRACTOR, such as dewatering, staging of excavation, installation of bracing, flexibility of sheeting, construction equipment used, and duration of the Work. All such factors shall be considered and investigated, as necessary, in the design of the sheeting and bracing.

D. Comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 Submittals

A. In cases where the excavation cannot be open cut to a safe working angle in accordance with applicable requirements, or where excavation may jeopardize adjacent site areas or the stability of nearby structures or facilities, the CONTRACTOR shall submit drawings, computations, and substantiating data, prepared, signed, and sealed by a Professional Engineer licensed in the State of Maryland, showing his proposed shoring and bracing design and method of construction, for the information of the DESIGNER, prior to the start of such construction.

B. Shoring and bracing systems shall be designed such that removal shall not jeopardize work already performed. Shoring and bracing systems shall not remain permanently in place without the written approval of the DESIGNER.

C. Any review or comments by the DESIGNER shall not relieve the CONTRACTOR of his responsibility for sheeting and bracing.

D. In trenches, the sheeting shall be designed so that the lowest brace is no closer than 12-inches above the base of the structure to be installed.

1.3 Quality Control

During the installation of the sheeting and bracing and as long as the excavation is open, the CONTRACTOR's "Competent Person" shall monitor the work to ensure that it is carried out in accordance with his design and procedures.

PART 2 PRODUCTS

All materials shall meet, or exceed, the minimum requirements of the applicable codes and assumptions included in the CONTRACTOR’s design.

PART 3 EXECUTION

3.1 Verifying Existing Conditions

Before commencing work, the CONTRACTOR shall check and verify all governing dimensions and elevations, including field measurements of existing and adjoining work on which his work is dependent, to assure proper fit and clearance of each part of the Work to the new and existing structures.

3.2 Coordination with Other Operations

The schedule and progress of the shoring, bracing, and sheeting work shall be coordinated with the excavation and backfilling work. If, during the progress of the excavation, lateral movement of the surrounding soils, or any other evidence of instability, is discovered, further excavation or backfilling work in the excavation shall cease and corrective measures shall be taken immediately to prevent further movement.

3.3 Removal of Shoring and Bracing Materials

A. Where the CONTRACTOR is permitted by the DESIGNER to leave shoring and bracing material in place, all such material shall be removed to the extent that the top of the material shall be a minimum of 5 feet below the proposed finished grade. No shoring or bracing may remain in place within the limits of the proposed geomembrane liner placement.

B. Removal of shoring and bracing shall be carried out in a manner such that no structure shall be disturbed or damaged during or after removal. Protection of structures during the removal of shoring and bracing shall be the sole responsibility of the CONTRACTOR, and any disturbance or damage shall be rectified at no expense to the OWNER.

3.4 Safety

Installation and removal of shoring and bracing shall meet, or exceed, the minimum requirements of the applicable codes, and safety precautions as outlined in such codes, and shall be enforced by the CONTRACTOR.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of excavation, mass excavation, stripping and removal of surface soils, excavation, removal, and disposal of excess and unsuitable materials, relocation of excavated soils to designated areas, and other related and incidental work within the designated area, and as required for the construction of other work, as shown, specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The CONTRACTOR shall locate all existing active and abandoned utilities and structures in work areas prior to commencing any excavation activities, and shall protect from damage those utilities and structures which are to remain in place.

C. Comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State or Federal, authorities having jurisdiction.

1.2 Definitions

A. Excavation shall mean the removal of all materials and shall include soil, facilities, structures above and below ground, rock, pavements, topsoil, boggy waste, rubbish, tree stumps, boulders, logs, ashes, cinders, organic material (such as peat, humus or organic silt), softened or disturbed soils, or other unsuitable bearing materials, as determined in the field by the QAC.

B. Mucking or mucking-out shall mean excavation, as defined herein, without prior dewatering.

1.3 Protection of People and Property

A. The CONTRACTOR shall plan and conduct his operations as to prevent damage to existing structures, safeguard people and property, minimize traffic inconvenience, and provide safe working conditions.

B. Excavations, except as specified herein, shall be adequately shored and braced. Where the installation of shoring is impractical, or might cause damage as a result of, but not limited to, vibration, settlement, or lateral movement, the CONTRACTOR shall utilize other methods, consistent with applicable standards and regulations.

C. Excavation may be made without sheeting and bracing, within the limitations and requirements of the governmental agencies having jurisdiction, provided that:

1. Hazards, such as described herein before, do not exist in the proximity of the excavation.
2. Work is not in streets, or other paved, landscaped, or improved areas.
3. Work can be restricted to the land provided for the CONTRACTOR's use.
4. Sheeting and bracing are not specifically required by the Contract Documents.

5. The CONTRACTOR shall submit a certification by a Professional Engineer, licensed in the State of Maryland, indicating the maximum slope of the sides of the excavation proposed, and that said slopes will be stable under all weather and working conditions for the period that the excavation will be open. Such certification shall be based on the CONTRACTOR's own subsurface exploration and consideration of the options available to the CONTRACTOR, such as dewatering, construction equipment, and proximity of spoil area. Any review of comments by the DESIGNER, QAC, or OWNER shall not relieve the CONTRACTOR of his responsibilities arising from the excavation.

D. In cases where excavation without shoring and bracing is not permissible, trench boxes may be used.

E. The CONTRACTOR shall not stockpile any excavated material adjacent to trench excavations, without the DESIGNER's written approval.

F. Prior to exposing subgrades for placement of cover fills and backfills, the area of the Work shall be surrounded by a soil berm, to contain surface runoff accumulating within the berm and exclude surface runon from areas surrounding the Work. The CONTRACTOR shall employ excavation methods that minimize the need to remove accumulated water from excavations. Water may be disposed of by pumping through a sedimentation filter and treating the discharge in accordance with methods approved by the DESIGNER if accumulation of water is unavoidable.

1.4 <u>Site Conditions</u>

Borehole logs and laboratory analyses of samples performed by others shall be provided to the CONTRACTOR upon request. Any such information developed by the CONTRACTOR shall be made available to the OWNER.

PART 2 PRODUCTS

A. All materials shall be as defined on the Permit Drawings and these Specifications.

B. Unsuitable material shall include any topsoil, soft or non-bearing soils, mulch, waste materials, debris, wood waste, organic material, peat, humus, or any other material deemed unsuitable and required to be removed by the QAC.

PART 3 EXECUTION

3.1 <u>Limits of Excavation</u>

A. *Excavation Classifications*: The following classifications of excavation will be made when rock or earth excavation is encountered in Work.

1. Earth excavation includes excavation of on-site soils to achieve proposed excavation grades. These soils could be sandy, silty, or clayey materials. Some of these soils will be saved for later use for liner system components or daily cover. Staging of materials retained for future use will be staged within the landfill footprint, in future cell locations.
2. Deleterious material includes pavements and other obstructions visible on ground surface, underground facilities, utilities, refuse, debris, waste, and other items indicated to be demolished and removed, together with earth and other materials encountered that are not classified as rock, or unauthorized excavation.
3. Rock excavation in trenches and pits includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 1.0 cubic yard (heaped) capacity, 42" wide bucket on track-mounted power excavator equivalent to Caterpiller Model 215, rated at not less than 90 HP flywheel power and 30,000 lb. drawbar pull. Trenches in excess of 10-feet in width, and pits in excess of 30-feet in either length or width, are classified as Open Excavation.
4. Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with modern track-mounted, heavy-duty, excavating equipment without drilling, blasting, or ripping. Rock excavation equipment is defined as Caterpillar Model No. 973 or No. 977K, or equivalent track-mounted loader, rated at not less than 170HP flywheel power, and developing 40,000 pounds break-out force (measured in accordance with SAE J732C).
5. Typical materials classified as rock are boulders 1/2 cu. yd. or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits.
6. Intermittent drilling, blasting or ripping performed to increase production and not necessary to permit excavation of material encountered, will be classified as earth excavation.
7. Rock excavation shall not be performed until material to be excavated has been classified by the QAC.

B. *Unauthorized excavation* consists of removal of materials below the limits specified herein and indicated subgrade elevations or dimensions shown on the Permit Drawings, without specific direction of the QAC and excavation of rock material prior to classification of material as rock by QAC.

Unauthorized excavation shall be at CONTRACTOR's expense unless otherwise approved by QAC.

C. *Additional Excavation*: When excavation has reached required subgrade elevations, notify QAC who will make a review of conditions.

1. If unsuitable bearing materials are encountered at required subgrade elevations, for select backfill within limits of cell construction, carry excavations to develop suitable bearing and replace excavated material as directed by QAC. Within the limits of cell construction, at least 6-inches of surface materials identified as unsuitable shall be stripped. Select fill as defined in Section 02223 “Structural/General Fill and Intermediate Cover” shall be used to replace unsuitable materials.
2. Further removal of unsuitable material and its replacement will be performed based on results of proofrolling, and as directed by QAC.
3. If unsuitable materials are encountered in trenches at specified subgrade elevations for crushed stone or aggregate bedding beneath pipes, or other drainage structures, they shall be removed. The new exposed subgrade shall be compacted, and the areas refilled to the specified bedding subgrade elevation with select fill as specified in Section 02223 “Structural/General Fill and Intermediate Cover”. Unsuitable materials for bedding beneath pipes or other drainage structures shall include miscellaneous fill, topsoil, or soil containing organic materials, or other such materials identified in the field by the QAC.

D. *Stability of Excavations*: Slope sides of excavations shall comply with local codes and ordinances having jurisdiction. Shore and brace in accordance with Section 02150 “Shoring and Bracing” where sloping is not possible, because of space restrictions or stability of material excavated. Comply with all OSHA and other applicable safety requirements.

Maintain sides and slopes of excavations in safe condition until completion of backfilling.

3.2 <u>Material Storage</u>

Stockpile excavated materials satisfactory for use as common fill on-site where directed by DESIGNER, until required for backfill or fill. Stockpile shall be graded and shaped to maintain proper drainage.

A. Locate and retain soil materials away from the edge of excavations, where the weight of the material could create a surcharge on such edge, whether sheeted or not. Do not store within drip line of trees indicated to remain.
B. Dispose off-site refuse, waste, debris, or other materials that cannot be reused during construction or by OWNER at the existing operating landfill, as alloed in the facility pemit.

3.3 Excavation

A. *Excavation for Trenches:* Excavate trenches to the uniform width required for a particular item to be installed, sufficiently wide to provide ample working room, shoring, or as shown on Permit Drawings.

1. Excavated trenches with a depth greater than 4-feet shall be considered a confined space, and shall be excavated in conformance with the requirements of the CONTRACTOR's Health and Safety Plan.
2. All excavated material shall be removed from the area at time of excavation, and stockpiled on-site or disposed as determined by the QAC.
3. Open excavations shall be protected using suitable barricades and signs.
4. Excavate trenches to depth indicated or required to allow placement of specified thickness of bedding materials beneath the bottom of all barrels, bells, or couplings of all pipes installed. Carry depth of trenches for piping to establish flow lines and invert elevations indicated in the Permit Drawings.
5. Where rock is encountered, carry excavation 1-foot below required elevation and backfill with compacted structural fill, as defined in Section 02223 "Structural/General Fill and Intermediate Cover " overlain by a 6-inch thick layer of coarse aggregate prior to installation of pipe.
6. Do not backfill trenches until tests and inspections have been made, and backfilling is authorized by the QAC. The CONTRACTOR shall use care in backfilling to avoid damage or displacement of pipe or foundation systems.
7. Trench dewatering shall be in accordance with Section 02140 "Construction Dewatering", of these Specifications. If inadequate dewatering causes softening of the subgrade, CONTRACTOR shall, at its own expense, excavate softened subgrade, as determined by the QAC, and backfill with structural fill as specified in Section 02223 "Structural/General Fill and Cover Material".

B. Following excavation for swales, concrete structures, outlets, outfalls, pipes, etc., the CONTRACTOR shall regrade and add compacted fill, as needed, to achieve required surface for placement of materials, as shown in the Permit Drawings. All visible sharp, protruding objects shall be removed, or covered with a minimum of 12-inches of compacted fill.

C. CONTRACTOR shall remove all unsuitable material (and all objects greater than 6-inches) within 24-inches of a swale or channel, or as determined by QAC, and replace same with compacted fill.

D. Protect excavation bottoms against freezing. No fill or structures shall be allowed to be placed on frozen materials or subgrades softened as a result of freeze/thaw action.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of structural/general fill and intermediate cover, including fill for roads, berms, embankments, over excavated subgrade areas, backfill of anchor trenches and pipe trenches, and other related and incidental work within the designated area and as required for the construction of other work, as shown specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The Contractor shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

A. American Society for Testing and Materials (ASTM):
1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
3. ASTM D 1587- Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils.
4. ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) content of Soil and Rock.
5. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
6. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in-Place by Nuclear Methods (Shallow/Depth).
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in-Place by Nuclear Methods (Shallow Depth).
8. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 Definition

A. *Structural Fill* – Material used to construct perimeter embankments and fill required for structural foundations, roads, fill for over-excavated subgrade areas and sedimentation ponds and the Closure Cap protective soil layer.

B. *General Fill* – Material used to backfill anchor trenches, pipe trenches, and around structures such as manholes and vaults.

PART 2 PRODUCTS

2.1 Materials

A. *General Requirements*

1. Fill and cover materials, unless otherwise specified, shall consist of suitable soil from selected borrow areas (located on or off site), approved by the DESIGNER.
2. No frozen earth shall be used for backfill and fill, and no backfill or fill shall be placed over frozen surfaces. All backfill and fill materials shall be free from all perishable and objectionable (as described below) materials. All fill shall be protected from freezing conditions.
3. All required fill and cover materials shall be free from organic materials, wood, trash, and other objectionable materials which may be compressible or which cannot be properly compacted. Fill and cover materials shall not contain broken concrete, masonry rubble, or other similar materials that could damage geosynthetics. Fill and cover materials shall have physical properties such that it can be readily spread and compacted. Snow, ice, and frozen soil shall be removed from fill and cover material prior to placement.

B. *Structural Fill*

1. Material proposed to use as structural fill shall meet the following specifications:
2. Borrow materials shall have a USCS classification of GM, GW, GC, SM, SW, SC, ML, or CL in accordance with ASTM D2487. The maximum particle size shall not exceed 6 inches, unless otherwise specified. The maximum particle size for the protective soil layer component of the Closure Cap shall not exceed 2-inches. The plasticity index (PI) shall be less than, or equal to 25.
3. Structural fill materials shall have an internal friction angle greater than 28 degrees as determined by a triaxial shear test (ASTM D4767).
4. Test frequencies listed in tables 1 and 2 under PART 3.

C. *General Fill*

1. Material proposed to use as general fill shall be approved by the QAC and meet the general requirements listed in section 2.1(A)

PART 3 INSTALLATION

3.1 Structural Fill

A. *Quality Assurance (QA) Pre-construction Testing*

The QAC shall conduct QA pre-construction sampling/testing to verify compliance with the specifications listed in section 2.1(B) at the following frequencies:

TABLE 1
QA Pre-construction Testing

Test Name	Test Standard	Frequency
Soil Classification	ASTM D2487	1 per source
Sieve Analysis (with hydrometer)	ASTM D422	1 per source

Atterberg Limits	ASTM D4318 (B)	1 per source
Standard Proctor	ASTM D698	1 per source
Moisture Content	ASTM D2216	1 per source

B. *Placement*

1. General Specifications
   a. Areas on which embankments, containment berms, or other fill will be constructed, shall be cleared of all vegetation. Immediately prior to filling, the subgrade shall be proof-rolled, unless otherwise specified. All unsuitable material, ponded water, and soft disturbed soils, as determined by the QAC, shall be removed prior to filling and filled with compacted structural fill.
   b. Structural fill shall be placed in an approximate loose lift thickness of 12 inches. Lift thickness may be increased to bridge over saturated areas at the discretion of the QAC.
   c. Compaction shall be accomplished using a penetrating-foot compactor (e.g.,
   d. Caterpillar 815 peg-foot compactor, or equal) subject to the approval of the QAC and/or DESIGNER.
   e. Structural fill shall be compacted to 95% of its maximum dry density determined by Standard Proctor (ASTM D698). Field-testing for dry density and compaction moisture content shall be performed using a nuclear gauge (ASTM D-2922/3017) or drive cylinder (ASTM D-2937). During the construction of each lift of structural fill, field moisture-density tests shall be performed at the frequency listed in Table 2. The frequency of testing may be increased at the discretion of the QAC when visual observations indicate a potential problem.
   f. The surface of each compacted lift shall be scarified prior to the placement of subsequent lifts to ensure homogeneous bonding.
2. Embankment Construction
   a. Structural fill placed for embankments shall be placed in accordance with general specifications listed in section 3.1(B).
3. Over-excavated Areas
   a. Structural fill placed in over-excavated areas shall be placed in accordance with Specifications listed in section 3.1(B).
4. Structural Fill for Sedimentation Ponds
   a. Structural fill for sedimentation ponds shall be placed in accordance with general specifications listed in section 3.1(B). Structural fill shall not contain any more than 15 percent, by volume, particle sizes larger than 2inches.

5. Access Road Construction
   a. In addition to the general specifications listed in section 3.1(B), the construction of the access road shall meet the following specifications:
   b. Access Road Subgrade structural fill shall have a maximum particle size of 3-inches. Borrow materials shall be free of organic matter.
   c. Any Temporary Access Roads required by the CONTRACTOR shall be at least 12-feet wide at the crest.
   d. Access Road Subgrade structural fill shall have side slopes no steeper than 2(H):1(V), maximum. The CONTRACTOR shall design and maintain the road surface and side slopes, as necessary, to maintain the original grades and conditions specified in the Contract Documents. The road shall be passable at all times with construction traffic and passenger automobiles. At the end of the work, the CONTRACTOR shall repair the road to achieve a well-maintained condition to the satisfaction of the DESIGNER.
   e. A woven geotextile followed by coarse aggregate shall be place over the final surface of the access road. The ends of the woven geotextile shall be over lapped a minimum of 2 feet. Refer to permit drawings, geotextile section 02595, and coarse aggregate section 02233 for specifications on placement and quality assurance.

C. *Quality Control (QC) Construction Testing*

The QAC shall monitor the placement of structural fill on a full time basis and conduct QC construction sampling/testing to verify compliance with the specifications at the following frequencies:

TABLE 2
QC Construction Testing

Test Name	Test Standard	Frequency
Soil Classification	ASTM D2487	Every 10,000 CY
Sieve Analysis (with hydrometer)	ASTM D422	Every 10,000 CY
Atterberg Limits	ASTM D4318 (B)	Every 10,000 CY
Standard Proctor	ASTM D698	Every 10,000 CY
Moisture Content	ASTM D2216	Every 10,000 CY
Field Density	ASTM D2922/2937	Every 10,000 SF, 1 per 100 LF for Access Road
Field Moisture	ASTM D3017	Every 10,000 SF, 1 per 100 LF for Access Road

3.2 General Fill

A. *Quality Assurance (QA) Pre-construction Testing*

1. QA pre-construction testing shall not be required for general fill. The QAC shall approve material proposed for use as general fill prior to placement.
2. Placement
   a. Backfill for Pipe Trenches and Around Structures
      i. Backfill shall not be placed until the structure, pipeline, subgrade or other construction component has been inspected in place and approved by the QAC. The extent of pipe trenches left open shall be kept to a minimum.
      ii. Unless otherwise approved by the QAC, excavations shall be backfilled as soon as possible after structures are constructed, pipes are laid and the work is inspected, tested (as required) and accepted, and permission to backfill has been given by the QAC.
      iii. Pipes shall be bedded and backfilled as shown on the Permit Drawings or as approved by the QAC.
      iv. Fill shall be brought up in essentially horizontal uniform lifts throughout the area. The loose lift thickness shall not exceed 12 inches, unless otherwise noted.
      v. The backfill shall be compacted with the compaction effort acceptable to the QAC. The method of compaction shall not damage the pipe, the structure, or the geosynthetics. A minimum of 12 inches of fill must exist over pipes prior to the use of heavy equipment for compaction.
      vi. Hand-operated plate type vibratory or other suitable equipment may be used in areas not accessible to larger rollers or compactors, and to avoid damaging pipes or structures.
   b. Backfill for Geomembrane Anchor Trenches
      i. General fill approved by the QAC shall be placed in the anchor trench and compacted with a compaction effort acceptable to the QAC. Heavy equipment equipped with rubber tires, or other suitable equipment may be used for compaction.

B. *Quality Control (QC) Construction Testing*

1. QC sampling for laboratory testing shall not be required for general fill during construction. Quality control shall consist of the following activities:
2. The QAC shall monitor placement of general fill on a full time basis; and,
3. Conduct density testing at the discretion of the QAC where insufficient compaction is suspected and in areas where the uniformity of the material is not maintained based on visual observation.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of intermediate cover, and other related and incidental work within the designated area and as required for the construction of other work, as shown specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The Contractor shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

A. American Society for Testing and Materials (ASTM):

1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
3. ASTM D 1587- Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils.
4. ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) content of Soil and Rock.
5. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
6. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in-Place by Nuclear Methods (Shallow/Depth).
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in-Place by Nuclear Methods (Shallow Depth).
8. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 Definitions

A. *Intermediate Cover* – Pursuant to COMAR Sec. 26.04.07.18(G) Intermediate cover soil is a uniform compacted layer of clean earth not less than 1 foot in depth placed over each lift not later than 1 month following completion of that lift. Procedures for placement of Intermediate cover soil are provided in Section 12 of this Phase III Permit Application.

PART 2 PRODUCTS

2.1 Materials

2.1.1
Intermediate Cover

Material proposed for use as intermediate cover, unless otherwise approved by MDE, shall be a uniform compacted layer of clean earth not less than 1 foot in depth placed over each lift not later than 1 month following completion of that lift.

PART 3 INSTALLATION

3.1 Intermediate Cover

A. *Quality Assurance (QA) Pre-construction Testing*
QA pre-construction testing shall not be required for intermediate cover material. The QAC shall approve material proposed for use as intermediate cover prior to placement.

B. *Placement*
Intermediate cover shall consist of at least 12-inches of soil placed in a single lift and compacted using tracked heavy equipment or roller. .

C. *Quality Control (QC) Construction Testing*
No QC testing is required for Intermediate Cover material.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of subbase soil, and other related and incidental work within the designated area and as required for the construction of other work, as shown specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

A. *American Society for Testing and Materials (ASTM):*
   1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
   2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
   3. ASTM D 1587 - Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils.
   4. ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) content of Soil and Rock.
   5. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   6. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in-Place by Nuclear Methods (Shallow/Depth).
   7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in-Place by Nuclear Methods (Shallow Depth).
   8. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 Definitions

A *Subbase Soil* – Material used as the bottom-most layer in the cell liner system to provide protection to geosynthetics from underlying natural soils.

PART 2 PRODUCTS

2.1 Materials

A. Material proposed to use as subbase soil shall meet the following specifications:
   1. Subbase sol material shall have a USCS classification of ML or CL in accordance with ASTM D2487.
   2. The maximum particle size shall not exceed 1-inch, unless otherwise specified. The plasticity index shall be less than, or equal to, 25.

3. Subbase soil shall not contain debris, trash, or other deleterious materials. The soil shall not be contaminated with chemicals or other substances that would inhibit the growth of vegetation.
4. The permeability shall be less than or equal to 1.0 x 10^{-5} cm/sec, as determined by ASTM D5084.
5. Subbase soil materials shall have an internal friction angle greater than 28 degrees as determined by a triaxial shear test (ASTM D4767).

PART 3 INSTALLATION

3.1 Pre-Construction Laboratory Testing

A. Prior to the placement of the subbase soil, each source of materials shall be tested to determine the moisture-density-permeability "window" to meet the permeability requirements. Table 1 outlines the minimum borrow source testing requirements.

TABLE 1
Minimum Pre-Construction Borrow Source Testing Requirements

Test	Method	Testing Frequency
Moisture Content	ASTM D-2216	1 per 5,000 cy, or fraction thereof, of each material type
Liquid and Plastic Limits	ASTM D-4318	1 per 5,000 cy, or fraction thereof, of each material type
Percent Finer Than No. 200 Sieve	ASTM D-422	1 per 5,000 cy, or fraction thereof, of each material type
Moisture-Density Relationship (Standard Proctor)	ASTM D-698	1 per 5,000 cy, or fraction thereof, of each material type
Remolded Permeability	ASTM D-5084	3 per 5,000 cy, or fraction thereof, of each material type (strategically selected to define the moisture-density-permeability window)
Specific Gravity	ASTM D-854	1 per 5,000 cy, or fraction thereof, of each material type
Internal Friction Angle	ASTMD4767	1 per 100,000 square feet

B. The pre-construction laboratory testing must be completed and approved by the QAC before use.

3.2 Construction

A. No material shall be placed until the QAC has approved the installation of the underlying subgrade preparation.
B. No material shall be placed until the QAC has approved the pre-construction laboratory testing as described in Section 3.1.
C. The subbase soil shall be compacted with a smooth-drum roller to 90 percent of the maximum dry density (ASTM D698) as determined by the pre-construction

laboratory-testing program. In no case shall the compaction be less than 90 percent. Should the QAC have reason to suspect that the material delivered to the Site has changed from that previously tested and approved; the QAC shall immediately notify the CONTRACTOR's on-Site representative and arrange for additional laboratory testing.

D. Subbase soil field-testing for dry density and compaction moisture content shall be performed using a nuclear gauge (ASTM D-2922/3017) or drive cylinder (ASTM D-2937). During the construction of each lift of subbase soil, five (5) field moisture-density tests shall be performed per acre. The frequency of testing may be increased at the discretion of the QAC when visual observations indicate a potential problem (i.e., material change, zones of suspected failing moisture content, zones of failing density, etc.).

E. Subbase soil compaction moisture content shall be wet of the optimum moisture content as established by ASTM D698, and shall fall within the acceptable moisture-density-permeability window developed from the pre-construction laboratory testing.

F. All subbase soil materials shall be transported over constructed temporary haul roads or benches to the toe of the slope. Material shall be placed at the toe of the slope by transporting equipment and pushed up slope by LGP spreading equipment. Transporting equipment shall not be allowed on slopes of the capping system under any circumstances. All equipment to be used on the slope shall be low ground pressure, and be approved by the DESIGNER.

G. The CONTRACTOR shall take care to ensure that:
   1. No foreign material is mixed into the subbase soil that may damage the proposed geosynthetics.
   2. No vehicles shall drive on the uncovered geosynthetics.
   3. All grade stakes used for survey control during subbase soil placement are removed in their entirety.

3.3 Quality Control (QC) Construction Testing

A. Quality control testing shall consist of field-testing for moisture content, dry density, and percent compaction as outlined in Section 3.2.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of Final Cover, and other related and incidental work within the designated area and as required for the construction of other work, as shown specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The Contractor shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

A. American Society for Testing and Materials (ASTM):

1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
3. ASTM D 1587- Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils.
4. ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) content of Soil and Rock.
5. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
6. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in-Place by Nuclear Methods (Shallow/Depth).
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in-Place by Nuclear Methods (Shallow Depth).
8. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 Definitions

A. *Final Cover* – Pursuant to COMAR Sec. 26.04.07.18(H) Final Cover is a uniform compacted layer of earthen material not less than 2 feet in depth placed over the final lift of the filled landfill not later than 90 days following completion of that lift. Procedures for placement of the Final Cover Layer are provided in Section 12 of this Phase III Permit Application.

PART 2 PRODUCTS

2.1 Materials

2.1.1 Final Cover Layer

A. The Final Cover layer will directly underlie the cap geomembrane, unless otherwise specified, shall consist of suitable soil meeting the requirements for

Structural Fill (Specification 02223, Section 2.1(B)) (except that the maximum particle size shall be 2-inches) from selected borrow areas (located on or off site), approved by the DESIGNER.

B. The Final Cover materials shall not contain frozen earth and shall not be placed over frozen surfaces. All backfill and fill materials shall be free from all perishable and objectionable (as described below) materials. All fill shall be protected from freezing conditions.

C. The Final Cover materials shall be free from organic materials, wood, trash, and other objectionable materials which may be compressible or which cannot be properly compacted. The Final Cover materials shall not contain broken concrete, masonry rubble, or other similar materials that could damage geosynthetics. Fill and cover materials shall have physical properties such that it can be readily spread and compacted. Snow, ice, and frozen soil shall be removed from fill and cover material prior to placement.

D. The Final Cover material shall have an internal friction angle greater than 28 degrees as determined by a triaxial shear test (ASTM D4767).

PART 3 INSTALLATION

3.1 Final Cover Layer

A. *Quality Control (QC) Construction Testing*

Soil utilized for the Final Cover sol shall comply with the specifications for structural soil fill (Section 02223) and be tested at the following frequencies:

TABLE 2
QC Construction Testing

Test Name	Test Standard	Frequency
Soil Classification	ASTM D2487	Every 10,000 CY
Sieve Analysis (with hydrometer)	ASTM D422	Every 10,000 CY
Atterberg Limits	ASTM D4318 (B)	Every 10,000 CY
Moisture Content	ASTM D2216	Every 10,000 CY

1. QA for the Final Cover shall consist of the following activities:
   a. The QAC shall conduct four (4) depth checks per acre to ensure a minimum of 12 inches prior to placement of closure cap geosynthetic components; and,
   b. Inspect the surface of the final layer prior to the installation of the geosynthetic capping system.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of the installation of the subsurface drainage system associated with the subgrade or closure cap system as shown, specified, or required. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

A. *American Society for Testing and Materials (ASTM):*

1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D2434- Standard Practice for Permeability of Granular Soils (Constant Head).
3. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
4. ASTM D3042 – Standard Test Method for Insoluble Residue in Carbonate Aggregates. (Carbonate Content).

1.3 Submittals

The CONTRACTOR shall submit manufacturer's data sheets, and certification of compliance with specifications for all pipes, fittings and appurtenances, per Section 01300 - Submittals, of these Specifications.

PART 2 PRODUCT

2.1 Materials

A. *Perforated Pipe* – Pipe for the subsurface drainage system shall consist of a 6-inch and 8-inch diameter (as indicated on the Drawings) high density polyethylene (HDPE) corrugated ADS N-12 pipe, or approved equivalent. Perforations shall be 1/8-inch, 1-inch long slots, located staggered 120 degree angles in every corrugation valley, consistent with the ADS Standard CD slotting pattern, or approved equivalent.

B. *Coarse Aggregate* – Shall be USC Classification GW or GP, ASTM No. 57 stone.

C. *Geotextile Wrap* – Nonwoven 16 oz/yd^2 geotextile (See Geotextile Specification Section 02595.)

PART 3 INSTALLATION

3.1 General

A. All piping shall be of the type and size as shown on the Construction Drawings and described in this Section of the Specifications.

B. Pipe segments shall be attached in accordance with manufacturer's recommendations.

3.2 Pre-construction and Construction Testing

A. Refer to Coarse Aggregate and Geotextile sections 02233 and 02595, respectively, in Contract Specifications for pre-construction and construction testing.

3.3 Placement

The drainage system shall be installed as follows:

A. Geotextile filter fabric shall be placed along the flow lines, shown on construction drawings, in a manner that will allow enough material to burrito wrap the subsequent pipe and coarse aggregate with a minimum overlap of 2 foot over the top of the aggregate.

B. A 2-inch coarse aggregate bedding lift shall be placed directly over the geotextile.

C. Corrugated perforated pipe shall be placed in the flow line directly over the 2-inch coarse aggregate bedding.

D. Clean Coarse aggregate shall be placed over the perforated pipe to 6 inches above the top of the pipe.

E. The pipe and the coarse aggregate shall then be burrito wrapped with the previously installed geotextile.

F. The drainage assembly shall subsequently be covered with protective cover.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of furnishing, placing the leachate collection layer(s) as shown, specified or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities having jurisdiction.

1.2 References

A. American Society for Testing and Materials (ASTM):

1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D 1587- Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils.
3. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
4. ASTM D5084 - Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
5. ASTM D3042 – Standard Test Method for Insoluble Residue in Carbonate Aggregates.
6. ASTM C128 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.

PART 2 PRODUCTS

2.1 Materials

The material proposed to use for the construction of the leachate collection layer shall extend across the cell floor and up the slopes as shown in the permit drawings and shall meet the following specifications:

A *Sand* - used for the leachate drainage layer shall be USCS Classification SW, SP, SM, SC, SP-SM, or SW-SM, and shall have a hydraulic conductivity of not less than 1.0×10^{-3} cm/sec. (see Note 1).

B *Geotextile* – Overlying the sand shall be 12-oz, non-woven as specified in Section 02595 “Geotextile” (see Note 2).

C Verification of the above specifications shall be supplied to the QAC prior to delivery of the drainage layer material.

NOTE 1: The test frequencies for the above specifications are listed in Table 1 and Table 2 in sections 3.1 and 3.3.

NOTE 2: The test frequencies for the above specifications are listed in Section 02595 "Geotextile"

PART 3 INSTALLATION

3.1 Quality Assurance (QA) Pre-construction Testing

A The QAC shall conduct QA pre-construction sampling/testing to verify compliance with the Specifications listed in section 2.1 at the following frequencies:

TABLE 1
QA Pre-construction Testing

Test Name	Test Standard	Frequency
Soil Classification	ASTM D2487	1 per source
Sieve Analysis	ASTM C136	1 per source
Hydraulic Conductivity	ASTM D2434	1 per source
Carbonate Content	ASTM D3042	1 per source

3.2 Placement

A No material shall be placed until the QAC has approved the installation of the underlying geomembrane liner.

B The geotextile or geocomposite drainage layer shall be placed directly over the geomembrane liner as specified in Sections 02595 and 02418, respectively.

C The leachate drain rock layer shall be placed directly above the geotextile in one relatively horizontal lifts and in a manner that will reduce wrinkling of the underlying geomembrane.

D The CONTRACTOR shall use extreme care in the placing of the leachate drain rock layer material over the geomembrane. The material shall be placed in a manner that will maintain a minimum thickness of one foot of material between the primary geomembrane liner and low ground pressure (LGP) (less than or equal to 5 psi) spreading equipment. A minimum distance of 72-inches shall be maintained between exposed geomembrane and heavy equipment transporting drainage layer material. All equipment to be used in this operation shall be low ground pressure, and be approved by the DESIGNER.

E The CONTRACTOR shall take care to ensure that:

1 No foreign material is mixed into the leachate collection layer that may produce clogging or restrict the ability of the layer to transmit liquid.

2 No vehicles shall drive on the uncovered geomembrane.

3 All grade stakes used for survey control during drainage layer placement are removed in their entirety.

F Where applicable, the CONTRACTOR shall ensure that the leachate collection layer material is free of any foreign objects to the complete satisfaction of the DESIGNER prior to placing over the geomembrane.

G The CONTRACTOR shall exercise care during the stockpiling and handling of the leachate collection layer material to avoid the inclusion of fine-grained soil particles or other deleterious materials.

3.3 Leachate Collection Layer Material Quality Control (QC) Construction Testing

A During construction, the thickness of the leachate drainage material shall be measured by the QAC at a frequency of five (5) locations per acre throughout the day to ensure its compliance with Item C section 3.2.

B The QAC shall conduct QC construction sampling/testing to verify compliance with the specifications listed in section 2.1at the following frequencies:

TABLE 2
QC Construction Testing

Test Name	**Test Standard**	**Frequency**
Soil Classification	ASTM D2487	Every 3,000 CY
Sieve Analysis	ASTM C136	Every 3,000 CY
Hydraulic Conductivity	ASTM D2434	Every 3,000 CY

PART 4 SURVEYING

A All surveying shall be performed by a land surveyor licensed in the State of Maryland.

B The final as-built thickness of the leachate drainage layer material shall be surveyed on a pre-established 50-foot control grid. The thickness shall be determined by comparison of the as-built survey of the top of the geomembrane layer to the top of the completed drainage layer.

C Tolerance for thickness of the leachate drainage layer is 0.0’ to 0.3’.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A.. The CONTRACTOR shall furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of furnishing, and placing the stone in the construction of road surfacing, pipe bedding, or as shown, specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

A. American Society for Testing and Materials (ASTM):

1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D2434 - Standard Practice for Permeability of Granular Soils (Constant Head).
3. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
4. ASTM D3042 – Standard Test Method for Insoluble Residue in Carbonate Aggregates. (Carbonate Content).

PART 2 PRODUCTS

2.1 Material

A. The material shall be clean, sound, tough, durable, angular, subangular, subrounded or round stone, not lumpy, and free from slag, cinders, ashes, rubbish, or other deleterious material. Subangular, angular, subrounded, and round shall be as defined in ASTM D2488, "Standard Practice for Description and Identification of Soils [Visual-Manual Procedure]".

B. The CONTRACTOR shall maintain a uniform gradation of coarse aggregate.

C Aggregate shall be stored in designated areas approved by the DESIGNER. The CONTRACTOR is responsible for maintaining the stone free of contamination, and any stone determined by the DESIGNER to be contaminated shall not be incorporated into the work.

D. Coarse Aggregate for the access road and drainage pipe bedding shall meet the following grading requirements:

1. AASHTO No. 57: Perimeter Access Road & Pipe Bedding

Opening of Sieve Size	Percent Passing by Weight
1-1/2 inch	100
1 inch	95-100
1/2 inch	25-50
No. 4	0-10
No. 8	0-5

2. AASHTO #8 for entrance road surface:

Opening of Sieve Size	Percent Passing by Weight
1/2 inch	100
3/8 inch	85-100
No. 4	10-30
No. 8	0-10
No. 16	0-5

2.2 Testing

A. The QAC shall submit to the DESIGNER for approval, certification that the materials proposed for use as coarse aggregate comply with Specification for the proposed application. The certification shall include, but not necessarily be limited to, testing provided by the material supplier, including Gradation - ASTM D422.

The following minimum confirmatory testing shall be conducted by the QAC for coarse aggregate used for the leachate collection system:

Test Name	Test Standard	Frequency	Specification
Sieve Analysis	ASTM D422	1 per source	GW or GP
Carbonate Content	ASTM D1603	1 per source & 1/1,000 tons	<15% for Leachate collection System only
Permeability	ASTM D3042	1 per source & 1/1,000 tons	>1 x 10^{-2} cm/sec

B. No material shall be placed unless approved by the QAC.

C. If, in the opinion of the QAC, the material is unsuitable for the proposed application, the CONTRACTOR shall submit to the QAC the required certification, as specified in A. above, for material from a different source.

PART 3 INSTALLATION

3.1 Placement

A. A uniform layer of coarse aggregate shall be placed to the lines, depths and grades as shown on the Permit Drawings.

B. The CONTRACTOR shall place coarse aggregate in such a manner that the material is kept clean and free of foreign materials.

C. The QAC will at any time inspect the stone in the trenches, or in on-site stockpiles for contamination and, if necessary, reject all or portions of the stone.

D. The CONTRACTOR shall use extreme care in the placing of the material over geosynthetics. The material shall be placed in a manner to maintain a minimum thickness of 1-foot between the geosynthetics and the low ground pressure spreading equipment. Low ground pressure equipment shall be used to place all coarse aggregate within the limits of the geosynthetics. Equipment with ground pressure less than 5-psi may travel on a minimum 12-inch thick coarse aggregate layer. Equipment with a ground pressure equal to or greater than 5-psi must travel on a minimum 72-inch thick coarse aggregate layer.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of protective cover, and other related and incidental work within the designated area and as required for the construction of other work, as shown specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

A. American Society for Testing and Materials (ASTM):

1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
3. ASTM D 1587 - Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils.
4. ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) content of Soil and Rock.
5. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
6. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in-Place by Nuclear Methods (Shallow/Depth).
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in-Place by Nuclear Methods (Shallow Depth).
8. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 Definitions

A Protective Cover – Material used over the geosynthetic components of the closure capping system for the initial 18-inches of the earthen cover layer,

PART 2 PRODUCTS

2.1 Materials

A. Closure Cap

1. Material proposed to use as protective cover shall meet the following specifications.

i. Closure Cap material shall have a USCS classification of GM, GW, GC, SM, SW, SC, ML, or CL in accordance with ASTM D2487. The maximum particle size shall not exceed 1.5-inches, unless otherwise specified. The plasticity index shall be less than, or equal to, 25.
ii. Closure Cap material shall not contain debris, trash, or other deleterious materials. The soil shall not be contaminated with chemicals or other substances that would inhibit the growth of vegetation.
iii. The permeability shall be less than or equal to 1.0×10^{-5} cm/sec, as determined by ASTM D5084.
iv. Closure Cap protective cover shall have an internal friction angle greater than 28 degrees as determined by a triaxial shear test (ASTM D4767).

PART 3 INSTALLATION

3.1 Pre-Construction Laboratory Testing – Protective Cover

A. Prior to the placement of the Protective Cover each source of materials shall be tested to determine the moisture-density-permeability "window" to meet the permeability requirements. Table 1 outlines the minimum borrow source testing requirements.

TABLE 1
Minimum Pre-Construction Borrow Source Testing Requirements

Test	Method	Testing Frequency
Moisture Content	ASTM D-2216	1 per 5,000 cy, or fraction thereof, of each material type
Liquid and Plastic Limits	ASTM D-4318	1 per 5,000 cy, or fraction thereof, of each material type
Percent Finer Than No. 200 Sieve	ASTM D-422	1 per 5,000 cy, or fraction thereof, of each material type
Moisture-Density Relationship (Standard Proctor)	ASTM D-698	1 per 5,000 cy, or fraction thereof, of each material type
Remolded Permeability	ASTM D-5084	3 per 5,000 cy, or fraction thereof, of each material type (strategically selected to define the moisture-density-permeability window)
Specific Gravity	ASTM D-854	1 per 5,000 cy, or fraction thereof, of each material type
Internal Friction Angle	ASTM D4767	1 per source

B. The pre-construction laboratory testing must be completed and approved by the QAC before use.

C. Laboratory testing shall not be required for cell liner system protective cover but shall be visually monitored.

3.2 Construction

A. No material shall be placed until the QAC has approved the installation of the underlying geosynthetics.

B. No material shall be placed until the QAC has approved the pre-construction laboratory testing as described in Section 3.1.

C. The Protective Cover layer shall be placed directly over the geocomposite in one 18-inch compacted lift. The cover soil shall be compacted with a smooth-drum roller to 90 percent of the maximum dry density (ASTM D698) as determined by the pre-construction laboratory-testing program. In no case shall the compaction be less than 90 percent. Should the QAC have reason to suspect that the material delivered to the Site has changed from that previously tested and approved; the QAC shall immediately notify the CONTRACTOR's on-Site representative and arrange for additional laboratory testing.

D. Protective Cover field-testing for dry density and compaction moisture content shall be performed using a nuclear gauge (ASTM D-2922/3017) or drive cylinder (ASTM D-2937). During the construction of each lift of protective cover, five (5) field moisture-density tests shall be performed per acre. The frequency of testing may be increased at the discretion of the QAC when visual observations indicate a potential problem (i.e., material change, zones of suspected failing moisture content, zones of failing density, etc.).

E. Protective Cover compaction moisture content shall be wet of the optimum moisture content as established by ASTM D698, and shall fall within the acceptable moisture-density-permeability window developed from the pre-construction laboratory testing.

F. The CONTRACTOR shall use extreme care in the placing all protective cover material over the geosynthetics. The material shall be spread up slope in a manner that will maintain a minimum thickness of one foot of material between the geomembrane liner and low ground pressure (LGP) (less than or equal to 5 psi) spreading equipment. A minimum distance of 36-inches shall be maintained between geosynthetics and heavy equipment transporting any protective cover material.

G. All protective cover materials shall be transported over constructed temporary haul roads or benches to the toe of the slope. Material shall be placed at the toe of the slope by transporting equipment and pushed up slope by LGP spreading equipment. Transporting equipment shall not be allowed on slopes of the capping system under any circumstances. All equipment to be used on the slope shall be low ground pressure, and be approved by the QAC.

H. The CONTRACTOR shall take care to ensure that:
   1. No foreign material is mixed into the protective cover that may damage the under lying geosynthetics.
   2. No vehicles shall drive on the uncovered geosynthetics.
   3. All grade stakes used for survey control during protective cover placement are removed in their entirety.

3.3 Quality Control (QC) Construction Testing

A. Quality control testing shall consist of field-testing for moisture content, dry density, and percent compaction as outlined in Section 3.2.

***** END OF SECTION *****

PART 1 - GENERAL

1.1 Description of Work

A. Furnish all labor, materials, equipment and incidentals necessary to perform all fill and grading required to complete the placement of vegetative support layer shown on the Contract Drawings and specified herein. The work shall include, but not necessarily be limited to, the earthwork required for vegetative support layer placement, and all related work. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. Comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 Tolerances

The minimum thickness of the vegetative support layer is as shown on the Contract Drawings. Tolerances for the thickness of vegetative support layer are -0.0 to +0.4 feet.

PART 2 - PRODUCTS

2.1 Materials

A. Soil material used as vegetative support layer shall be loamy fine sand, loamy sand, sandy clay, sandy clay loam, fine sandy loam, clay loam, silty clay, or sandy loam as defined by the U.S. Department of Agriculture textural classification chart, and shall be suitable to support vegetative growth.

B. The vegetative support layer shall not contain trash or debris, or stones, lumps, roots, or similar objects larger than 1 inch in any dimension.

C. The vegetative support layer shall have a pH between 5.8 and 7.6.

D. Soil material used as the vegetative support layer must be capable of sustaining vegetation, as specified in Section 02936 “Seeding”.

2.2 Testing

A. The CONTRACTOR shall submit, to the QAC for approval, laboratory test results indicating that the material proposed for use as vegetative support layer meets the requirements of Section 2.1. Testing shall include, but not necessarily be limited to, the following:

1. Grain Size — ASTM D422
2. Atterberg Limits — ASTM D4318

3.	pH	ASTM D4972
4.	Organic Content	ASTM D2974
5.	Soil fertility	LaMotte or Baker

B. No material shall be placed unless approved by the OWNER and QAC.

C. If, in the opinion of the QAC, the proposed vegetative support layer is unsuitable for the proposed application, the CONTRACTOR shall submit to the QAC the required suitable testing, as specified in (A) above, for soil from a different source.

PART 3 - EXECUTION

3.1 Installation

A. This item shall consist of the placement of the vegetative support layer in all areas disturbed during the course of construction.

B. The CONTRACTOR shall provide all the required materials, labor, and equipment to perform the Work in accordance with these Specifications.

C. No vegetative support layer soils shall be placed until placement of underlying soil (backfill, fill, etc.) is complete and approved by the OWNER.

D. The vegetative support layer shall be installed in a single, 6-inch thick, compacted lift.

E. The CONTRACTOR shall take care to ensure that underlying soil remains intact and does not become mixed with the vegetative support layer during installation.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall provide all labor, materials, equipment, tools and appurtenances required to complete the work of furnishing and placing stone riprap, as shown, specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

PART 2 PRODUCTS

2.1 Material

A. Stone riprap shall consist of hard, durable, subangular material. It shall be free from any considerable amount of flat, laminated or elongated particles; and shall be free from cracks, overburden, shells, clay, organic matter, or other deleterious matter.

B. The stone riprap shall sustain a loss of not more than 40 percent after 500 revolutions in the ASTM abrasion test (Los Angles machine - ASTM C535), and shall pass the soundness test (ASTM C88). Stone riprap shall have a minimum specific gravity of 2.50, as defined by ASTM C127.

C. The riprap shall be composed of an evenly distributed mixture such that 50 percent of the mixture, by weight, shall be larger than the d_{50} size, as indicated on the Permit Drawings. The diameter of the largest stone size in such a mixture shall be at least 2.0 times the d_{50} size. The diameter of the smallest stone size in such a mixture shall be greater than 0.5 times the d_{50} size.

D. The breadth or thickness of a single stone shall not be less than 1/3 its length.

2.2 Testing

The supplier shall provide a written certification letter to the CONTRACTOR and DESIGNER stating that the riprap meets project specifications.

PART 3 EXECUTION

3.1 Installation

A. Stone riprap shall be placed to thicknesses as indicated on Permit Drawings.

B. Stone riprap shall be placed in a manner that will not damage geotextile, synthetics, utilities or other facilities. Riprap shall not be dropped from a height exceeding three feet.

C. The tolerance in riprap thickness in place shall be –0.0 to +0.3 feet.

D. No material shall be placed unless approved by the DESIGNER.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. This Section describes requirements and restrictions for handling and disposal of liquids generated during construction activities. Such liquids include potentially contaminated liquids such as, water resulting from vehicle decontamination, gas condensate and leachate; and "clean water" such as wet or saturated zones encountered during construction, and storm water runoff and precipitation entering active excavations. The CONTRACTOR shall furnish all materials, equipment, transportation, and labor necessary to complete the Work.

B. The CONTRACTOR will abide by all pertinent MDE, USEPA, OSHA, and other applicable regulations and guidelines, and the directions of the QAC when performing all work applicable to this Section. The CONTRACTOR shall provide a "Competent Person" to implement, supervise and inspect the Work.

C. In general, water from "clean excavations" may be discharged to the stormwater basins after the CONTRACTOR obtains a "Construction NPDES" Pemit from the appropriate regulatory authority. Other liquids shall be managed separately as described herein.

1.2 Submittals

A. The CONTRACTOR shall submit a description of methods for containing, collecting, and disposing of potentially contaminated liquids generated during construction, including, but not limited to, seeps, gas condensate, leachate, groundwater, and decontamination water.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 On-Site Handling

A. The handling of potentially contaminated liquids shall be done in a manner such that the liquids will be contained on the Site and not be allowed to flow onto the ground or off the Site as surface water discharge.

B. Discharge of collected groundwater or other liquids to adjacent surface waters or ground surface will not be allowed without the required permits from MDE to allow that discharge.

C. Any damage or pollution to adjacent soil or surface waters due to the CONTRACTOR's actions or negligence under this requirement, or any fines, penalties, costs of clean-up or reconstruction required as a result thereof, shall be at the sole expense of the CONTRACTOR. The CONTRACTOR shall immediately remedy, clean-up, and correct any conditions as a result of its pollution of surface waters.

D. The CONTRACTOR shall furnish secure, watertight temporary storage for potentially contaminated liquids until the liquids can be characterized and disposed appropriately as determined by the QAC. The storage shall be accessible by tanker trucks. The handling of liquids shall be done in a manner such that the liquids remain at acceptable suspended solids levels for the approved disposal facility. Filter or settle as necessary to minimize suspended solids.

E. Separate, segregate, and divert surface water runoff from groundwater encountered during excavation and Site grading activities. Handle groundwater separately from surface water runoff. The CONTRACTOR shall maintain all ground and surface water control measures as necessary and as directed by the DESIGNER.

F. Any non-aqueous liquids encountered shall be immediately brought to the attention of the OWNER and QAC. Non-aqueous liquids shall be collected separately in drums or other containers provided by the CONTRACTOR for temporary storage.

3.2 Transport and Disposal – Aqueous Liquids

A. The CONTRACTOR shall collect, pump, store, handle, and transfer potentially contaminated liquids intercepted, segregated, and collected during performance of the Work.

B. The CONTRACTOR shall coordinate and pay for the off-site disposal of aqueous liquids generated by or as a result of the CONTRACTOR's actions. The CONTRACTOR shall perform any characterization required for this off-Site disposal at no cost to the OWNER.

C. Any non-aqueous liquids found shall be removed by the CONTRACTOR and stored in separate drums prior to disposal. Coordinate with the OWNER to schedule additional testing.

D. Settled solids and used filter materials shall be disposed of in accordance with applicable regulations as approved by the OWNER.

3.3 Management of Non-Aqueous Liquids

A. Containerized non-aqueous or oily liquids or solvents shall be stored at a designated area of the Site satisfactory to the OWNER and provided with secondary containment by the CONTRACTOR. Disposal of non-aqueous or oily liquids or solvents generated by or resulting from the CONTRACTORS actions will be arranged and paid for by the CONTRACTOR.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The Contractor shall furnish all labor, material, and equipment to complete installation of geocomposite drainage layer (GDL), including all necessary and incidental items, in accordance with the Permit Drawings and these Specifications. The CONTRACTOR shall provide a "Competent Person" to implement, supervise, and inspect all work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.)

1.2 Reference Standards

The latest revisions of the following standards are hereby made a part of these specifications.

A. *American Society of Testing and Materials (ASTM*).
1. ASTM D 1238, Standard Test Method for Flow Rates of Thermoplastics by Extrusion Process Plastometer.
2. ASTM D 1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique.
3. ASTM D4716, Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using Constant Head.
4. ASTM D 4218, Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle Furnace Technique.
5. ASTM D 3786, Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabric – Diaphragm Bursting Strength Tester Method.
6. ASTM D 4491, Standard Test Method for Water Permeability of Geotextiles by the Permittivity Method.
7. ASTM D 4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
8. ASTM D 4632, Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method).
9. ASTM D 4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
10. ASTM D4833, Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
11. ASTM D 904, Standard Test Methods for Comparison of Bond Strength or Ply Adhesion of Similar Laminates Made from Flexible Materials.
12. ASTM D 5199, Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes.
13. ASTM D 4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
14. ASTM D 1621, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

1.3 Delivery, Storage and Handling

A. Packing and Shipping:

1. Manufacturer shall identify rolls of GDL with following:
   - (a) Manufacturer's name.
   - (b) Product identification.
   - (c) Roll number.
   - (d) Roll dimensions.

B. Storage and Protection:

1. OWNER will provide a suitable on-site storage area for geocomposite materials from time of delivery until installed.
2. GDL material shall be stored off the ground on pallets, platforms, or dunage.
3. The integrality of the wrappers shall be maintained or suitable covering shall be installed.
4. On mobilization, the geosynthetic installer shall be responsible for protecting geocomposite from dirt, water, ultraviolet light exposure, and other sources of damage.
5. Preserve integrity and readability of GDL roll labels.

PART 2 MATERIALS

2.1 General Requirements

A. General Requirements:

The geocomposite shall consist of the following.

1. Geonet shall conform to the property values listed in Table 1.
2. Geotextile shall conform to the property values listed in Table 2.
3. Geotextile and geonet used for manufacture of GDL shall be stock products, except when specifically authorized in writing by the DESIGNER, materials shall not be specifically manufactured to meet this project.
4. GDL shall be capable of retaining its structure during handling, placement and long-term service.

B. The polymer used to manufacture the Geonet component of the GDL shall be polyethelene that is clean and free of any foreign contaminants. Regrind material, which consists of edge trimmings and other scraps, may be used to manufacture the Geonet; however, post consumer recycled material shall not be used.

C. The Geonet shall contain UV inhibitors to prevent ultraviolet light degradation.

D. Labels on each roll of GDL shall identify the length, width, lot and roll numbers, and name of Manufacturer.

E. Physical properties of the GDL shall be as shown in Table 1 of this section.

TABLE 1
Required Geocomposite Drainage Layer Properties [1]

PROPERTY	TEST METHOD	UNITS	VALUE
Geonet			
Thickness (min.)	ASTM D 5199	mils	315
Tensile Strength (min.)[2]	ASTM D 5035	lb/ ft	500
Density (min.)	ASTM D 1505	g/cm^3	0.94
Melt Flow Index (max.)	ASTM D 1238	g/10 min	1.0
Carbon Black Content (min.)	ASTM D 4218	%	2.0
Geocomposite			
Ply Adhesion (min.)	ASTM D 7005	lb/inch	0.75
Interface Friction Angle (min.)[3]	ASTM D 5321	(degrees)	30 –geotextile to cover soil 34–geotextile to geomembrane
Transmissivity – Machine Direction MD (min.)[4]	ASTM D 4716	(m^2/sec)	3.0×10^{-3} for i=0.333 4.0×10^{-3} for i=0.036

Notes:

1) *Tenax Tenflow, or approved equivalent.*
2) *Based on 5 specimens in the machine direction.*
3) *The QAC shall perform laboratory interface friction tests on Geocomposite/Project Specified Geomembrane and Geocomposite/Project Specified Soil interfaces in accordance with ASTM D5321. Normal stresses of 100, 250, 500, and 1,000 psf along with a displacement rate of 0.2 geosynthetic/ geosynthetic / 0.04 geosynthetic/ soil (inches/min) shall be used. Geotextile shall be attached to the Geonet in the same configuration as will be used in the field. All tested interfaces shall exhibit the listed minimum required interface friction angle.*
4) *Conduct test for Transmissivity at a normal compressive load of 1,000 psf and at a hydraulic gradient of 0.036 (top of the landfill) and 0.333 (sideslopes). Boundary conditions from top to bottom are: upper load plate/ soil / geocomposite / geomembrane / lower load plate. Seating period shall be at least 100 hours to meet design criteria, and one (1) hour to meet conformance criteria.*

F. Geotextile shall be heat bonded to both sides of the Geonet. Heat bonding shall be performed by the Manufacturer prior to shipping to the site. The geotextile shall be a nonwoven needle punched synthetic fabric meeting the property requirements of Table 2.

TABLE 2
Required Geotextile Properties

PROPERTY	TEST METHOD	UNITS	VALUE
Weight (MARV)	ASTM D5261	oz/sy	6
AOS (MARV)	ASTM D4751	U.S. Sieve	70
Permittivity (MARV)	ASTM D4491	sec^{-1}	1.3
Grab Tensile Strength (MARV)	ASTM D4632	lbs	160
Grab Elongation (MARV)	ASTM D4632	%	50
Puncture Strength	ASTM D4833	lbs	90
UV Resistance @500 Hours	ASTMD4355	%	70

G. The GDL shall be unloaded, transported, stored, and protected in accordance with the manufacturer's recommendations in order not to damage or degrade the properties of the material.

H. The CONTRACTOR shall protect the work described in this Section before, during, and after installation, and shall protect the installed work covered by other Sections.

I. The CONTRACTOR shall, during all periods of shipment and storage, protect the geotextile from direct sunlight, ultraviolet light, temperatures greater than 120° F, mud, dirt, dust, debris, and other deleterious sources. GDL shall be maintained, wrapped in a heavy-duty protective covering, until it is installed.

J. If the QAC determines material is damaged, or has excessive sunlight exposure, the CONTRACTOR shall immediately make all repairs and replacements, at no additional cost to the OWNER.

PART 3 EXECUTION

3.1 Submittals

The Contractor shall submit the following to the QAC:

A. *Mill Certificate and Sample:* Prior to shipping to the site, the Contractor shall submit one copy of a mill certificate or affidavit signed by a legally authorized official of the Manufacturer for the GDL attesting that the GDL meets the physical and manufacturing requirements stated in these Specifications. The Contractor shall also submit a sample (12" x 12") of the GDL to be used. The sample shall be labeled with the product name and be accompanied by the Manufacturer's specifications.

B. *Shipping, Handling, and Storage Instructions*: The Manufacturer's plan for shipping, handling, and storage shall be submitted for review.

C. *Delivery Tickets*: The contractor shall provide delivery tickets, or other approved receipts, as evidence for materials received that will be incorporated into the construction.

D. *Quality Control Certificates:* For GDL delivered to the site, quality control certificates, signed by the Manufacturer's quality assurance manager shall be provided for every roll of GDL. Each certification shall have the roll identification number(s), test methods, frequency, and test results. At a minimum, the test results and frequency of testing shall be as shown in Table 3 of this section.

TABLE 3
Required Manufacturer's Quality Control Test Data

Property	Test Method	Frequency
Geonet Tests		
DENSITY	ASTM D1505	50,000 ft^2
MELT FLOW INDEX	ASTM D1238	50,000 ft^2
THICKNESS	ASTM D5199	50,000 ft^2
CARBON BLACK	ASTM D1603	50,000 ft^2
TENSILE STRENGTH-MD	ASTM D5035	50,000 ft^2
Geotextile Tests		
MASS PER UNIT AREA	ASTM D5261	100,000 ft^2
GRAB ELONGATION	ASTM D4632	100,000 ft^2
GRAB TENSILE	ASTM D4632	100,000 ft^2
PUNCTURE	ASTM D4833	100,000 ft^2
PERMITTIVITY	ASTM D4491	1 per lot
AOS, US SIEVE	ASTM D4751	1 per lot
Geocomposite Tests		
PLY ADHESION	ASTM D7005	100,000 ft^2
TRANSMISSIVITY-MD	ASTM D4716	200,000 ft^2

3.2 Quality Assurance Testing

The QAC shall collect samples and test for the following:

TABLE 4
Quality Assurance Testing

Property	Method	Frequency
Geotextile-Geonet peel adhesion	ASTM D 7005	1 per 100,000 sf*
Interface Friction Angle	ASTM D5321	1 set per project

*-Or minimum 1 per lot.

3.3 Handling and Placement

A. After the geomembrane has been installed, seamed, tested, and approved by the QAC, the surface shall be cleaned free of excess dirt and debris.
B. The Contractor and the Installer shall handle all GDL in such a manner to ensure it is not damaged in any way. Precautions shall also been taken to prevent damage to underlying layers during placement of the GDL.
C. The GDL roll should be installed down the slope.
D. In the presence of wind, all GDL shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain until replaced with cover material.
E. If necessary, the GDL shall be positioned by hand after being unrolled to minimize wrinkles.
F. If the project includes an anchor trench at the top of the side slopes, the GDL shall be properly anchored to resist sliding. Anchor trench compacting equipment shall not come into direct contact with the GDL.

G. If there are any obstructions (such as outlet pipes or monitoring wells) while deploying the GDL, the GDL shall be cut to fit around the obstruction. Care should be taken to make sure there is no gap between the obstruction and the GDL. The GDL should be cut in a way that the lower geotextile and geonet core is in contact with the obstruction and the upper geotextile has an excess overhang. There must be enough of the upper geotextile to be able to tuck the upper geotextile back under the GDL to protect the exposed geonet core. This will prevent any soil particles from migrating into the geonet core flow channels.

H. In applying fill material, no equipment can drive directly across the GDL. The specified fill material shall be placed and spread utilizing vehicles with a low ground pressure (LGP). The earthen cover soil for the cap and Leachate Collection Layer for the liner shall be placed on the GDL from the bottom of the slope proceeding upwards and in a manner that prevents instability of the cover soil or damage to the geocomposite. Placement of the earthen cover soil Leachate Collection Layer shall proceed immediately following placement and inspection of the GDL. Unless otherwise specified by the QAC, all equipment for spreading fill materials overlying the geocomposite shall comply with the following:

Maximum Equipment Ground Pressure (psi)	Minimum Separation Thickness (inches)
<5	12
5 – 10	18
>10	24

I. Compaction of the initial lift placed over the GDL must be performed in a manner that does not damage the GDL. This may be accomplished using a 12-inch compacted lift compacted using a dozer and a steel drum roller. The protective cover is compacted to 90% of standard Proctor (ASTM D698).

J. QAC personnel will observe placement of the GDL and note any thinning of the geotextiles, particularly the geotextiles placed next to the membrane. If any repair or removal of the geotextile is necessary, it will be conducted according to the methods described in Section 3.5-Repair.

3.4 <u>Seams and Overlaps</u>

A. Each component of the GDL (geotextile(s) and geonet) will be secured or seamed to the like components at overlaps.

B. Geonet Component

1. Each component of the geocomposite (geotextile(s) and geonet) will be secured or seamed to the like components at overlaps.
2. Adjacent edges of the geonet along the length of the GDL should be overlap 2-3 inches. These overlaps shall be joined by tying the geonet cores together with white or yellow plastic fasteners or polymeric braid. These ties shall be spaced at a maximum of every 5 feet along the roll length.

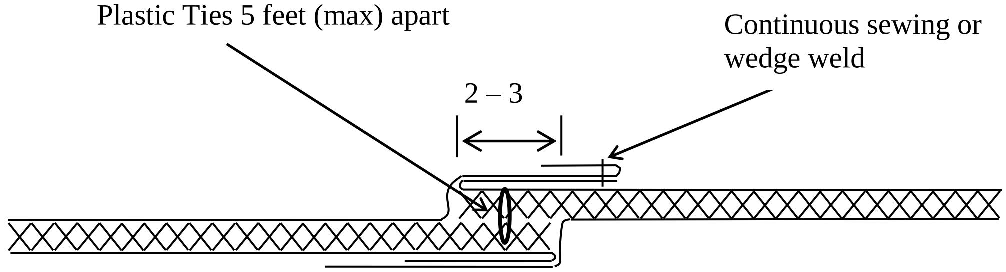


Figure 1: **Overlap along Roll Length ((MD)**

3. Adjoining GDL rolls (end to end) along the width of the roll should be shingled down in the direction of the slope, with the geonet portion of the top GDL overlapping the geonet portion of the bottom geocomposite a minimum of 12 inches across the roll width. The geonet should be tied every 12 inches across the roll width and every 6 inches in the anchor trench or as specified by the QAC.

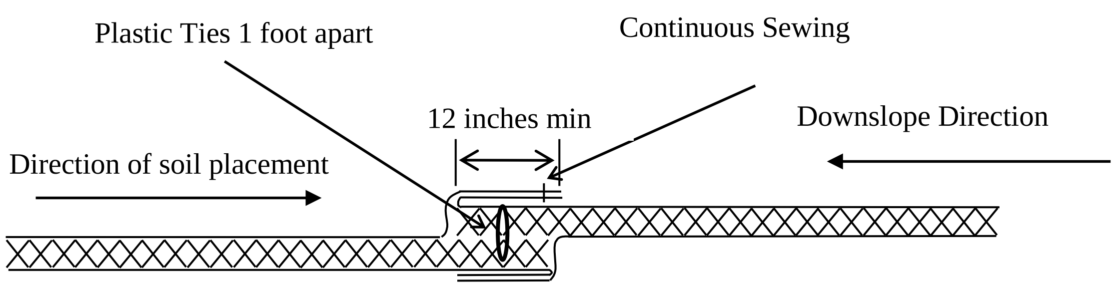
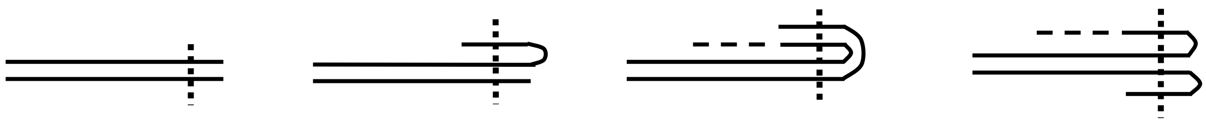


Figure 2: Overlap along Roll Width (CD)

C. *Geotextile Component*

1. The bottom layer of geotextile (if any) shall be overlapped.
2. The top layers of the geotextile shall be sewn together, or at the discretion of the QAC may be heat bonded or wedge weld. Geotextile shall be overlapped a minimum of 4 inches prior to seaming or heat bonding, geotextile sewing seams to be used are Prayer "J", or Butterfly. The seam shall be a two-thread, double locked stitch, or a double row of single-thread, chain stitch. If heat bonding is to be used, care must be taken to avoid burn through of the geotextile. It is important that the geotextiles be joined continuously along to the roll as to prevent any fugitive particle migration into the geonet core flow channels.



Prayer Seam | Modified Prayer Seam (in case of unequal length) | "J" Seam | Butterfly Seam

3.5 Repair

A. Prior to covering the deployed GDL, each roll shall be inspected for damage resulting from construction.

B. Any rips, tears, or damaged area on the deployed GDL shall be removed and patched by placing a patch extending 12 inches beyond the edges of the damaged area. The patch shall be secured to the original geonet by tying every 6 inches with approved tying devices. If the hole or tear width across the roll is more than 50 percent of the width of the roll, the damaged area shall be cut out and the two portions of the geonet shall be joined as explained above.

C. Any rips, tears, or damaged area on the deployed geotextile shall be removed if necessary and patched by placing a patch extending 12 inches beyond the edges of the damaged area.

3.6 Protection

A. After installation, the geotextile should be visually inspected to assure that no objects are present that could potentially harm the geotextile.

B. Any geotextile damaged during its installation or during placement of cover material, as deemed by the QAC, shall be replaced by the CONTRACTOR, at no additional cost to the OWNER.

C. The work shall be scheduled so that the covering of the geotextile with the material to be placed over it is accomplished within 30 days after placement of the geotextile. Failure to comply with this requirement shall require replacement of an additional geotextile, at no additional cost to the owner.

D. When spot-repairing geotextile with patches, a 3-foot heat-seamed overlap will be used or by a means approved by the QAC.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of furnishing, and placing geotextile, complete with appurtenances, as shown, specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement, supervise, and inspect all work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 Submittals

The CONTRACTOR shall furnish a mill certificate from the company manufacturing the each type of geotextile attesting that the geotextile meets the chemical, physical, and manufacturing requirements specified. Geotextiles shall be rejected by the QAC, and replaced by the CONTRACTOR, if they are found to have defects, rips, holes, flaws, deterioration, or other damage.

1.3 Product Handling

A. The CONTRACTOR shall protect the work described in this Section before, during, and after installation, and shall protect the installed work covered by other Sections.

B. The CONTRACTOR shall, during all periods of shipment and storage, protect the geotextile from direct sunlight, ultraviolet light, temperatures greater than 120° F, mud, dirt, dust, debris, and other deleterious sources. Geotextiles shall be maintained, wrapped in a heavy-duty protective covering, until it is installed.

C. If the QAC determines material is damaged, or has excessive sunlight exposure, the CONTRACTOR shall immediately make all repairs and replacements, at no additional cost to the OWNER.

1.4 Definitions

On the Permit Drawings and in the Specifications, the word “geotextile” is used and refers to a non-woven geotextile, as described in section 2.1.

1.5 Conformance Testing of Geotextile

A. Filter geotextiles used in the drainage system shall be tested prior to shipment to ensure that the properties of the finished product are in accordance with the construction specifications. The required material properties, test methods, values, and units for nonwoven geotextiles are presented in sections 2.1 and 2.2. Samples of filter geotextile shall be tested by the manufacturer at a frequency of one (1) sample for every 100,000 square feet (SF) of material produced. Each roll of geotextile will have the product identification, roll number, lot number, date of manufacturer, and manufacturer name clearly marked.

B. Prior to delivery of the geotextile to the Site, the QAC shall obtain certifications for the materials.

C. Upon delivery of the geotextile to the Site, the QAC shall obtain representative samples of the furnished product for conformance testing. Samples of the geotextile will be tested by an independent testing laboratory at a frequency of one (1) sample per lot, but a minimum of one (1) sample per 250,000 square feet of material delivered.

PART 2 MATERIALS

2.1 6 OZ./ S.Y. NONWOVEN GEOTEXTILE

A. The filter geotextile shall be nonwoven.

B. Filter geotextiles shall be placed as indicated on the Permit Drawings. The filter geotextile shall meet the following minimum average required value (MARV) minimum properties.

TABLE 1

Test Name	Test Standard	Value	QC Testing Frequency	QA Testing Frequency
Mass per Unit Area	ASTM D5261	6.0 oz/sy	1 test per 100,000 SF	1 test per 250,000 SF
Grab Tensile Strength	ASTM D4632	160 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Grab Tensile Elongation	ASTM D4632	50 %	1 test per 100,000 SF	1 test per 250,000 SF
Puncture Strength	ASTM D6241	410 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Apparent Opening Size	ASTM D4751	70 sieve	1 per production lot	1 per production lot
Permittivity	ASTM D4491	1.5 sec^{-1}	1 per production lot	1 per production lot
UV Resistance	ASTM D4355	70 %	Certified by Manufacturer	-

2.2 10 OZ./ S.Y. NONWOVEN GEOTEXTILE

A. The nonwoven geotextile to be used for the visual barrier/separation layer between the leachate collection layer and the protective layer, or as otherwise shown on the Contract Drawings, shall consist of needle-punched, continuous filament polyester or polypropylene fabric, and conform to the following minimum requirements:

TABLE 2

Test Name	Test Standard	Value	QC Testing Frequency	QA Testing Frequency
Mass per Unit Area	ASTM D5261	10.0 oz/sy	1 test per 100,000 SF	1 test per 250,000 SF
Trapezoidal Tear Strength	ASTM D4533	100 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Grab Tensile Strength	ASTM D4632	230 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Grab Tensile Elongation	ASTM D4632	50 %	1 test per 100,000 SF	1 test per 250,000 SF
Puncture Strength	ASTM D6241	725 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Apparent Opening Size	ASTM D4751	100 sieve	1 per production lot	1 per production lot
Permittivity	ASTM D4491	1.2 sec^{-1}	1 per production lot	1 per production lot
UV Resistance	ASTM D4355	70 %	Certified by Manufacturer	-

*All values are minimum.

2.3 <u>12 OZ./ S.Y. NONWOVEN GEOTEXTILE</u>

A. The separation geotextile shall maintain separation between the aggregate and the underlying fill in the perimeter road.

B. Cushion geotextiles shall be placed as indicated on the Permit Drawings. The cushion geotextile shall meet the following minimum average required value (MARV) minimum properties:

TABLE 3

Test Name	Test Standard	Value	QC Testing Frequency	QA Testing Frequency
Mass per Unit Area	ASTM D5261	12.0 oz/sy	1 test per 100,000 SF	1 test per 250,000 SF
Trapezoidal Tear Strength	ASTM D4533	125 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Grab Tensile Strength	ASTM D4632	320 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Grab Tensile Elongation	ASTM D4632	50 %	1 test per 100,000 SF	1 test per 250,000 SF
Puncture Strength	ASTM D6241	925 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Apparent Opening Size	ASTM D4751	100 sieve	1 per production lot	1 per production lot
Permittivity	ASTM D4491	0.8 sec^{-1}	1 per production lot	1 per production lot
UV Resistance	ASTM D4355	70 %	Certified by Manufacturer	-

2.4 16 OZ./ S.Y. NONWOVEN GEOTEXTILE

A. This geotextile shall be installed for cushion and layer separation around the coarse aggregate envelope around the leachate collection header and lateral pipes.

B. Cushion geotextiles shall be placed as indicated on the Permit Drawings. The cushion geotextile shall meet the following minimum average required value (MARV) minimum properties:

TABLE 5

Test Name	Test Standard	Value	QC Testing Frequency	QA Testing Frequency
Mass per Unit Area	ASTM D5261	16.0 oz/sy	1 test per 100,000 SF	1 test per 250,000 SF
Trapezoidal Tear Strength	ASTM D4533	145 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Grab Tensile Strength	ASTM D4632	380 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Grab Tensile Elongation	ASTM D4632	50 %	1 test per 100,000 SF	1 test per 250,000 SF
Puncture Strength	ASTM D6241	1080 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Apparent Opening Size	ASTM D4751	100 sieve	1 per production lot	1 per production lot
Permittivity	ASTM D4491	0.7 sec^{-1}	1 per production lot	1 per production lot
UV Resistance	ASTM D4355	70 %	Certified by Manufacturer	-

PART 3 EXECUTION

3.1 Site Preparation

A. Site subgrade preparation shall conform to the requirements of this Section, and Section 02223 “Structural and General Fill”.

B. The surface to receive geotextile shall be cleared of sharp objects, boulders, stumps, or any materials that may contribute to fabric punctures, shearing, rupturing or tearing to the satisfaction of the QAC.

C. The base surface or surface of embankments shall be graded as smooth as possible, and compacted with a smooth-drummed roller having a minimum operating weight of 10 tons, capable of vibratory and static compaction. The subgrade shall be inspected for unstable areas or soft spots, before the geotextile is placed. Unsuitable areas shall be over-excavated, and additional fill shall be placed and compacted to eliminate those unstable areas.

3.2 Installation

A. The geotextile shall be placed in the manner and at the locations shown. Geotextile shall be laid smooth and free of tension, stress, folds, wrinkles, or creases.

B. All filter geotextile seams shall be continuously sewn or by means approved by the QAC. Spot sewing is not allowed. Filter geotextiles will be overlapped a minimum of 6-inches prior to seaming.

C. If geotextile is damaged during any step of installation, a piece of geotextile material shall be cut and placed over the damaged area and overlap the undamaged material a minimum of 3-feet in each direction.

D The geotextile shall be placed on side slopes as shown on the Permit Drawings. If necessary, the geotextile shall be positioned by hand after being unrolled to minimize wrinkles. The geotextile shall not be placed in the horizontal direction (i.e. across the slope) on slopes steeper than 10 (horizontal): 1 (vertical) (10H:1V), except as part of a patch.

3.3 Protection

A. After installation, the geotextile should be visually inspected to assure that no objects are present that could potentially harm the geotextile.

B. Any geotextile damaged during its installation or during placement of cover material, as deemed by the QAC, shall be replaced by the CONTRACTOR, at no additional cost to the OWNER.

C. The work shall be scheduled so that the covering of the geotextile with the material to be placed over it is accomplished within 30 days after placement of the geotextile. Failure to comply with this requirement shall require replacement of an additional geotextile, at no additional cost to the owner.

D. When spot-repairing geotextile with patches, a 3-foot lystered overlap will be used or by a means approved by the QAC.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of the installation of high-density polyethylene (HDPE) geomembrane installation for the liner system and other related and incidental work within the designated area and as required for the construction of other work, as shown, specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The CONTACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 Submittals

A. *Pre-installation*: Submit the following prior to geomembrane deployment:

1. Origin (supplier's name and production plant) and identification (brand name and number) of resin used to manufacture geomembrane.
2. Copies of dated quality control certificates issued by resin supplier.
3. Results of tests conducted by geomembrane manufacturer to verify that resin used to manufacture geomembrane meets Specifications.
4. Statement that amount of reclaimed polymer added to resin during manufacturing did not exceed 2% by weight.
5. List of materials that comprise geomembrane, expressed in following categories as percent by weight:
   a) polyethylene;
   b) carbon black; and,
   c) other additives.
6. Manufacturer's specification for geomembrane, including properties listed and measured using appropriate test methods.
7. Written certification that minimum values given in manufacturer's specification are guaranteed by geomembrane manufacturer.
8. Quality control certificates, signed by geomembrane manufacturer. Each quality control certificate shall include applicable roll identification numbers, testing procedures, and results of quality control tests.
9. Field panel layout and identification code including dimensions and details.
10. Resumes of INSTALLER’s Superintendent and Master Seamer, including dates and duration of employment.
11. Installation schedule.
12. List of personnel performing seaming operations, including experience.
13. Certificate that extrusion rod is comprised of same resin as geomembrane liner material.
14. Manufacturer Material and Installation warranties.

B. *Installation*: Submit as installation proceeds.
   1. Quality control documentation recorded during installation.
   2. Subgrade surface acceptance certificates signed by INSTALLER for each area that will be covered directly by geomembrane. Submit on deployment of geomembrane.
   3. Deployment of geomembrane will be considered acceptance of subgrade by the INSTALLER, if certificate is not submitted.

1.3 Pre-Qualifications

A. *Manufacturer:*
   Manufacturer shall have minimum 5-years continuous experience in manufacture of HDPE geomembrane, or experience totaling 10,000,000 square feet (sq. ft.) of manufactured HDPE, or geomembrane manufacture for minimum of ten (10) completed facilities.
B. *Fabricator (if applicable):*
   Fabricator shall have minimum 5-years continuous experience in fabrication of HDPE geomembrane or experience totaling 2,000,000 sq. ft. of fabricated HDPE geomembrane for minimum of ten (10) completed facilities.
C. *Installer:*
   1. Installer shall have minimum 5-years continuous experience in installation of HDPE geomembrane or experience totaling 2,000,000 sq. ft. of installed HDPE geomembrane for minimum of ten (10) completed facilities.
   2. Personnel performing seaming operations shall be qualified by experience or training. Minimum of one seamer shall have experience seaming minimum 2,000,000 sq. ft. of HDPE geomembrane using same type of seaming apparatus in use at Site. Most experienced seamer, "Master Seamer," shall provide direct supervision, as required, over less experienced seamers.

1.4 Quality Assurance Program

The Manufacturer, fabricator, and installer shall participate in and conform to items and requirements of quality assurance program as outlined in this Section and the Construction Quality Assurance (CQA) Plan.

1.5 Delivery, Storage, and Handling

A. *Packing and Shipping:*
   1. Manufacturer shall identify each roll delivered to site with following:
      a) Manufacturer's name.
      b) Product Identification.
      c) Thickness.
      d) Roll number.
      e) Roll dimensions.

2. The INSTALLER shall protect geomembrane from excessive heat, cold, puncture, cutting, or other damaging or deleterious conditions during loading, transport, and unloading at site.

B. *Acceptance at Site:*
1. INSTALLER shall be responsible for unloading all geosynthetics delivered to the Site, unless otherwise agreed at the pre-construction meeting.
2. Shipper shall notify INSTALLER, or other party responsible for off-loading materials, 48-hours in advance of material delivery.
3. INSTALLER, or other party responsible for off-loading materials, shall bear all costs (including but not limited to OWNER's, QAC's, 3rd party contractor costs) associated with failure to supply appropriate personnel and equipment required to off-load geosynthetic materials.
4. Perform physical inventory of materials delivered to the Site for use in the work. Perform inventory on delivery, or as soon as practicable thereafter.
5. Conduct surface observations of each roll for defects and damage. This examination shall be conducted without unrolling rolls, unless defects or damages are found or suspected. Note type and extent of defects or damage observed.
6. Defective or damaged rolls, or portions of rolls, will be rejected and shall be removed from Site and replaced, at no additional expense to the OWNER.
7. Rolls or portions of rolls without proper identification or labeling will be rejected and shall be removed from Site.

C. *Storage and Protection:*
1. The geomembranes will be unloaded, transported, stored, and protected in accordance with the manufacturer's recommendations so as not to damage or degrade the properties of the material.
2. OWNER will provide on-site storage area for geomembrane rolls from time of delivery until deployment.
3. The INSTALLER shall protect geomembrane from dirt, water, and other sources of damage.
4. The INSTALLER shall preserve the integrity and readability of geomembrane roll labels.

PART 2 PRODUCTS

2.1 Materials

The geomembrane used for cell construction is a textured on both sides, 60-mil high-density polyethylene (HDPE). The geomembrane shall meet the following properties:

TABLE 1
Minimum Properties for 60-mil HDPE Textured Geomembrane

Testing Properties	Testing Method	60 mil HDPE Value
Thickness mils (min avg.) • Lowest individual for 8 out of 10 values • Lowest individual for any of the 10 values	ASTM D5994	57 mils 54 mils 51 mils
Density g/cc	ASTM D1505 or ASTM D792	0.940 (min avg) (either method)
Asperity Height (min avg.) (1) (2)	GM-12	10 mils
Tensile Properties (min. avg.) (3) • Break strength – lb/in • Break elongation - %	ASTM D6693	 90 100
Tear Resistance – lb (min. avg.)	ASTM D1004	42
Puncture Resistance – lb (min. avg.)	ASTM D4833	90
Stress Crack Resistance (11)	ASTM D5397 (11) (Appendix)	200 hr
Carbon Black Content - %	ASTM D1603 (4)	2.0 to 3.0
Carbon Black Dispersion	ASTM D5596	Note (5)
Oxidative Induction Time (OIT) (min avg.) (6) • Standard OIT, or • High Pressure OIT	 ASTM D3895 ASTM D5885	 100 400
Oven Aging at 85°C (7) • Std. OIT (min. avg.), % retained after 90 days, or • High Pressure OIT (min. avg.), % retained after 90 days	 ASTM D5721 ASTM D3895 ASTM D5885	 55 80
UV Resistance (8) • Std. OIT (min. avg.), or • High Pressure OIT (min avg.) % retained after 1600 hrs	 ASTM D3895 ASTM D5885	 N.R. (9) 50
Interface Friction Angle (min.) – degrees	ASTM D 5321	34 for geotextile to geomembrane 32 for geomembrane to soil

(1) Of 10 readings, 8 out of 10 must be ≥7 mils, and lowest individual reading must be ≥ 5 mils.
(2) Alternate the measurement side for double-sided textured sheet. Both sides are to be measured and considered separately.
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Break elongation is calculated using a gauge length of 2.0 in. at 2.0 in./min.
(4) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3.

(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(9) Not recommended since high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.
(11) The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheet made from the same formulation as being used for the textured sheet materials, or the texturing act as the notch. Follow procedure listed in ASTM D5397 appendix.

A *Geomembrane*: The Geomembrane shall be manufactured from new polyethylene resin, except as noted below:
1. Use of geomembrane recycled during manufacturing process shall be permitted, with written approval from the DESIGNER, if recycled geomembrane does not exceed 2% by weight.
2. Geomembrane manufactured from non-complying resin shall be rejected.

B *Geomembrane Characteristics:*
1. The geomembrane shall contain a maximum of 1%, by weight, of additives, fillers or extenders (not including carbon black).
2. The geomembrane shall contain between 2% and 3%, by weight, of carbon black for ultraviolet light resistance.
3. No pinholes, bubbles or other surface features that compromise geomembrane integrity are allowed. Geomembrane shall be free of blisters, nondispersed raw materials, or other signs of contamination resulting from the manufacturing process. Geomembrane rolls or portions of rolls with these defects shall be rejected.

2.2 Seaming and Testing Equipment

A. *Welding:*
1. The INSTALLER shall maintain a minimum of two (2) spare operable seaming machines on-site unless otherwise agreed upon at pre-construction meeting.
2. Seaming equipment shall not damage geomembrane.
3. Use extrusion welding apparatus equipped with gauges indicating temperature of extrudate at the equipment nozzle, or utilize hand-held gauges to measure extrudate temperatures.
4. Use self-propelled fusion-welding machines that create an air channel between two (2) welded tracks and are equipped with following:
   a. Gauge indicating temperature of heating element; and,
   b. Gauge indicating the speed of travel.
5. Place electric generator on smooth base such that no damage occurs to geomembrane.

B. *Vacuum Testing Equipment:*
   1. The vacuum box assembly shall consist of a rigid housing open at the bottom, with a transparent viewing window on top and a soft neoprene gasket attached to bottom rim of housing, a porthole or valve assembly, and a vacuum gauge;
   2. Pump assembly equipped with pressure controller and pipe connections;
   3. Pressure/vacuum rubber hose with fittings and connections;
   4. Soapy solution to wet test area; and,
   5. Means of applying soapy solution.

C. *Air Pressure Testing Equipment:*
   1. Air pump (manual or motor driven), equipped with pressure gauge, capable of generating, sustaining, and measuring pressure between 24 and 35 psi (160 and 240 kPa), and mounted on cushion to protect geomembrane;
   2. Rubber hose with fittings and connections;
   3. Means of safely sealing weld air channel;
   4. Sharp hollow needle, or other approved pressure feed device; and,
   5. Air pressure monitoring device.

D. *Tensiometer:*
   1. Tensiometers shall be capable of maintaining constant jaw separation rate of 20-inches per minute; and,
   2. Tensiometers shall be calibrated annually. A certificate indicating that the equipment has been calibrated within one (1) year of use in the work shall be maintained with the tensiometer. The INSTALLER will provide the QAC with a copy of the certificate of calibration.

2.3 <u>Source Quality Control</u>

Tests and inspections shall be performed by geomembrane manufacturer as follows:

A. Test geomembranes to demonstrate that resin meets this Specification.

B. Continuously monitor geomembrane during manufacturing process for inclusions, bubbles, or other defects. Geomembranes, which exhibit defects, shall not be acceptable for installation.

C. Monitor thickness continuously during manufacturing process.

D. The MANUFACTURER shall conduct quality control (QC) testing to verify conformance with table 1 in section 2.1, at the following frequencies:

TABLE 2
Quality Control (QC) Manufacturers Testing

Testing Properties	Testing Method	Manufacturer QC Testing Frequency
Thickness mils (min avg.)	ASTM D5994	1 per Roll
Density g/cc	ASTM D1505 or ASTM D792	1 per 50,000 SF
Asperity Height (min avg.) (1) (2)	GM-12	1 per 50,000 SF
Tensile Properties (min. avg.) (3)	ASTM D6693	1 per 50,000 SF
Tear Resistance – lb (min. avg.)	ASTM D1004	1 per 50,000 SF
Puncture Resistance – lb (min. avg.)	ASTM D4833	1 per 50,000 SF
Stress Crack Resistance (11)	ASTM D5397	per GRI GM10
Carbon Black Content - %	ASTM D1603 (4)	1 per 50,000 SF
Carbon Black Dispersion	ASTM D5596	1 per 50,000 SF
Oxidative Induction Time (OIT) (min avg.) (6) • Standard OIT, or • High Pressure OIT	ASTM D3895 ASTM D5885	(11)
Oven Aging at 85°C (7) • Std. OIT (min. avg.), % retained after 90 days, or • High Pressure OIT (min. avg.), % retained after 90 days	ASTM D5721 ASTM D3895 ASTM D5885	(11)
UV Resistance (8) • Std. OIT (min. avg.), or • High Pressure OIT (min avg.) % retained after 1600 hrs	ASTM D3895 ASTM D5885	(11)

(1) Of 10 readings, 8 out of 10 must be ≥7 mils, and lowest individual reading must be ≥ 5 mils
(2) Alternate the measurement side for double sided textured sheet. Both sides are to be measured and considered separately.
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Break elongation is calculated using a gauge length of 2.0 in. at 2.0 in./min.
(4) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3
(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(9) Not recommended since high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.
(11) Manufacturer may provide a certification letter. The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheet made from the same formulation as being used for the textured sheet materials, or the texturing act as the notch. Follow procedure listed in ASTM D5397 appendix.

PART 3 EXECUTION

3.1 Quality Assurance Sampling and Testing

A. Prior to or upon delivery of the material to the Site, the QAC shall obtain conformance test samples from selected geomembrane. Conformance test samples may be cut at the MANUFACTURER's facilities after the materials represented by such samples have been segregated from all other materials and have been designated for the project. The INSTALLER shall make rolls available and assist QAC in obtaining material inventory and samples. Samples shall be tested in accordance with Table 1 (sec 2.1) at the following frequencies:

TABLE 3
Quality Assurance (QA) Conformance Testing

Testing Properties	Testing Method	Conformance QA Testing Frequency
Thickness mils (min avg.)	ASTM D5994	1 per 200,000 SF*
Density g/cc	ASTM D1505 or ASTM D792	1 per 200,000 SF*
Asperity Height (min avg.) (1) (2)	GM-12	1 per 200,000 SF*
Tensile Properties (min. avg.) (3)	ASTM D6693	1 per 200,000 SF*
Tear Resistance – lb (min. avg.)	ASTM D1004	1 per 200,000 SF*
Puncture Resistance – lb (min. avg.)	ASTM D4833	1 per 200,000 SF*
Stress Crack Resistance (11)	ASTM D5397	N/A
Carbon Black Content - %	ASTM D1603 (4)	1 per 200,000 SF*
Carbon Black Dispersion	ASTM D5596	1 per 200,000 SF*
Oxidative Induction Time (OIT) (min avg.) (6) • Standard OIT, or • High Pressure OIT	ASTM D3895 ASTM D5885	N/A
Oven Aging at 85°C (7) • Std. OIT (min. avg.), % retained after 90 days or • High Pressure OIT (min. avg.), % retained after 90 days	ASTM D5721 ASTM D3895 ASTM D5885	N/A
UV Resistance (8) • Std. OIT (min. avg.), or • High Pressure OIT (min avg.) % retained after 1600 hrs	ASTM D3895 ASTM D5885	N/A

(1) Of 10 readings, 8 out of 10 must be ≥7 mils, and lowest individual reading must be ≥ 5 mils.
(2) Alternate the measurement side for double sided textured sheet.
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Break elongation is calculated using a gauge length of 2.0 in. at 2.0 in./min.

(4) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3 * or minimum 1 per lot.

B. All rolls represented by quality assurance testing shall be rejected if test failure occurs. The INSTALLER may at their expense request additional testing to validate individual rolls. Rolls bracketed by passing tests may be used in the work.

3.2 Surface Preparation

A. The CONTRACTOR is responsible for preparing subgrade surface for geomembrane placement.
B. After prepared subgrade surface has been accepted in accordance with Quality Assurance Plan, report to DESIGNER any change in subgrade surface condition that may require repair work. The CONTRACTOR shall maintain prepared subgrade surfaces with the cooperation and assistance of the INSTALLER.
C. Do not place geomembrane onto an area that has become degraded due to weather conditions. Observe and report surface condition daily to evaluate suitability for geomembrane deployment.
D. Repair damage to prepared surface caused by installation activities at INSTALLER'S expense.

3.3 Installation

A. *Panel Nomenclature:*
1. Field panels are defined as a roll or portion of roll cut and seamed in the field, excluding patches and cap strips.
2. Identify each field panel with a unique identification code (number or letter-number). This identification code shall be agreed upon by DESIGNER, INSTALLER, and QAC.
3. The INSTALLER shall be responsible for marking the panel and roll number on the geomembrane.

B. *Protection:*
1. Do not use equipment that damages geomembrane.
2. Ensure subgrade surface underlying geomembrane has not deteriorated since previous acceptance, and remains acceptable immediately prior to and during geomembrane deployment.
3. Keep geosynthetic elements immediately underlying geomembrane clean and free of debris.
4. Do not permit personnel to smoke or wear shoes that can damage geomembranes while working on the geomembrane. Personnel shall not bring glass or metal containers on geomembrane, except as required to perform the work.
5. Unroll panels in manner that does not cause excessive scratches or crimps in geomembrane and does not damage supporting soil.
6. Place panels in manner that minimizes wrinkles (especially differential wrinkles between adjacent panels).

7. Prevent wind uplift by providing adequate temporary loading and/or anchoring (e.g., sandbags) that shall not damage geomembrane. In case of high winds, continuous loading is recommended along panel edges.
8. Protect geomembrane in areas where excessive traffic is expected, using geotextiles, extra geomembrane, or other suitable materials.
9. The contractor must protect the work described in this section before, during, and after installation.

C. *Field Panel Deployment:*
1. Install field panels at locations indicated on INSTALLER's layout plan to the greatest extent possible.
2. Replace seriously damaged (torn, twisted or crimped) field panels, or portions thereof, at no cost to OWNER. Repair less serious damage as specified herein. QAC shall determine if material shall be repaired or replaced.
3. Remove from work area damaged panels, or portions of panels, that have been rejected by the QAC.
4. Do not proceed with deployment at ambient temperature below 32° F (0° C) or above 104° F (40° C) unless authorized, in writing, by DESIGNER.
5. Do not deploy during precipitation, in presence of excessive moisture, (fog, dew), in areas of ponded water, or in presence of excessive winds.
6. Do not undertake deployment if weather conditions will preclude material seaming on same day as deployment.
7. Do not deploy more geomembrane field panels in one day than can be seamed during that day.

D. *Seam Layout:*
1. To the greatest extent possible, orient seams parallel to line of maximum slope (i.e., oriented along, not across, slope).
2. No horizontal seams will be permitted on the slope, unless approved, in writing, by the DESIGNER.
3. No horizontal seam shall be less than 5 ft (1.5 m) from toe of slope, unless approved by the QAC.
4. In general, maximize lengths of field panels and minimize number of field seams.
5. Align geomembrane panels to have nominal overlap of 3 in. (75 mm) for extrusion welding and 4 to 6 in. (100 mm to 150 mm) for fusion welding. Final overlap shall be sufficient to allow destructive “peel” tests to be performed on seam.

E. *Temporary Bonding:*
1. Hot air device (Leister) shall be used to temporarily bond the geomembrane panels to be extrusion welded.
2. Do not damage geomembrane when temporarily bonding adjacent panels. Apply minimal amount of heat required to lightly tack the geomembrane panels together. Control the temperature of hot air at nozzle of any temporary welding apparatus to prevent damage to geomembrane.
3. Do not use solvent or adhesive.

F. *Seaming Methods:*
1. Approved processes for field seaming are extrusion fillet welding and fusion welding. Proposed alternate processes shall be documented and submitted to DESIGNER for approval. Alternate procedures shall be used only after being approved in writing by the DESIGNER.
2. Use fusion welding as primary method of seaming adjacent field panels.
   a. Cross seam “tees”, associated with fusion or extrusion seam welding, shall be patched in accordance with the requirements of this Section.
   b. Place welder on protective pad to prevent geomembrane damage when not in use.
   c. When subgrade conditions dictate, use movable protective layer (e.g. geomembrane rub sheet) directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between sheets and prevent debris from collecting around pressure rollers. Rub sheet shall be removed from under the liner once seaming is complete.
3. Use extrusion fillet welding as secondary method for seaming between adjacent panels and as primary method of welding for detail and repair work.
   a. Purge heat-degraded extrudate from barrel of extruder.
   b. Place smooth insulating plate or fabric beneath hot welding apparatus when not in use.
   c. Use clean and dry welding rods or extrudate pellets.
   d. Clean dirt and debris from geomembrane surface prior to extrusion welding.
   e. Grind weld area to using suitable hand held equipment to prepare geomembrane surface for extrusion welding. Grind perpendicular to seam. Take care not to over-grind the geomembrane beyond the extents of the extrudate coverage.
   f. Complete extrusion welding within one (1) hour of seaming operation grinding process without damaging geomembrane.

G. *Seaming Procedures:*
1. General Seaming Procedures - Ambient temperature between 32°F (0°C) and 104°F (40°C).
   a. Do not field seam without Master Seamer being present.
   b. Seam only during dry conditions, i.e., no precipitation or other excessive moisture, such as fog or dew.
   c. Do not seam during excessive winds, except as needed to protect the work. Do not seam if wind creates unsafe working conditions.
   d. If required, use a “rub-sheet” or similar hard surface directly under seam overlap to achieve proper support for seaming apparatus.
   e. Align panels to minimize wrinkles and/or “fishmouths” in welds.
   f. Extend seams to outside edge of panels placed in anchor trench.
   g. Prior to seaming, ensure that seam area is free of moisture, dust, dirt, debris, or foreign material.
   h. “Fishmouths” or wrinkles at seam overlaps shall be cut along ridge of wrinkle in order to achieve flat overlap. Cut “fishmouths”

or wrinkles shall be seamed or patched in accordance with this Section.

2. Cold Weather Seaming Procedures (ambient temperature is below 32°F (0°C)).
   a. No seaming of geomembrane is permitted unless demonstrated to QAC that geomembrane seam quality will not be compromised.
   b. Additional destructive samples and/or field test strips shall be cut from seams welded under ambient temperature of 32°F (0°C), at QAC'S discretion.
3. Warm Weather Procedures (ambient temperature is above 104°F (40°C)).
   a. No seaming of geomembrane is permitted unless demonstrated to QAC that geomembrane seam quality will not be compromised.
   b. Additional destructive samples and/or field test strips shall be cut from seams welded over ambient temperature of 104°F (40°C), at QAC'S discretion.

H. *Repair Procedures:*
1. Acceptable repair procedures include following:
   a. Patching: A piece of the same geomembrane material extrusion welded into place. Use to repair holes, tears, nondispersed raw materials, and contamination by foreign matter. All panel intersections of three (3) or more geomembrane panels shall be patched.
   b. Capping: Strip of the same geomembrane material extrusion welded into place over an inadequate seam. Use to repair large lengths of failed seams.
   c. Spot welding or seaming (Grind and Weld): Bead of molten extrudate placed on flaw. Use to repair scuffing, dimpling, or other minor, localized flaws. Spot welding shall not be used to repair holes in the geomembrane liner.
   d. Removal and replacement: Remove bad seam and replace with strip of same geomembrane material welded into place. Use to repair large lengths of failed seams.
   e. Extrusion welding a flap associated with double-tracked fusion welded seams: Repairs of this type shall not be used unless approved by QAC, and only if the flap is a minimum of 1.5 inches long. Repairs of this type shall not exceed 100 ft (30 m) in length. A patch as described previously shall be placed at one or both ends if located within the active cover area (excluding the anchor trench).
2. For each repair method:
   a. Ensure surfaces are clean, dry, and prepared in accordance with specified seaming process.
   b. Ensure seaming equipment used in repairing procedures meet requirements of this Specification.

c. Extend patches or caps at least nches (150 mm) beyond edge of defect. The corners of patches shall be rounded with a radius of approximately 6 inches (150 mm). The minimum diameter of any patch repairing a pinhole shall be 12 inches.

I. *Anchor Trench:*
1. The CONTRACTOR shall excavate anchor trenches to lines and grades shown on Permit Drawings prior to geomembrane placement, unless otherwise specified.
2. The CONTRACTOR shall provide anchor trench with slightly rounded corners shall be provided, to avoid sharp bends in geomembrane.
3. The INSTALLER shall provide and use plywood, boards, or other suitable materials, to permit welding machines to weld across, rather than through, anchor trenches.
4. The CONTRACTOR shall dewater the completed anchor trench, to prevent ponding or softening of adjacent soils while trench is open.
5. The CONTRACTOR and INSTALLER shall coordinate operations to minimize time anchor trench remains open and uncovered.
6. The INSTALLER shall provide sufficient temporary ballast, approved by the QAC, to prevent geosynthetics from being pulled or blown from the anchor trench.
7. The CONTRACTOR and INSTALLER shall remove debris related to their respective construction activities, including temporary ballast material, from anchor trench, prior to installation of subsequent materials. The anchor trench shall be cleaned to the satisfaction of the QAC.
8. The CONTRACTOR shall place and compact backfill in the anchor trench as soon as practical after geosynthetic installation is completed. The anchor trench shall be backfilled prior to placing leachate drainage layer material. Refer to specification Section 02223, Structural and General Fill for backfilling procedure

3.4 Field Quality Assurance and Quality Control

A. *Visual Inspection:*
1. The QAC will examine seam and non-seam areas of geomembrane to identify defects, holes, blisters, nondispersed raw materials, and any sign of contamination by foreign matter.

B. *Trial Seams:*
1. Make trial seams on fragment pieces of geomembrane liner to verify that conditions are adequate for production seaming.
2. Make trial seams for each combination of materials to be welded (i.e., textured/smooth, smooth/smooth, textured/textured). Seamers may only weld those combinations for which they have produced acceptable trial welds. Seamers are not required to produce trial seams for material combinations they will not be welding.
3. Make trial seams at beginning of each seaming period, following restart of welding equipment, upon change of seamers, and at least once every five (5) hours, for each production seaming apparatus used that day.

4. Make trial seams using the same materials and under the under same conditions as production welding.
5. Trial seam sample shall be at least 4-feet (1.2 m) long by 1-foot (0.3 m) wide (after seaming) with seam centered lengthwise.
6. Cut six (6) test specimens from sample, using 1-inch (25 mm) wide die cutter. These specimen locations shall be selected randomly along trial seam sample by GEOSYNTHETIC QAC. Test three (3) specimens in peel and three (3) specimens in shear, using field tensiometer. Samples shall fail in film tear bond (FTB) mode. Trial seams shall meet the following minimum strengths:

TABLE 4
Seam Strength Values for Trial Seams and Destructive Sample Testing

PROPERTY	METHOD	60 MIL TEXTURED HDPE SPECIFIED VALUE
Shear Strength	ASTM D4437	120 ppi (min)
Peel Adhesion: Fusion Extrusion	 ASTM D4437 ASTM D4437	 91 ppi (min) 78 ppi (min)
For shear tests, sheet shall yield before failure of seam. For peel adhesion, seam separation shall not extend more than 25 percent of seam width into seam. For either test, testing shall be discontinued when sample has visually yielded. Four (4) out of 5 specimens shall meet the, or exceed, the values listed for shear and peel. The 5th specimen can be as low as 80%.		

7. If the specimen fails, the INSTALLER shall attempt to identify the cause of the failure (e.g., mechanical malfunction, dirt in weld). On correction of the deficiency, the seamer shall produce a second trial seam. If the second trial seam fails, the seamer shall not be permitted to weld production seams until deficiencies are corrected and two (2) consecutive successful trial welds are achieved. If mechanical failure is determined to be the cause of the second trial seam failure, the machine shall be removed from service until suitable repairs are made. The seamer shall be required to produce a passing trial seam with the replacement machine.

C. *Nondestructive Seam Testing:*

1. General:
   a. The purpose of nondestructive testing is to check continuity of the seams. It will not provide quantitative information on seam strength.
   b. Nondestructively test field seams over their full length using vacuum test for extrusion seams, air pressure for double-fusion seams, or other DESIGNER approved method. The INSTALLER shall document all non-destructive testing results.

c. The INSTALLER shall perform nondestructive testing as seaming work progresses.

d. The RM shall observe all non-destructive testing on a procedural basis. The RM shall record all non-destructive testing information at or shortly after the time of testing. The INSTALLER and QAC shall coordinate to ensure that all installation activities are monitored by the RM in accordance with these Specifications.

2. Vacuum Testing for extrusion seam:

   a. Energize vacuum pump and reduce tank pressure to approximately 5 pounds per square inch (psig) (10-inches of Hg) (35 kPa) gauge pressure.
   b. Wet strip of extrusion seam approximately 12-inches by 48-inches (0.3 m by 1.2 m) with soapy solution.
   c. Ensure viewing window is clean.
   d. Place box over wetted area.
   e. Close bleed valve and open vacuum valve.
   f. Ensure that leak-tight seal is created.
   g. For minimum of 10 seconds, apply vacuum and examine geomembrane through viewing window for presence of soap bubbles.
   h. If no bubbles appear within 10 seconds, close vacuum valve and open bleed valve, move box over to next adjoining area with minimum 3-inch (75 mm) overlap and repeat process.
   i. Mark and repair areas where soap bubbles appear.

3. Air Pressure Testing for dual track, hot wedge fusion weld:

   a. Seal both ends of seam to be tested. Take suitable precautions if sealing seam ends with open flame.
   b. Insert needle or other approved pressure feed device into air channel created by fusion weld.
   c. Insert a protective cushion between air pump and geomembrane.
   d. Pressurize the air channel to approximately 30-psig (200 kPa). Close valve and allow pressure to stabilize for approximately two (2) minutes.
   e. Observe air pressure for an additional five (5) minutes after initial stabilization period ends. If pressure loss exceeds 3-psig or pressure does not stabilize, locate faulty area, repair, and retest.
   f. On completion of testing, cut opposite end of tested seam length to verify continuity of air channel. If air does not escape, locate blockage and retest unpressurized area. Repair all cuts and holes created in the air channel.
   g. Cap any seam length that cannot be successfully air pressure tested. The cap seam shall then be vacuum tested as required in subsection 2 (Vacuum Testing).
   h. Remove needle or other approved pressure feed device and repair hole in geomembrane.

4. Leak Location Testing
   a. Leak testing shall be conducted on the geomembrane prior to placement of overlying layers to confirm that there are no holes along seams or within the geomembrane panels. A "water puddle survey" will be used for bare geomembrane. In this method,
      i. A small amount of water is put in contact with the liner.
      ii. A "squeegee" is used to push the water over the geomembrane.
      iii. A low voltage electrical supply is connected to the earth ground and to the leak detector.
      iv. When a hole in the geomembrane is encountered, electrical current will flow through the water and the leak contacting the underlying soils.
      v. The current is monitored using an electronic detector that converts the increase in the current into an audible tone indication, which the technician can hear through headphones.
   b. Leak testing shall be repeated after the placement of the leachate collection layer, as this process of placing the overlying materials can cause damage.
      i. A high voltage isolated DC power supply was used to impress a voltage across the liner using one electrode placed in the operations layer located on top of the primary liner and a second electrode placed in the electrically conducting material located between the liners. Therefore, the geomembrane liner provides an electrical barrier between the electrodes except where there are holes in the geomembrane liner.
      ii. Electrical current flowing through the holes in the geomembrane liner produces localized anomalous areas of high current density near the holes.
      iii. This electrical current path is provided by electrically conducting material such as water, sand, or soil.
5. Inaccessible Seams:
   a. Cap-strip seams that cannot be nondestructively tested.
   b. Cap-strip material shall be composed of same type and thickness geomembrane as geomembrane to be capped.
   c. Examine cap-stripping operations with QAC for uniformity and completeness. Document observations.

D. *Destructive Seam Testing:*
1. General:
   a. The purpose of destructive seam testing to evaluate seam strength.
   b. Destructive seam testing shall be performed as seaming progresses.
   c. The destructive seam sample shall fail if the overlap is insufficient for grips of testing machine to close on sample (available flap is ½ inch long or less).

2. Location and frequency:
    a. Test at minimum frequency of one (1) test location per 500 ft (150 m) of welding length performed by each welding machine. This minimum frequency to be determined as an average taken from the total linear footage of seaming, per machine, at the end of the geomembrane installation.
    b. Test locations shall be determined by the QAC, during seaming operations.
    c. INSTALLER will not be informed in advance of locations where seam samples will be taken.
    d. DESIGNER or QAC reserves right to increase frequency of testing in accordance with performance results of samples previously tested.
3. Sampling Procedures:
    a. Cut samples at locations selected by QAC.
    b. QAC shall number each sample and record sample number and location in panel layout drawing.
    c. QAC shall mark each section of destructive test sample with sample number, seam number, seamer and machine identification, and date.
    d. Repair holes in geomembrane resulting from destructive seam sampling as soon as possible, in accordance with repair procedures described in this Section.
    e. Non-destructively test repairs in accordance with this Section.
4. Sample Dimensions:
    a. Field Testing: Cut two (2) 1-inch (25 mm) wide sample coupons, from each end of seam section identified by QAC. Distance between these two (2) samples shall be approximately 42-inches (1.1 m). Test both samples in peel mode, using field tensiometer. If both samples meet requirements of Table 4 located in section 3.4, B, item 6, collect sample for laboratory testing.
    b. Laboratory Testing: Collect laboratory test sample from seam length between field test sample coupon locations. Cut sample for laboratory testing, approximately 12-inches (0.3 m) wide by a minimum 42-inches (1.1 m) long, with seam centered lengthwise. Cut this sample into three (3) sections. QAC shall distribute sample sections as follows:
        1) Geosynthetic Quality Assurance Laboratory: minimum 18inch (0.5 m) long section for laboratory testing.
        2) INSTALLER: minimum 12-inch (0.3 m) long section for archive or optional laboratory testing.
        3) OWNER: minimum 12-inch (0.3m) long section for archive storage.
    c. Final determination of sample sizes shall be agreed upon at pre-construction meeting. Sample sizes shall be minimized, consistent with laboratory testing requirements.
    d. Submit laboratory sample for quantitative testing.

5. Destructive Test Failure Procedures:
   When a sample fails destructive testing, whether test is conducted in the field or at the Geosynthetic Quality Assurance Laboratory, the INSTALLER has following options:
   a. Repair the entire seam between two (2) passing destructive test locations along the path of machine producing the failed weld bracketing the failed location.
   b. Trace the welding path 10-feet (3 m) minimum in each direction from failed test, and repeat field testing procedures indicated in this Section at each location. If these additional samples pass testing, then collect laboratory test samples. If these laboratory samples pass testing, repair seam between these locations. If either, or both, sample fails, repeat process until passing sample is located. If necessary, tracking will extend back to previous days of welding until a passing sample is located. Repair seam between passing destructive sample locations.
   c. Acceptable repaired seams shall be bound by passing laboratory destructive tests locations. The QAC shall mark and additional destructive test sample for seam cap strip repairs of 150 ft (50 m) or more.
   d. If a destructive test sample fails, the DESIGNER may require additional testing of seams welded by same seamer and/or welding apparatus produced during same time shift as failed seam.

E. *Repair Verification:*
   1. Repairs shall be non-destructively tested.
   2. Nondestructive test results that pass shall indicate adequate repair.
   3. Destructive test samples shall be collected on repairs 100-feet long, or greater. Frequency may be increased at the discretion of the CQC.
   4. In the event destructive or nondestructive tests of repairs fail to meet the requirements of this Section, the work will be redone, at no expense to the DESIGNER, until passing test results are achieved.
   5. QAC shall monitor and document geomembrane repairs, and non-destructive testing.

F. *Large Wrinkles:* Wrinkle is considered to be large when geomembrane can be folded over onto itself.
   1. When seaming of geomembrane is completed, and prior to placing overlying materials, QAC shall identify all large geomembrane wrinkles, to be repaired.
   2. Cut and repair all wrinkles identified by QAC. Welds produced while repairing wrinkles shall be nondestructively tested.
   3. Repair wrinkles identified by QAC. Repair during coldest part of installation period.

*****END OF SECTION*****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of the installation of low-density polyethylene (LLDPE) geomembrane installation for the Closure Cap and other related and incidental work within the designated area and as required for the construction of other work, as shown, specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The CONTACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 Submittals

A. *Pre-installation*: The CONTRACTOR shall submit the following prior to geomembrane deployment:
   1. Origin (supplier's name and production plant) and identification (brand name and number) of resin used to manufacture geomembrane.
   2. Copies of dated quality control certificates issued by resin supplier.
   3. Results of tests conducted by geomembrane manufacturer to verify that resin used to manufacture geomembrane meets Specifications.
   4. Statement that amount of reclaimed polymer added to resin during manufacturing did not exceed 2% by weight.
   5. List of materials that comprise geomembrane, expressed in following categories as percent by weight:
      a. polyethylene;
      b. carbon black; and,
      c. other additives.
   6. Manufacturer's specification for geomembrane, including properties listed and measured using appropriate test methods.
   7. Written certification that minimum values given in manufacturer's specification are guaranteed by geomembrane manufacturer.
   8. Quality control certificates, signed by geomembrane manufacturer. Each quality control certificate shall include applicable roll identification numbers, testing procedures, and results of quality control tests.
   9. Field panel layout and identification code including dimensions and details.
   10. Resumes of the INSTALLER’s Superintendent and Master Seamer, including dates and duration of employment.
   11. Installation schedule.
   12. List of personnel performing seaming operations, including experience.
   13. Certificate that extrusion rod is comprised of same resin as geomembrane liner material.
   14. Manufacturer Material and Installation warranties.

B. *Installation*: Submit as installation proceeds.
   1. Quality control documentation recorded during installation.
   2. Subgrade surface acceptance certificates signed by INSTALLER for each area that will be covered directly by geomembrane. Submit on deployment of geomembrane.
   3. Deployment of geomembrane will be considered acceptance of subgrade by the INSTALLER, if certificate is not submitted.

1.3 Pre-Qualifications

A. *Manufacturer:*
Manufacturer shall have minimum 5-years continuous experience in manufacture of LLDPE geomembrane, or experience totaling 10,000,000 square feet (sq. ft.) of manufactured LLDPE, or geomembrane manufacture for minimum of ten (10) completed facilities.

B. *Fabricator (if applicable):*
Fabricator shall have minimum 5-years continuous experience in fabrication of LLDPE geomembrane or experience totaling 2,000,000 sq. ft. of fabricated LLDPE geomembrane for minimum of ten (10) completed facilities.

C. *Installer:*
   1. Installer shall have minimum 5-years continuous experience in installation of LLDPE geomembrane or experience totaling 2,000,000 sq. ft. of installed LLDPE geomembrane for minimum of ten (10) completed facilities.
   2. Personnel performing seaming operations shall be qualified by experience or training. Minimum of one seamer shall have experience seaming minimum 2,000,000 sq. ft. of LLDPE geomembrane using same type of seaming apparatus in use at Site. Most experienced seamer, "Master Seamer," shall provide direct supervision, as required, over less experienced seamers.

1.4 Quality Assurance Program

The Manufacturer, fabricator, and installer shall participate in and conform to items and requirements of quality assurance program as outlined in this Section and the Construction Quality Assurance (CQA) Plan.

1.5 Delivery, Storage, and Handling

A. *Packing and Shipping:*
   1. Manufacturer shall identify each roll delivered to site with the following:
      a. Manufacturer's name.
      b. Product Identification.
      c. Thickness.
      d. Roll number.
      e. Roll dimensions.

2. The INSTALLER shall protect geomembrane from excessive heat, cold, puncture, cutting, or other damaging or deleterious conditions during loading, transport, and unloading at site.

B. *Acceptance at Site:*
   1. INSTALLER shall be responsible for unloading all geosynthetics delivered to the Site, unless otherwise agreed at the geosynthetics kick-off meeting.
   2. Shipper shall notify INSTALLER, or other party responsible for off-loading materials, 48-hours in advance of material delivery.
   3. INSTALLER, or other party responsible for off-loading materials, shall bear all costs (including but not limited to OWNER's, QAC's, 3rd party contractor costs) associated with failure to supply appropriate personnel and equipment required to off-load geosynthetic materials.
   4. Perform physical inventory of materials delivered to the Site for use in the work. Perform inventory on delivery, or as soon as practicable thereafter.
   5. Conduct surface observations of each roll for defects and damage. This examination shall be conducted without unrolling rolls, unless defects or damages are found or suspected. Note type and extent of defects or damage observed.
   6. Defective or damaged rolls, or portions of rolls, will be rejected and shall be removed from Site and replaced, at no additional expense to the OWNER.
   7. Rolls or portions of rolls without proper identification or labeling will be rejected and shall be removed from Site.

C. *Storage and Protection:*
   1. The geomembranes will be unloaded, transported, stored, and protected in accordance with the manufacturer's recommendations so as not to damage or degrade the properties of the material.
   2. OWNER will provide on-site storage area for geomembrane rolls from time of delivery until deployment.
   3. The INSTALLER shall protect geomembrane from dirt, water, and other sources of damage.
   4. The INSTALLER shall preserve the integrity and readability of geomembrane roll labels.

PART 2 PRODUCTS

2.1 Materials

The geomembrane used for the closure is a low-density polyethylene (LLDPE) textured on both sides, 40-mil liner. The geomembrane shall meet the following properties:

TABLE 1
Minimum Properties 40-mil LLDPE Textured Geomembrane

Testing Properties	Testing Method	40 mil LLDPE Value
Thickness mils (min avg.) • Lowest individual for 8 out of 10 values • Lowest individual for any of the 10 values	ASTM D 5994	38 mils 36 mils 34 mils
Density g/cc	ASTM D1505 or ASTM D792	0.939 (max avg) (either method)
Asperity Height (min avg.) (1) (2)	GM-12	10 mils
Tensile Properties (min. avg.) (3) • Break strength – lb/in • Break elongation - %	ASTM D6693	60 250
Tear Resistance – lb (min. avg.)	ASTM D1004	22
Puncture Resistance – lb (min. avg.)	ASTM D4833	44
Stress Crack Resistance (11)	ASTM D5397 (11) (Appendix)	NA
Carbon Black Content - %	ASTM D1603 (4)	2.0 to 3.0
Carbon Black Dispersion	ASTM D5596	Note (5)
Oxidative Induction Time (OIT) (min avg.) (6) • Standard OIT, or • High Pressure OIT	ASTM D3895 ASTM D5885	100 400
Oven Aging at 85°C (7) • Std. OIT (min. avg.), % retained after 90 days, or • High Pressure OIT (min. avg.), % retained after 90 days	ASTM D5721 ASTM D3895 ASTM D5885	35 60
UV Resistance (8) • Std. OIT (min. avg.), or • High Pressure OIT (min avg.) % retained after 1600 hrs	ASTM D3895 ASTM D5885	N.R. (9) 35
Interface Friction Angle (min.) –degrees	ASTM D 5321	34 for geotextile to geomembrane 32 for geomembrane to soil

(1) Of 10 readings, 8 out of 10 must be ≥7 mils, and lowest individual reading must be ≥ 5 mils.
(2) Alternate the measurement side for double-sided textured sheet. Both sides are to be measured and considered separately.
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Break elongation is calculated using a gauge length of 2.0 in. at 2.0 in./min.
(4) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:9 in Categories 1 or 2 and 1 in Category 3.
(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(9) Not recommended since high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.
(11) The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheet made from the same formulation as being used for the textured sheet materials, or the texturing act as the notch. Follow procedure listed in ASTM D5397 appendix.

A *Geomembrane*: The geomembrane shall be manufactured from new polyethylene resin, except as noted below:
1. Use of geomembrane recycled during manufacturing process shall be permitted, with written approval from the DESIGNER, if recycled geomembrane does not exceed 2% by weight.
2. Geomembrane manufactured from non-complying resin shall be rejected.

B *Geomembrane Characteristics:*
1. The geomembrane shall contain a maximum of 1%, by weight, of additives, fillers or extenders (not including carbon black).
2. The geomembrane shall contain between 2% and 3%, by weight, of carbon black for ultraviolet light resistance.
3. No pinholes, bubbles or other surface features that compromise geomembrane integrity are allowed. Geomembrane shall be free of blisters, nondispersed raw materials, or other signs of contamination resulting from the manufacturing process. Geomembrane rolls or portions of rolls with these defects shall be rejected.

2.2 Seaming and Testing Equipment

A. *Welding:*
1. The INSTALLER shall maintain a minimum of two (2) spare operable seaming machines on-site unless otherwise agreed upon at pre-construction meeting.
2. Seaming equipment shall not damage geomembrane.
3. Use extrusion welding apparatus equipped with gauges indicating temperature of extrudate at the equipment nozzle, or utilize hand-held gauges to measure extrudate temperatures.
4. Use self-propelled fusion-welding machines that create an air channel between two (2) welded tracks and are equipped with following:
   a. Gauge indicating temperature of heating element; and,
   b. Gauge indicating the speed of travel.
5. Place electric generator on smooth base such that no damage occurs to geomembrane.

B. *Vacuum Testing Equipment:*
   1. The vacuum box assembly shall consist of a rigid housing open at the bottom, with a transparent viewing window on top and a soft neoprene gasket attached to bottom rim of housing, a porthole or valve assembly, and a vacuum gauge;
   2. Pump assembly equipped with pressure controller and pipe connections;
   3. Pressure/vacuum rubber hose with fittings and connections;
   4. Soapy solution to wet test area; and,
   5. Means of applying soapy solution.

C. *Air Pressure Testing Equipment:*
   1. Air pump (manual or motor driven), equipped with pressure gauge, capable of generating, sustaining, and measuring pressure between 24 and 35 psi (160 and 240 kPa), and mounted on cushion to protect geomembrane;
   2. Rubber hose with fittings and connections;
   3. Means of safely sealing weld air channel;
   4. Sharp hollow needle, or other approved pressure feed device; and,
   5. Air pressure monitoring device.

D. *Tensiometer:*
   1. Tensiometer shall be capable of maintaining constant jaw separation rate of 20-inches per minute; and,
   2. Tensiometer shall be calibrated annually. A certificate indicating that the equipment has been calibrated within one (1) year of use in the work shall be maintained with the tensiometer. The INSTALLER will provide the QAC with a copy of the certificate of calibration.

2.3 <u>Source Quality Control</u>

Tests and inspections shall be performed by geomembrane manufacturer as follows:

A. Test geomembranes to demonstrate that resin meets this Specification.
B. Continuously monitor geomembrane during manufacturing process for inclusions, bubbles, or other defects. Geomembranes, which exhibit defects, shall not be acceptable for installation.
C. Monitor thickness continuously during manufacturing process.
D. The MANUFACTURER shall conduct quality control (QC) testing to verify conformance with table 1 in section 2.1, at the following frequencies:

TABLE 2
Quality Control (QC) Manufacturers Testing

Testing Properties	Testing Method	Manufacturer QC Testing Frequency
Thickness mils (min avg.)	ASTM D 5994	1 per Roll
Density g/cc	ASTM D1505 or ASTM D792	1 per 50,000 SF
Asperity Height (min avg.) (1) (2)	GM-12	1 per 50,000 SF
Tensile Properties (min. avg.) (3)	ASTM D6693	1 per 50,000 SF
Tear Resistance – lb (min. avg.)	ASTM D1004	1 per 50,000 SF
Puncture Resistance – lb (min. avg.)	ASTM D4833	1 per 50,000 SF
Stress Crack Resistance (11)	ASTM D5397	per GRI GM10
Carbon Black Content - %	ASTM D1603 (4)	1 per 50,000 SF
Carbon Black Dispersion	ASTM D 5596	1 per 50,000 SF
Oxidative Induction Time (OIT) (min avg.) (6) • Standard OIT, or • High Pressure OIT	ASTM D3895 ASTM D5885	(11)
Oven Aging at 85°C (7) • Std. OIT (min. avg.), % retained after 90 days, or • High Pressure OIT (min. avg.), % retained after 90 days	ASTM D5721 ASTM D3895 ASTM D5885	(11)
UV Resistance (8) • Std. OIT (min. avg.), or • High Pressure OIT (min avg.) % retained after 1600 hrs	ASTM D3895 ASTM D5885	(11)

(1) Of 10 readings, 8 out of 10 must be ≥7 mils, and lowest individual reading must be ≥ 5 mils.
(2) Alternate the measurement side for double sided textured sheet. Both sides are to be measured and considered separately.
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Break elongation is calculated using a gauge length of 2.0 in. at 2.0 in/min.
(4) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3.
(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(9) Not recommended since high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.
(11) Manufacturer may provide a certification letter. The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheet made from the same formulation as being used for the textured sheet materials, or the texturing act as the notch. Follow procedure listed in ASTM D5397 appendix.

PART 3 EXECUTION

3.1 Quality Assurance Sampling and Testing

A. Prior to or upon delivery of the material to the Site, the QAC shall obtain conformance test samples from selected geomembrane. Conformance test samples may be cut at the MANUFACTURER's facilities after the materials represented by such samples have been segregated from all other materials and have been designated for the project. The INSTALLER shall make rolls available and assist QAC in obtaining material inventory and samples. Samples shall be tested in accordance with Table 1 (sec 2.1) at the following frequencies:

TABLE 3
Quality Assurance (QA) Conformance Testing

Testing Properties	Testing Method	Conformance QA Testing Frequency
Thickness mils (min avg.)	ASTM D 5994	1 per 200,000 SF*
Density g/cc	ASTM D1505 or ASTM D792	1 per 200,000 SF*
Asperity Height (min avg.) (1) (2)	GM-12	1 per 200,000 SF*
Tensile Properties (min. avg.) (3)	ASTM D6693	1 per 200,000 SF*
Tear Resistance – lb (min. avg.)	ASTM D1004	1 per 200,000 SF*
Puncture Resistance – lb (min. avg.)	ASTM D4833	1 per 200,000 SF*
Stress Crack Resistance (11)	ASTM D5397	N/A
Carbon Black Content - %	ASTM D1603 (4)	1 per 200,000 sf*
Carbon Black Dispersion	ASTM D 5596	1 per 200,000 sf*
Oxidative Induction Time (OIT) (min avg.) (6) • Standard OIT, or • High Pressure OIT	ASTM D3895 ASTM D5885	N/A
Oven Aging at 85°C (7) • Std. OIT (min. avg.), % retained after 90 days or • High Pressure OIT (min. avg.), % retained after 90 days	ASTM D5721 ASTM D3895 ASTM D5885	N/A
UV Resistance (8) • Std. OIT (min. avg.), or • High Pressure OIT (min avg.) % retained after 1600 hrs	ASTM D3895 ASTM D5885	N/A

(1) Of 10 readings, 8 out of 10 must be ≥7 mils, and lowest individual reading must be ≥ 5 mils.
(2) Alternate the measurement side for double sided textured sheet.
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Break elongation is calculated using a gauge length of 2.0 in. at 2.0 in/min.
(4) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3 Or minimum 1 per lot.

B. All rolls represented by quality assurance testing shall be rejected if test failure occurs. The INSTALLER may, at their expense, request additional testing to validate individual rolls. Rolls bracketed by passing tests may be used in the work.

3.2 Surface Preparation

A. The CONTRACTOR is responsible for preparing subgrade surface for geomembrane placement.
B. After prepared subgrade surface has been accepted in accordance with Quality Assurance Plan, report to DESIGNER any change in subgrade surface condition that may require repair work. The CONTRACTOR shall maintain prepared subgrade surfaces with the cooperation and assistance of the INSTALLER.
C. Do not place geomembrane onto an area that has become degraded due to weather conditions. Observe and report surface condition daily to evaluate suitability for geomembrane deployment.
D. Repair damage to prepared surface caused by installation activities at INSTALLER'S expense.

3.3 Installation

A. *Panel Nomenclature:*
1. Field panels are defined as a roll or portion of roll cut and seamed in the field, excluding patches and cap strips.
2. Identify each field panel with a unique identification code (number or letter-number). This identification code shall be agreed upon by DESIGNER, INSTALLER, and QAC.
3. The INSTALLER shall be responsible for marking the panel and roll number on the geomembrane.

B. *Protection:*
1. Do not use equipment that damages geomembrane;
2. Ensure subgrade surface underlying geomembrane has not deteriorated since previous acceptance, and remains acceptable immediately prior to and during geomembrane deployment;
3. Keep geosynthetic elements immediately underlying geomembrane clean and free of debris;
4. Do not permit personnel to smoke or wear shoes that can damage geomembranes while working on the geomembrane. Personnel shall not bring glass or metal containers on geomembrane, except as required to perform the work;
5. Unroll panels in manner that does not cause excessive scratches or crimps in geomembrane and does not damage supporting soil;
6. Place panels in manner that minimizes wrinkles (especially differential wrinkles between adjacent panels);

7. Prevent wind uplift by providing adequate temporary loading and/or anchoring (e.g., sandbags) that shall not damage geomembrane. In case of high winds, continuous loading is recommended along panel edges; and,
8. Protect geomembrane in areas where excessive traffic is expected, using geotextiles, extra geomembrane, or other suitable materials.
9. The contractor must protect the work described in this section before, during, and after installation.

C. *Field Panel Deployment:*
1. Install field panels at locations indicated on INSTALLER's layout plan to the greatest extent possible.
2. Replace seriously damaged (torn, twisted or crimped) field panels, or portions thereof, at no cost to OWNER. Repair less serious damage as specified herein. QAC shall determine if material shall be repaired or replaced.
3. Remove from work area damaged panels, or portions of panels, that have been rejected by the QAC.
4. Do not proceed with deployment at ambient temperature below 32° F (0° C) or above 104° F (40° C) unless authorized, in writing, by DESIGNER.
5. Do not deploy during precipitation, in presence of excessive moisture, (fog, dew), in areas of ponded water, or in presence of excessive winds.
6. Do not undertake deployment if weather conditions will preclude material seaming on same day as deployment.
7. Do not deploy more geomembrane field panels in one day than can be seamed during that day.

D. *Seam Layout:*
1. To the greatest extent possible, orient seams parallel to line of maximum slope (i.e., oriented along, not across, slope).
2. No horizontal seams will be permitted on the slope, unless approved, in writing, by the DESIGNER.
3. No horizontal seam shall be less than 5 ft (1.5 m) from toe of slope, unless approved by the QAC.
4. In general, maximize lengths of field panels and minimize number of field seams.
5. Align geomembrane panels to have nominal overlap of 3 in. (75 mm) for extrusion welding and 4 to 6 in. (100 mm to 150 mm) for fusion welding. Final overlap shall be sufficient to allow destructive “peel” tests to be performed on seam.

E. *Temporary Bonding:*
1. Hot air device (Leister) shall be used to temporarily bond the geomembrane panels to be extrusion welded.

2. Do not damage geomembrane when temporarily bonding adjacent panels. Apply minimal amount of heat required to lightly tack the geomembrane panels together. Control the temperature of hot air at nozzle of any temporary welding apparatus to prevent damage to geomembrane.
3. Do not use solvent or adhesive.

F. *Seaming Methods:*
1. Approved processes for field seaming are extrusion fillet welding and fusion welding. Proposed alternate processes shall be documented and submitted to the DESIGNER for approval. Alternate procedures shall be used only after being approved in writing by the DESIGNER.
2. Use fusion welding as primary method of seaming adjacent field panels.
   a. Cross seam “tees”, associated with fusion or extrusion seam welding, shall be patched in accordance with the requirements of this Section.
   b. Place welder on protective pad to prevent geomembrane damage when not in use.
   c. When subgrade conditions dictate, use movable protective layer (e.g. geomembrane rub sheet) directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between sheets and prevent debris from collecting around pressure rollers. Rub sheet shall be removed from under the liner once seaming is complete.
3. Use extrusion fillet welding as secondary method for seaming between adjacent panels and as primary method of welding for detail and repair work.
   a. Purge heat-degraded extrudate from barrel of extruder
   b. Place smooth insulating plate or fabric beneath hot welding apparatus when not in use
   c. Use clean and dry welding rods or extrudate pellets.
   d. Clean dirt and debris from geomembrane surface prior to extrusion welding.
   e. Grind weld area to using suitable hand held equipment to prepare geomembrane surface for extrusion welding. Grind perpendicular to seam. Take care not to over-grind the geomembrane beyond the extents of the extrudate coverage.
   f. Complete extrusion welding within one (1) hour of seaming operation grinding process without damaging geomembrane.

G. *Seaming Procedures:*
1. General Seaming Procedures - Ambient temperature between 32° F (0° C) and 104° F (40° C).
   a. Do not field seam without Master Seamer being present.
   b. Seam only during dry conditions, i.e., no precipitation or other excessive moisture, such as fog or dew.

c. Do not seam during excessive winds, except as needed to protect the work. Do not seam if wind creates unsafe working conditions.
d. If required, use a “rub-sheet” or similar hard surface directly under seam overlap to achieve proper support for seaming apparatus.
e. Align panels to minimize wrinkles and/or “fishmouths” in welds.
f. Extend seams to outside edge of panels placed in anchor trench.
g. Prior to seaming, ensure that the seam area is free of moisture, dust, dirt, debris, or foreign material.
h. “Fishmouths” or wrinkles at seam overlaps shall be cut along ridge of wrinkle in order to achieve flat overlap. Cut “fishmouths” or wrinkles shall be seamed and patched in accordance with this Section.

2. Cold Weather Seaming Procedures (ambient temperature is below 32° F (0° C)).
   a. No seaming of geomembrane is permitted unless demonstrated to the QAC that geomembrane seam quality will not be compromised.
   b. Additional destructive samples and/or field test strips shall be cut from seams welded under ambient temperature of 32° F (0° C), at QAC'S discretion.
3. Hot Weather Procedures (ambient temperature is above 104° F (40° C)).
   a. No seaming of geomembrane is permitted unless demonstrated to the QAC that geomembrane seam quality will not be compromised.
   b. Additional destructive samples and/or field test strips shall be cut from seams welded over ambient temperature of 104° F (40° C), at QAC'S discretion.

H. *Repair Procedures:*
1. Acceptable repair procedures include following:
   a. Patching: A piece of the same geomembrane material extrusion welded into place. Use to repair holes, tears, nondispersed raw materials, and contamination by foreign matter. All panel intersections of three (3) or more geomembrane panels shall be patched.
   b. Capping: Strip of the same geomembrane material extrusion welded into place over an inadequate seam. Use to repair large lengths of failed seams.
   c. Spot welding or seaming (Grind and Weld): A bead of molten extrudate placed on flaw. Use to repair scuffing, dimpling, or other minor, localized flaws. Spot welding shall not be used to repair holes in the geomembrane liner.
   d. Removal and replacement: Remove bad seam and replace with strip of the same geomembrane material welded into place. Use to repair large lengths of failed seams.
   e. Extrusion welding a flap associated with double-tracked fusion welded seams: Repairs of this type shall not be used unless approved by QAC, and only if the flap is a minimum of 1.5 inches

long. Repairs of this type shall not exceed 100 ft (30 m) in length. A patch as described previously shall be placed at one or both ends if located within the active cover area (excluding the anchor trench).

2. For each repair method:
   a. Ensure surfaces are clean, dry, and prepared in accordance with specified seaming process.
   b. Ensure seaming equipment used in repairing procedures meet requirements of this Specification.
   c. Extend patches or caps at least 6 inches (150 mm) beyond edge of defect. The corners of patches shall be rounded with a radius of approximately 6 inches (150 mm). The minimum diameter of any patch repairing a pinhole shall be 12 inches.

I. *Anchor Trench:*

1. The CONTRACTOR shall excavate anchor trenches to lines and grades shown on Permit Drawings prior to geomembrane placement, unless otherwise specified.
2. The CONTRACTOR shall provide anchor trench with slightly rounded corners shall be provided, to avoid sharp bends in geomembrane.
3. The INSTALLER shall provide and use plywood, boards, or other suitable materials, to permit welding machines to weld across, rather than through, anchor trenches.
4. The CONTRACTOR shall dewater the completed anchor trench, to prevent ponding or softening of adjacent soils while trench is open.
5. The CONTRACTOR and INSTALLER shall coordinate operations to minimize time anchor trench remains open and uncovered.
6. The INSTALLER shall provide sufficient temporary ballast, approved by the QAC, to prevent geosynthetics from being pulled or blown from the anchor trench.
7. The CONTRACTOR and INSTALLER shall remove debris related to their respective construction activities, including temporary ballast material, from anchor trench, prior to installation of subsequent materials. The anchor trench shall be cleaned to the satisfaction of the QAC.
8. The CONTRACTOR shall place and compact backfill in the anchor trench as soon as practical after geosynthetic installation is completed. The anchor trench shall be backfilled prior to placing leachate drainage layer material. Refer to specification Section 02222, *Structural/General Fill and Intermediate Cover* for backfilling procedure.

3.4 Field Quality Assurance and Quality Control

A. *Visual Inspection:*

1. The QAC shall examine seam and non-seam areas of geomembrane to identify defects, holes, blisters, nondispersed raw materials, and any sign of contamination by foreign matter.

B. *Trial Seams:*

1. Make trial seams on fragment pieces of geomembrane liner to verify that conditions are adequate for production seaming.
2. Make trial seams for each combination of materials to be welded (i.e., textured/smooth, smooth/smooth, textured/textured). Seamers may only weld those combinations for which they have produced acceptable trial welds. Seamers are not required to produce trial seams for material combinations they will not be welding.
3. Make trial seams at beginning of each seaming period, following restart of welding equipment, upon change of seamers, and at least once every five (5) hours, for each production seaming apparatus used that day.
4. Make trial seams using the same materials and under the under same conditions as production welding.
5. Trial seam sample shall be at least 4-feet (1.2 m) long by 1-foot (0.3 m) wide (after seaming) with seam centered lengthwise.
6. Cut six (6) test specimens from sample, using 1-inch (25 mm) wide die cutter. These specimen locations shall be selected randomly along trial seam sample by GEOSYNTHETIC QAC. Test three (3) specimens in peel and three (3) specimens in shear, using field tensiometer. Samples shall fail in film tear bond (FTB) mode. Trial seams shall meet the following minimum strengths:

TABLE 4
Seam Strength Values for Trial Seams and Destructive Sample Testing

PROPERTY	METHOD	40 MIL TEXTURED LLDPE SPECIFIED VALUE
Shear Strength	ASTM D4437	60 ppi (min)
Peel Adhesion: Fusion Extrusion	 ASTM D4437 ASTM D4437	 50 ppi (min) 48 ppi (min)
For shear tests, sheet shall yield before failure of seam. For peel adhesion, seam separation shall not extend more than 25 percent of seam width into seam. For either test, testing shall be discontinued when sample has visually yielded. Four (4) out of 5 specimens shall meet the, or exceed, the values listed for shear and peel. The 5th specimen may be as low as 80%.		

7. If the specimen fails, the INSTALLER shall attempt to identify the cause of the failure (e.g., mechanical malfunction, dirt in weld). On correction of the deficiency, the seamer shall produce a second trial seam. If the second trial seam fails, the seamer shall not be permitted to weld production seams until deficiencies are corrected and two (2) consecutive successful trial welds are achieved. If mechanical failure is determined to be the cause of the second trial seam failure, the machine shall be removed from service until suitable repairs are made. The seamer shall be required to produce a passing trial seam with the replacement machine.

C. *Non-destructive Seam Testing:*

1. General:
   a. The purpose of non-destructive testing is to check continuity of the seams. It will not provide quantitative information on seam strength.
   b. Non-destructively test field seams over their full length using vacuum test for extrusion seams, air pressure for double-fusion seams, or other DESIGNER approved method. The INSTALLER shall document all non-destructive testing results.
   c. The INSTALLER shall perform non-destructive testing as seaming work progresses.
   d. The QAC shall observe all non-destructive testing on a procedural basis. The QAC shall record all non-destructive testing information at or shortly after the time of testing. The INSTALLER and QAC shall coordinate to ensure that all installation activities are monitored by the QAC in accordance with these Specifications.
2. Vacuum Testing for extrusion seam:
   a. Energize the vacuum pump and reduce tank pressure to approximately 5 pounds per square inch (psig) (10-inches of Hg) (35 kPa) gauge pressure.
   b. Wet a strip of extrusion seam approximately 12-inches by 48-inches (0.3 m by 1.2 m) with soapy solution.
   c. Ensure that the viewing window is clean.
   d. Place the box over wetted area.
   e. Close the bleed valve and open vacuum valve.
   f. Ensure that a leak-tight seal is created.
   g. Apply vacuum and examine the geomembrane through viewing window for presence of soap bubbles that would indicate a continuity leak for a minimum of 10 seconds.
   h. If no bubbles appear within 10 seconds, close vacuum valve and open bleed valve, move box over to next adjoining area with minimum 3-inch (75 mm) overlap and repeat process.
   i. Mark and repair areas where soap bubbles indicate continuity leaks.
3. Air Pressure Testing for dual track, hot wedge fusion weld:
   a. Seal both ends of the seam to be tested. Take suitable precautions if sealing seam ends with open flame.
   b. Insert needle or other approved pressure feed device into air channel created by fusion weld.
   c. Insert a protective cushion between air pump and geomembrane.
   d. Pressurize the air channel too approximately 30-psig (200 kPa). Close the valve and allow the pressure to stabilize for approximately two (2) minutes.
   e. Observe air pressure for an additional five (5) minutes after initial stabilization period ends. If pressure loss exceeds 4-psig or pressure does not stabilize, locate faulty area, repair, and retest.

f. On completion of testing, cut opposite end of tested seam length to verify continuity of air channel. If air does not escape, locate blockage and retest unpressurized area. Repair all cuts and holes created in the air channel.
g. Cap any seam length that cannot be successfully air pressure tested. The cap seam shall then be vacuum tested as required in subsection 2 (Vacuum Testing).
h. Remove needle or other approved pressure feed device and repair hole in geomembrane.

4. Inaccessible Seams:
   a. Cap-strip seams that cannot be nondestructively tested.
   b. Cap-strip material shall be composed of same type and thickness geomembrane as geomembrane to be capped.
   c. Examine cap-stripping operations with QAC for uniformity and completeness. The QAC shall document these observations.

D. *Destructive Seam Testing:*
1. General:
   a. The purpose of destructive seam testing is to evaluate seam strength.
   b. Destructive seam testing shall be performed as seaming progresses.
   c. The destructive seam sample shall fail if the overlap is insufficient for grips of testing machine to close on sample (available flap is 1/2 inch long or less).
2. Location and frequency:
   a. Test at a minimum frequency of one (1) test location per 500 ft (150 m) of welding length performed by each welding machine. This minimum frequency shall be determined as an average taken from the total linear footage of seaming, per machine, at the end of the geomembrane installation.
   b. Test locations shall be determined by the QAC, during seaming operations.
   c. INSTALLER will not be informed in advance of locations where seam samples will be taken.
   d. The DESIGNER or QAC reserves right to increase frequency of testing in accordance with performance results of samples previously tested.
3. Sampling Procedures:
   a. Cut samples at locations selected by QAC.
   b. The QAC shall number each sample and record sample number and location in panel layout drawing.
   c. The QAC shall mark each section of destructive test sample with sample number, seam number, seamer and machine identification, and date.

c. Repair holes in geomembrane resulting from destructive seam sampling as soon as possible, in accordance with repair procedures described in this Section.
d. Non-destructively test repairs in accordance with this Section.

4. Sample Dimensions:
   a. Field Testing: Cut two (2) 1-inch (25 mm) wide sample coupons, from each end of seam section identified by QAC. Distance between these two (2) samples shall be approximately 42-inches (1.1 m). Test both samples in peel mode, using field tensiometer. If both samples meet requirements of Table 4 located in section 3.4, B, item 6, collect sample for laboratory testing.
   b. Laboratory Testing: Collect laboratory test sample from seam length between field test sample coupon locations. Cut sample for laboratory testing, approximately 12-inches (0.3 m) wide by a minimum 42-inches (1.1 m) long, with seam centered lengthwise. Cut this sample into three (3) sections. QAC shall distribute sample sections as follows:
      1) Geosynthetic Quality Assurance Laboratory: minimum 18inch (0.5 m) long section for laboratory testing.
      2) INSTALLER: minimum 12-inch (0.3 m) long section for archive or optional laboratory testing.
      3) OWNER: minimum 12-inch (0.3m) long section for archive storage.
   c. Final determination of sample sizes shall be agreed upon at the geosynthetics kick-off meeting. Sample sizes shall be minimized, consistent with laboratory testing requirements.
   d. Submit laboratory sample for quantitative testing

5. Destructive Test Failure Procedures:
   When a sample fails destructive testing, whether the test is conducted in the field or at the Geosynthetic Quality Assurance Laboratory, the INSTALLER has following options:
   a. Repair the entire seam between two (2) passing destructive test locations along the path of machine producing the failed weld bracketing the failed location.
   b. Trace the welding path 10-feet (3 m) minimum in each direction from failed test, and repeat field testing procedures indicated in this Section at each location. If these additional samples pass testing, then collect laboratory test samples. If these laboratory samples pass testing, repair the seam between these locations. If either, or both, sample fails, repeat process until passing sample is located. If necessary, tracking will extend back to previous days of welding until a passing sample is located. Repair the seam between passing destructive sample locations.
   c. Acceptable repaired seams shall be bound by passing laboratory destructive tests locations. The QAC shall mark and additional destructive test sample for seam cap strip repairs of 100 ft (30 m) or more.

d. If a destructive test sample fails, the DESIGNER may require additional testing of seams welded by same seamer and/or welding apparatus produced during same time shift as failed seam.

E. *Repair Verification:*
1. Repairs shall be non-destructively tested.
2. Nondestructive test results that pass shall indicate adequate repair.
3. Destructive test samples shall be collected on repairs 100-feet long, or greater. Frequency may be increased at the discretion of the CQC.
4. In the event destructive or nondestructive tests of repairs fail to meet the requirements of this Section, the work will be redone, at no expense to the OWNER, until passing test results are achieved.
5. QAC shall monitor and document geomembrane repairs, and non-destructive testing.

F. *Large Wrinkles*: Wrinkles are considered to be large when geomembrane can be folded over onto itself.
1. When seaming of geomembrane is completed, and prior to placing overlying materials, QAC shall identify all large geomembrane wrinkles, to be repaired.
2. Cut and repair all wrinkles identified by QAC. Welds produced while repairing wrinkles shall be nondestructively tested.
3. Repair wrinkles identified by QAC. Repair during coldest part of installation period.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all materials, labor, tools and appurtenances required to complete the precast concrete air release and check valve vaults for the leachate force main trunk lines, as described herein and shown on the Contract Drawings. The CONTRACTOR shall provide a "Competent Person" to implement, supervise, and inspect all work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 Design Requirements

Valve vaults shall be constructed of specified materials to the sizes, shapes, and dimensions shown on the Contract Drawings, or as otherwise approved by the DESIGNER. The height or depth of manholes/drop boxes/vaults will vary with the location.

1.3 Submittals

A. The CONTRACTOR shall submit to the DESIGNER shop drawings and engineering data on precast concrete vaults, manhole frames, covers, and steps.

B. The CONTRACTOR shall submit to the DESIGNER standard (typical) details showing joints and seals between precast riser sections and showing joints between pipes and vault walls.

1.4 Quality Assurance

A. Prior to delivery, all basic materials specified herein shall be tested and inspected by an approved independent commercial testing laboratory or, if approved by the DESIGNER, certified copies of test reports prepared by the manufacturer's testing laboratory will be acceptable. All materials that fail to conform to these Specifications shall be rejected.

B. After delivery to the Site, any materials, which have been damaged in transit or are otherwise unsuitable for use in the Work shall be rejected and removed from the Site, at no additional cost to the OWNER.

PART 2 PRODUCTS

2.1 Materials and Construction

A. *Concrete and Reinforcement*

1. Concrete used in vault, drop box, vault construction shall be Class "A" concrete conforming to the requirements of Section 03300 - Cast-In-Place Concrete of these Specifications.
2. Steel reinforcement shall be epoxy coated and conform to the requirements of Section 03200 - Concrete Reinforcement of these Specifications.

B. *Precast Concrete Vaults*

1. Precast concrete vaults shall consist of precast reinforced concrete sections, a flat slab top section, and a base slab section conforming to the typical vault details shown on the Permit Drawings.
2. Precast vault sections shall be manufactured, tested, and marked in accordance with the latest provisions of ASTM C 478.
3. The minimum 28-day compressive strength of the concrete for all sections shall be 4,000 psi.
4. The maximum allowable absorption of the concrete shall not exceed eight (8) percent of the dry weight.
5. The ends of each reinforced concrete vault riser section and the bottom end of the top section shall be so formed that when the vault risers and the top are assembled, they will make a continuous and uniform vault.
6. Each section of the precast vault shall have not more than two (2) holes for the purpose of handling and laying. These holes shall be tapered and shall be plugged with rubber stoppers or mortar after installation.
7. Steps shall be installed in each section of the vault in accordance with the Permit Drawings.

C. *Frames, Covers, Attachments, and Steps*

1. Frames and covers shall be per Anne Arundel County Standard D-16.

PART 3 EXECUTION

3.1 Placement of Precast Concrete Vaults

A. Prior to placing precast vaults, a minimum 9-inch-thick layer of coarse aggregate shall be placed as bedding. After approval of bedding by the DESIGNER, vaults shall be placed and invert/bottom elevations established and verified.

B. After placing vault base, inverts shall be constructed using Class "A" concrete in accordance with the Permit Drawings, and inverts shall have the same cross section as the invert of the culverts to which they connect. The vault invert shall be carefully formed to the required size and grade by gradual and even changes in sections.

C. After the base section has been set, and inverts formed, the precast vault sections shall be placed thereon, care being exercised to form the incoming and outgoing pipes into the wall of the vault at the required elevations.

D. The manhole cover and frame for the vault shall be set at the required elevation and properly anchored to the masonry.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of furnishing and installing reinforced concrete culvert pipe (RCP) as shown, specified, and as otherwise required by the Contract Documents.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State, or Federal authorities having jurisdiction. The CONTRACTOR shall provide a “Competent Person” to implement, supervise, and inspect the Work.

1.2 Related Sections

A. 02150 – Shoring and Bracing
B. 02220 – Excavation
C. 02223 – Structural/General Fill and Intermediate Cover
D. 02271 – Stone Riprap

1.3 Submittals

A. Submit to the DESIGNER for favorable review, at least 21 calendar days prior to use, Shop Drawings, catalog cuts, and manufacturer’s literature for all pipe and pipe fittings including information on coatings and linings, material specifications, dimensions, tolerances, and all related data. The CONTRACTOR shall furnish the manufacturer’s material certificates for all pipe, fittings, and accessories supplied under this Section demonstrating that the requirements of this Section have been met. No material shall be installed prior to furnishing this required information and receiving favorable review.

1.4 Quality Assurance

A. Pipe installation shall be performed by skilled workers. Each pipe laying crew shall have a pipe laying foreman.
B. Accurately install pipe to the lines and grades shown in the Contract Documents, or as directed by DESIGNER so that inverts are smooth.
C. A full circle shall be visible at the far end, when looking through pipes, unless bends are specified or shown in the Contract Documents.
D. Deflections at joints are not permitted without prior written consent from the DESIGNER.
E. The DESIGNER shall be notified whenever an existing pipeline location or other existing feature conflicts with the proposed locations of the Work.
F. Pipe and fittings of the same type shall be the products of a single manufacturer.

G. All piping shall be of the type and size as shown on the Contract Drawings and as described herein.

1.5 Delivery, Storage, And Handling

A. All pipes and fittings shall be carefully handled when loading and unloading. Lift by hoists or lower on skidways in a manner to avoid shock. Avoid damaging the pipe and its coating or lining if present.
B. Where required, due to weight of material and for the safety and protection of workmen, materials, equipment, property, and the Work, use derricks, ropes, or other suitable equipment for lowering pipe into trenches. Take particular care to avoid damaging the pipes.
C. Store piping and related materials so as to cause the least possible interference with the Work, Site operations, streets, sidewalks, driveways, other thoroughfares, parking areas, delivery areas, and the public in general. Should the OWNER so direct, relocate such material and/or equipment which is creating an interference or inconvenience. Relocate such material or equipment which is obstructing the Site or interfering or obstructing other operations or activities of the OWNER or the DESIGNER.
D. The MANUFACTURER's recommended procedures for pipe stacking shall be followed. When pipes are stacked for storage, the heaviest series of pipe shall be placed at the bottom.
E. If any defective pipes are discovered after being laid or placed, removal and replacement with a sound pipe will be required at the CONTRACTOR's sole expense.

PART 2 PRODUCTS

2.1 Reinforced Concrete Pipe

A. Reinforced concrete pipe shall conform to the requirements of AASHTO M170 for Standard Strength Reinforced Concrete Culvert Pipe for Class V Pipe unless otherwise designated on the plans. All pipes 24 inches in diameter or smaller shall be of the bell-and-spigot type. Pipes larger than 24 inches in diameter shall be tongue and groove or bell and spigot.

2.2 Rubber Ring Gaskets

A. Rubber ring gaskets shall conform to ASTM C443 and shall be tough, flexible, chemical-resistant material, and of such size and shape as to ensure satisfactory pipe joints when incorporated in the Work.

PART 3 EXECUTION

3.1 Inspection

A. Each length of pipe and each fitting shall be carefully inspected prior to lowering into trench. All materials not meeting the requirements of these Specifications, or otherwise found defective or unsatisfactory by the OWNER and/or DESIGNER, shall be rejected and immediately marked and removed from the Site by the CONTRACTOR. The CONTRACTOR shall provide suitable replacement materials, conforming to these Specifications, at no additional cost to the OWNER.

B. Bedding, subgrade, and other trench conditions shall be carefully inspected prior to laying pipe in each stretch of open trench. All conditions shall be made available to the DESIGNER for inspection purposes, and the OWNER and/or DESIGNER shall be further advised where, in the CONTRACTOR's opinion, unstable or otherwise deleterious conditions exist.

C. Each stretch of completed pipeline shall be inspected and the direction of flow and percentage of slope verified by the DESIGNER prior to backfilling. The CONTRACTOR shall provide record survey data certified by a Professional Land Surveyor licensed in the State of New Jersey for favorable review by the DESIGNER for compliance with slope requirements. Backfilling operations shall not be initiated prior to inspection and favorable review of survey data by the OWNER and the DESIGNER.

3.2 Laying Of Pipe

A. The laying of pipe shall begin at the downstream end of the pipeline. The lower segment of the pipe shall be in firm contact with the bedding throughout its full length. Bell or groove ends of pipe shall be placed facing upstream.

B. The pipe bedding shall meet the requirements of structural fill in Section 02223 of these Specifications, and shall be placed to conform to pipe shape.

3.3 Pipe Installation

A. Pipes and fittings shall be carefully lowered into the trench.

B. Pipe and fittings shall be installed so that there will be no deviation at the joints and so that inverts present a smooth surface. Pipe and fittings which do not fit together to form a tight fitting joint are not permitted. RCP shall be joined using flexible watertight rubber gaskets conforming to ASTM C443.

C. Pipes shall be installed in the locations and to the required lines and grades as shown in the Contract Documents, using a method of control which has been favorably reviewed by the DESIGNER. The OWNER and the DESIGNER have the authority to order the removal or relaying of all pipe laid contrary to the Specifications.

D. Excavate, support, and dewater pipe trenches in accordance with Sections 02150, 02220, and 02221 of these Specifications. Excavations shall be maintained free of water during the progress of the Work. All slides or cave-ins of the trenches or cuts shall be remedied to the satisfaction of the OWNER and the DESIGNER.

E. Maintain cleanliness of installed pipe and fittings interiors throughout the work. Plug ends when pipe installation is not in progress. Remove all plugs as required to place pipe into operation. Drainage of construction excavations through new pipes is prohibited.

F. All adjustments to the line and grade of pipe shall be done by scraping away or filling in the bedding under the barrel of the pipe and not by blocking or wedging. Where additional bedding is required, it shall be provided at the CONTRACTOR's sole expense. In all cases, the trench under the joint shall be excavated and suitably shaped to permit an even bearing for the barrel of the pipe. The minimum depth of bedding, as shown in the Contract Documents, shall be maintained at all times.

G. When unsuitable materials or conditions are encountered, excavate below grade until suitable foundation is encountered and the trench backfilled with compacted gravel or crushed stone foundation.

H. Favorable review by the DESIGNER is required prior to changing the location of any of the Work due to field conditions. Changes in pipe sizes are prohibited without prior written consent from the DESIGNER.

I. All installed piping shall form completely connected systems including connections to valves, equipment, structures, existing facilities, and appurtenances specified in other sections to result in a satisfactorily operating installation.

J. Backfill pipes in accordance with Section 02223 of these Specifications.

3.4 <u>Adjust and Clean</u>

A. All sections of piping found defective in material, alignment, grade, joints, or otherwise, shall be corrected to the satisfaction of the OWNER and/or DESIGNER.

B. Leave all the pipes and connections watertight.

C. Upon completion of construction of pipelines and appurtenances, all pipelines shall be thoroughly flushed out with water and all temporary plugs shall be removed. Flushing shall be executed in such manner that dirt or other material will not be discharged into existing watercourses.

***** END OF SECTION *****

PART GENERAL

1.1 Description of Work

A. CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of furnishing and installing High Density Polyethylene (HDPE) piping as shown and specified in the Contract Documents and Contract Drawings.

B. Piping shall be fabricated and installed for operating ranges as follows:
1. Temperature Range: -40°F to 150°F
2. Pressure Range: Full Vacuum to 100 psig

1.2 Related Sections

A. 02233 – Coarse Aggregate
B. 02418 - Geocomposite Drainage Layer

1.3 Submittals

A. Before beginning pipe installation, the CONTRACTOR shall furnish MANUFACTURER's certificates that state that the pipes, valves, fittings, and other materials meet this specification. The CONTRACTOR shall prepare and submit to the QAC MANUFACTURERs' information (catalog cuts and/or shop drawings) for each type of pipe, valve, and fitting to be furnished.

B. Shop drawings shall show plans of the piping system, indicating the type and location of all pipe, fittings, and joints to be used, size and length of pipe, size of valves, and the manner in which piping systems shall be supported. All pipe supports, pipe couplings, and specials shall be clearly shown, indicating size, length, and other necessary dimensions.

C. Shop drawings shall be submitted to the QAC and approved prior to delivery of any material to the site.

D. Prior to beginning pipe installation, the CONTRACTOR shall submit to the QAC for approval a measurement recording form for use during pressure testing.

E. Provide: a 4-inch length of each piping type including cross-section sample of a properly prepared joint; and a 4-inch length of each type of metallic locating tape.

1.4 Quality Assurance

A. MANUFACTURER's: Firms regularly engaged in manufacture of HDPE pipe, tube, and fittings of types and sizes required.

B. CONTRACTOR's personnel installing, inspecting, and testing HDPE shall be certified by pipe MANUFACTURER within one year prior to pipe installation. All necessary training shall be performed by pipe MANUFACTURER's representative, at CONTRACTOR's expense.

C. Pipe shall be accurately routed to the locations shown on the Contract Drawings.

D. Deflections in horizontal alignment at joints are not permitted without the written consent of the QAC. If so approved, the deflections shall not exceed one-half the MANUFACTURER's recommendation.

E. Pipe and fittings of the same type shall be the products of a single MANUFACTURER.

F. Pipe Adapters – Join pipes of different materials with adapters specifically manufactured for that purpose and favorably reviewed by the QAC, or as detailed on the Contract Drawings.

G. All piping shall be of the type and size shown on the Contract Drawings and described in this Section of the Specifications. All underground piping shall be HDPE unless otherwise noted on the Contract Drawings or favorably reviewed by the DESIGNER in writing.

H. Pipe and fittings shall be protected against the damaging ultraviolet rays of the sun when stored for any period. Such protection shall consist of canvas covering, or other material as recommended by the MANUFACTURER. Plastic sheets shall not be used that may allow excessive temperatures to develop where pipe is stored. All pipe, which has been distorted or otherwise negatively affected by high temperatures, shall be rejected, regardless of the pipe's appearance after return to ambient temperatures. Rejected pipe shall be removed from the site of the work at the sole expense of the CONTRACTOR.

I. The MANUFACTURER's recommended procedures for pipe stacking shall be followed. When pipe is stacked for storage, the heaviest series of pipe shall be placed at the bottom.

J. Pipe and fittings shall be protected from damage by sharp objects through all phases of work.

K. If any defective pipe is discovered after being laid or placed, removal and replacement with a sound pipe will be at the sole expense to the CONTRACTOR or the CONTRACTOR's subcontractor.

PART 2 PRODUCTS

2.1 <u>Pipe and Fittings</u>

A. Piping resins shall be high performance, high molecular weight, high density polyethylene conforming to ASTM D1248 (Type III, Class C, Category 5, Grade P34), and ASTM D3350 (Cell Classification PE345434C). The pipe and fittings shall be manufactured from pre-compounded resin manufactured by the pipe MANUFACTURER, with a minimum of two-percent carbon black to withstand outdoor exposure without loss of properties. In plant blending of non-compounded resins is not acceptable. All polyethylene pipes shall meet the requirements of ASTM F714 for SDR 17.0 High Density Polyethylene (HDPE) pipe as shown on the Contract Drawings. Pipe shall be furnished non-perforated, as required by the application. Each pipe length shall be marked with the MANUFACTURER's name or trademark, size, material code, and standard dimension ratio. All fittings shall be molded.

B. The pipe shall contain no recycled compound except that generated in the MANUFACTURER's own plant from resin of the same specification from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes (other than those manufactured), foreign inclusions, or other deleterious defects, and shall be identifiable in color, density, melt index, and other physical properties.

C. The polyethylene pipe MANUFACTURER shall provide certification that stress regression testing has been performed on the specific product. This stress regression testing shall have been done in accordance with ASTM D2837, Class PE3408, and the MANUFACTURER shall provide a product supplying a minimum hydrostatic design basis (HDB) of 1,600 psi at 63.4 degrees F, as determined in accordance with ASTM D2837.

D. Each pipe shall meet the following cell classification standards:

Flexural Modulus:	110,000 to 160,000 psi
Tensile Strength:	3,000 to < 3,500 psi
Environmental Stress Crack Resistance:	Test Condition C Test Duration 192 hours Maximum % Failure = 20
Hydrostatic Design Basis (23°C)	1,600 psi

2.2 Piping Accessories

A. Bolts, nuts and washers: Type 304 or 316 stainless steel, and not smaller than 1/4-inch; bolts shall have hexagonal heads and nuts shall be hexagonal.

B. Fittings that unite dissimilar metals shall be dielectric insulating type.

C. CONTRACTOR shall provide necessary HDPE spacers, as required to provide adequate clearance for the proper installation of the specified valves and equipment.

D. Flanged connections to valves, equipment and other piping materials shall be made with a HDPE stub-end flange adapter and epoxy coated carbon steel backing unless otherwise approved by DESIGNER.

E. Above ground HDPE shall be continuously supported from underneath using a flat piece of steel or uni-strut and be attached to the underneath support at periodic intervals in accordance with the HDPE pipe manufacture's written recommendations.

PART 3 EXECUTION

3.1 Quality Control

A. Each length of pipe and each fitting shall be carefully inspected prior to lowering into trench. All materials not meeting the requirements of these Specifications, or otherwise found defective or unsatisfactory by the QAC, shall be rejected and immediately marked and removed from the job site.

B. Bedding, sub-grade, and other trench conditions shall be carefully inspected prior to laying pipe in each stretch of open trench. All conditions shall be made available to QAC for inspection purposes, and QAC shall be further advised where, in CONTRACTOR's opinion, unstable or otherwise deleterious conditions exist.

C. The piping shall be installed in complete sections from high points to low points.

D. Each stretch of completed pipeline shall be inspected and direction verified prior to backfilling. Backfilling operations shall not be initiated prior to inspection and favorable review by QAC.

E. The CONTRACTOR shall arrange pipe installation, testing, and backfill to minimize the amount of time and length of open trenches. When trenches are to be left open overnight, they should be covered with plywood and plastic sheeting.

3.2 Preparation

A. Pipe and fitting interiors and joint surfaces, shall be thoroughly cleaned prior to installation. Pipe and fittings shall be maintained clean.

3.3 Pipe Installation

A. Pipes and fittings shall be carefully lowered into the trench.

B. Pipe and fittings shall be installed so that there will be no deviation at the joints and so that inverts present a smooth surface. Pipe and fittings which do not fit together to form a tight fitting joint are not permitted.

C. Unless noted on Contract Documents, all HDPE joints shall be butt-fusion welded. Butt-fusion welds shall be performed as follows unless otherwise recommended by the pipe MANUFACTURER:

1. Clean pipe ends inside and outside with a clean rag to remove dirt, water, grease, and other foreign materials.
2. Square cut end of each pipe section with the facing tool of the fusion machine or plastic pipe cutters. Remove cuttings and burrs from pipe ends.
3. Check lineup of pipe ends in the fusion machine to ensure that pipe ends meet squarely and completely over entire surface to be

fused. Proper alignment is necessary to obtain uniform heating of the pipe ends and uniform bead at fused joint.

4. Heater Plate:
   a. Insert the heater plate between the aligned pipe ends. Bring and hold pipe ends in contact with heater plate.
   b. Maintain contact without pressure and allow pipe to heat and soften approximately:
      (1) 1/8 inch back from pipe end for 2-inch pipe.
      (2) 3/16 inch back from pipe end for 3-inch and larger pipe.
   c. Heater thermometer reading shall be between:
      (1) 500°F and 575°F on coated plates.
      (2) 475°F and 500°F on uncoated plates.
   d. Double check heater plate temperature with a tempilstik or pyrometer for correct surface temperature.
   e. Carefully move pipe ends away from heater plate and remove plate.
   f. If softened material sticks to plate, discontinue the joint. Clean heater plate, resquare pipe ends, and start over.
5. Flash Bead:
   a. Bring heated pipe ends together with firm pressure per MANUFACTURER's recommendation to form a uniform upset flash bead approximately 1/8 inch to 3/16 inch wide around entire circumference of pipe.
   b. Bead will have appearance of double upset flash.
   c. Pressure is necessary to cause heater material to flow together, which gives the fusion bead an appearance that is distinctive in appearance to this type of material.
   d. Maintain pressure until the joint cools.
6. Allow joint to cool (until finger can remain comfortably on bead) and solidify until bead feels hard. After joint is cool, remove from lineup clamps.
7. Inspect finger joint for uniform nonporous appearance. Joints should have uniform double bead/squeezeout to indicate the proper temperature of the heating plate was maintained.
8. If joint appears faulty, cut the joint and repeat procedure.

D. Pipes shall be installed in the locations as shown on the Contract Drawings and provided in these Specifications, using a favorably approved method of control. QAC has the authority to order the removal or relaying of all pipe laid contrary to the Specifications.

E. Excavations shall be maintained free of water during the progress of the Work. No pipes shall be laid in water nor shall there be any joints made up in water. All slides or cave-ins of the trenches or cuts shall be remedied to the satisfaction of the QAC.

F. Cleanliness of installed pipe and fitting interiors shall be maintained throughout the Work.

G. All adjustments to the line and grade of pipe shall be done by scraping away or compacted filling of the bedding under the barrel of the pipe, and not by blocking or wedging. The minimum depth of bedding, as shown on the Contract Drawings, shall be maintained at all times.

H. Fittings shall be installed as required and in accordance with the Contract Documents. The installation of fittings after the pipeline has been laid will not be permitted without the favorable review of the DESIGNER.

I. Favorable review by the DESIGNER is required prior to changing the location of any of the Work due to field conditions. Changes in pipe sizes are prohibited without prior consent from the DESIGNER.

J. All installed piping shall form completely connected systems including connections to and appurtenances specified in other sections to result in a satisfactorily operating installation.

K. All pipe shall be so laid that, after the line is completed, the interior surface thereof shall conform accurately to the established grade and alignment. No deflections shall be allowed at joints. Piping shall be laid as specified below:

1. Pipe assembly shall be lowered carefully into prepared trench.
2. Line shall not be dropped or subjected to jarring, impact, or unnecessary strain.
3. Sections not carefully lowered in place shall be raised and reinspected. Damaged sections shall be replaced at the sole expense to the CONTRACTOR.
4. Excess stress or strain conditions shall be avoided during installation.
5. Pipe being pulled for placement shall not exceed 500 feet in length.
6. Maximum pulling force that can be applied to a pipe can be estimated by multiplying the maximum allowable stress by the cross sectional area of pipe. Pipe shall not be pulled by flanged end.

L. Minimum pipe lengths of 20 feet (up to maximum pipe lengths of 40 feet) shall be utilized, except that shorter random lengths may be utilized where wyes and tees are present so that the connection can be made. The number of pipe joints shall be minimized. CONTRACTOR shall provide proper smooth and square ends prior to assembling.

M. All below grade pipe shall be buried a minimum of 36 inches below grade in carefully prepared and backfilled trenches in accordance with Contract Drawings.

N. Where the header pipe passes beneath roadways and driveways precautions such as a steel protective sleeve or sufficient pipe wall selections shall be taken to protect the pipe from crushing.

O. Maintain the specified depth and compaction of the embedment materials as shown on the Contract Drawings and as specified below:
   1. Trench/bed width shall be as shown on the Contract Drawings.
   2. Unstable trench wall or bottom shall be corrected in accordance with ASTM D2321.
   3. Bedding:
      a. Clean materials surrounding the forcemain pipes shall be free of rock, stones, and other debris that may cut, scrape, tear or rip the HDPE pipe during installation and operation.
      b. Prior to installation, bedding shall be graded and hand tamped along the entire length of pipe to be installed.
      c. Bedding material shall be a minimum of 6 inches of sand.
   4. Pipe Zone:
      a. Pipe zone shall be filled with sand as shown on the Contract Drawings.
      b. Pipe zone includes an area below pipe to 6 inches above the pipe and between pipes and side walls of trench or other pipes.
      c. Soil in pipe zone may be stabilized with cement-sand mix.
      d. A minimum of 6-inches of clean material must separate adjacent pipes at all times.
   5. Trench backfill shall meet the criteria specified in the Contract Documents and be favorably reviewed by the QAC.

P. Bends
   1. Joints shall not be located in pipe bends.
   2. The radius of the inner curve of such bend shall not be less than 25 times the inside diameter of the pipe.

Q. Thrust Blocking:
   1. If the HDPE pipe MANUFACTURER's engineering evaluation of soil conditions and design of installation determines thrust blocks are required, then thrust blocks shall be provided at branch connections (tees) and at changes in directions (elbows) as required to prevent movement.
   2. Thrust blocking shall be via concrete bearing surfaces set in soil. Pipes shall not be encased in concrete.
   3. Details of thrust blocking for each line size shall be furnished by HDPE pipe MANUFACTURER. Details shall be subject to favorable review by the OWNER.
   4. Thrust blocks shall not be required if heavy wall fittings (SDR 9) are used for mitre bends 12 inches in diameter and larger.

R. Tests

1. Subsequent to the laying of pipe and placing sufficient backfill between the joints to support and prevent movement of the installation, all newly laid pipe or any valved section thereof shall be subjected to testing as specified in the Section 01666.
2. All exposed pipe, fittings, valves, and joints shall be carefully examined during the open trench test. Any damaged or defective pipe, fittings or valves revealed during the pressure test shall be removed and replaced, by CONTRACTOR, at his expense, with sound material, in the manner previously specified, and the test shall be repeated until satisfactory to QAC.
3. The CONTRACTOR shall be furnished a written report of the results of the leakage test that identifies the specific length of pipe tested, the pressure, the duration of the test, and the results. The report shall be signed by CONTRACTOR. QAC will witness all leakage tests.
4. Remedy of Leaks
   a. If any test of pipe laid discloses leakage, locate and repair (or replace if pipe or fittings are defective) the defective joints until the leakage is within the allowable tolerance.
   b. All leaks are to be repaired regardless of the amount of leakage.

*****END OF SECTION*****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of the installation of the leachate collection system (LCS) as shown, specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State, or Federal authorities having jurisdiction.

1. 2 References

A. American Society for Testing and Materials (ASTM):

1. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

1.3 Submittals

The CONTRACTOR shall submit manufacturer's data sheets, and certification of compliance with specifications for all pipes, fittings and appurtenances, and leak testing requirements per Section 01300 - Submittals, of these Specifications.

PART 2 PRODUCT

2.1 Materials

A Perforated Pump Carrier Pipe – shall be perforated, High Density Polyethylene (HDPE) SDR 17. The pipe sizes, as well as the size and configuration of the perforations are specified in the Permit Drawings.

B Solid Wall Pump Carrier Pipe – shall be solid High Density Polyethylene (HDPE) SDR 17. The pipe sizes are specified in the Permit Drawings.

C Double Wall Force Main – shall be 6-inch solid High Density Polyethylene (HDPE) SDR 11 pipe inside of 10-inch High Density Polyethylene (HDPE) SDR 17 pipe.

D Geotextile – Nonwoven, 16 oz/yd^2 filter geotextile (See Geotextile Specification Section 02595.)

E Geocomposite – shall meet the requirements of Geocomposite specification 02418.

F Drain Rock – envelope of stone around the leachate collection laterals and headers shall be USCS Classification GW or GP and consist of No. 57 stone, washed gravel and shall have a hydraulic conductivity of not less than 1.0 x 10^{-2} cm/sec, and carbonate content <15%.

G Pumps, Motors, Fittings, and Flexible Hose - See Leachate Side Slope Pump System specification section 02652.

2.2 Delivery, Storage, and Handling

A All pipes and fittings shall be carefully handled when loading and unloading. Lift by hoists or lower on skid ways in a manner to avoid shock.

B Where required, due to weight of material and for the safety and protection of workmen, materials, equipment, property, and the work, use derricks, ropes, or other suitable equipment for lowering pipe into trenches. Take particular care to avoid damaging the pipe.

C Pipe and fittings shall be protected against ultraviolet light damage during storage. Such protection shall consist of canvas covering, or other material as recommended by the manufacturer. Covering which may allow excessive temperatures to develop where pipe is stored shall not be used. All pipes that have been distorted or otherwise negatively affected by high temperatures shall be rejected, regardless of the pipe's appearance after return to ambient temperatures. Rejected pipe shall be marked by the QAC and removed from the Site at the sole expense of the CONTRACTOR.

D The manufacturer's recommended procedures for pipe stacking shall be followed. When pipe is stacked for storage, the heaviest series of pipe shall be placed at the bottom.

E Pipe and fittings shall be protected from damage by sharp objects through all phases of work.

F If any defective pipe is discovered after being laid or placed, removal and replacement with a sound pipe will be required, without cost to the OWNER.

PART 3 INSTALLATION

3.1 General

A Pipe installation shall be performed by skilled workers. Each pipe laying crew shall have an experienced pipe foreman.

B Pipe shall be accurately installed to the lines and grades shown on the Permit Drawings, or as approved by the Quality Assurance Contractor (QAC), so that inverts are smooth.

C The DESIGNER shall be notified in advance whenever an existing pipeline location conflicts with the proposed locations of the Work.

D Pipe Adaptors - Join pipes of different materials with adaptors specifically manufactured for that purpose and as approved by the DESIGNER, or as detailed on the Construction Plans.

E All piping shall be of the type and size as shown on the Permit Drawings and described in this Section of the Specifications.

F Each length of pipe and each fitting shall be carefully inspected prior to placement. All materials not meeting the requirements of these Specifications, or otherwise found defective or unsatisfactory by the QAC, shall be rejected and immediately marked and removed from the job site by the CONTRACTOR.

G Bedding, sub-bedding, and other trench conditions shall be carefully inspected prior to laying pipe in each reach of open trench. All conditions shall be made available to the QAC for inspection purposes, and the QAC shall be further advised where, in the CONTRACTOR's opinion, unstable or otherwise deleterious conditions exist.

H Each reach of completed pipeline shall be inspected prior to backfilling. Backfilling operations shall not be initiated prior to inspection and acceptance by the QAC.

I All HDPE pipe segments shall be attached by butt-fusion welding or electro-fusion fittings.

J Pipe and fitting interiors and joint surfaces, shall be thoroughly cleaned prior to installation. Pipe and fittings shall be maintained clean.

K Pipes shall be installed in the locations and to the required lines and grades as shown on the Permit Drawings and provided in these Specifications, using an approved method of control. The DESIGNER has the authority to order the removal or relaying of all pipe laid contrary to the specifications, his instructions, or during his absence.

L Excavations shall be maintained free of water during the progress of the Work. No pipes shall be laid in water nor shall there be any joints made up in water. All slides or cave-ins of the trenches or cuts shall be remedied to the satisfaction of the DESIGNER.

M Cleanliness of installed pipe and fitting interiors shall be maintained throughout the Work.

N All adjustments to the line and grade of pipe shall be done by scraping away or compacted filling of the bedding stone under the barrel of the pipe, and not by blocking or wedging.

O Approval by the DESIGNER is required prior to changing the location of any of the Work due to field conditions. Changes in pipe sizes are prohibited without prior written consent from the DESIGNER.

P All pipe ends within the cell not terminated by another specific fitting shall have an end cap of the same material fusion welded to the pipe. All pipe end outside the cell not terminated by another specific fitting shall be covered with a slip cap. Slip caps shall not be bonded to the pipe unless otherwise specifically noted on the Permit Drawings.

3.2 <u>Cushion Geotextile</u>

A Cushion geotextile shall be placed as shown on Permit Drawings and as specified in Geotextiles section 02595.

B Cushion geotextile seams shall be sewn with an interlocking stitch as specified in Geotextiles section 02595.

3.3 <u>Geocomposite Drainage Layer</u>

A GDL shall be placed as shown on Permit Drawings and as specified in GDL specification 02418.

B GDL seams shall be sewn with an interlocking stitch as specified in GDL specification 02418.

3.4 Perforated and Solid Wall Pump Carrier Pipe

A Perforated and solid wall pump transfer pipe in the bottom of the sumps shall be placed directly on 1-ince thick, 2-foot wide HDPE flat stock as shown in the Permit Drawings. The HDPE flat stock shall be placed directly on the cushion geotextile and/or geocomposite.

B The perforated and solid wall pump transfer pipes shall be joined as specified in 3.1, I of this Section.

C A temporary anchor system capable of holding the pipe in place shall be employed until sufficient coarse aggregate in the sump and soil backfill on the side slope has been placed.

3.5 Drain Rock

A Drain rock and filter geotextile shall be placed over and around the perforated pipe comprising the leachate collection laterals and headers in the cells to the depths specified in the Permit Drawings.

B Drain rock shall be place in a manner so as not to damage the underlying geomembrane, geocomposite, or geotextile (see HDPE Geomembrane section 02597, Geocomposite Drainage Layer section 02418, Geotextile section 02595, , Leachate Collection Layer section 02232).

3.6 Double Wall Force Main

A The double wall force main pipe shall be placed to the lines and grades shown on the Permit Drawings.

B The double wall force main pipe shall be installed in excavation detailed in the Contract Drawings, and backfilled in accordance with specification 02223.

C Both the internal and external pipes of the dual containment conveyance pipe shall be air pressure or hydrostatically tested to 20 psi for 1 hour. The QAC shall be present during pressure testing. Prior to the installation of the solid-walled polyethylene piping, the CONTRACTOR shall perform a pressure test using the following procedures:

1 Similar sizes of polyethylene piping shall be butt welded together into testing segments not to exceed 2,000 feet (600 m). Segments shall be fitted with a cap on one end and testing apparatus on the other.

2 The segment to be tested should be laid on the ground surface and allowed time to reach constant and/or ambient temperature before initiating the test.

3 The test should be performed during a period when the pipe segment will be out of direct sunlight when possible, i.e., early morning, late evening, or cloudy days. This will minimize the pressure changes that will occur during temperature fluctuations.

4 The CONTRACTOR shall submit verification and results of gauge calibration prior to (no more than 60 days) and after completion of project.

5 The allowable pressure drop observed during the test shall not exceed 1 percent of the testing gauge pressure over a period of 1 hour. This pressure drop shall be corrected for temperature changes before determining pass or failure.

6 The equipment for this testing procedure will be furnished by the CONTRACTOR. This shall consist of a polyethylene flange adaptor with a PVC blind flange equal in size to the blower inlet valve. Tapped and threaded into the blind flange will be a temperature gauge 32°F to 2l2°F (0 to 100°C), a pressure gauge 0 to 20 psi (0 to 1 kg/cm^2), a "tire valve" to facilitate an air compressor hose, and a ball valve to release pipe pressure at completion of test. Polyethylene reducers shall be utilized to adapt test flange to size of pipe being tested.

D The following steps shall be performed when a pipe segment fails the 1 percent - 1-hour test:

1 The pipe and all fusions shall be inspected for cracks, pinholes or perforations.

2 All blocked risers and capped ends shall be inspected for leaks.

3 Leaks shall be verified by applying a soapy water solution and observing soap bubble formation.

4 All pipe and fused joint leaks shall be repaired by cutting out the leaking area and re-fusing the pipe.

5 After all leaks are repaired, a retest shall be performed.

PART 4 SURVEYING

A All surveying shall be performed by a land surveyor licensed in the state of Maryland.

B The force main pipes shall be surveyed at a minimum of 50-foot intervals to verify proper fall.

C All pipe inverts, outlets and fittings (i.e., wyes, reducers, and adapters) associated with the leachate collection system and the conveyance pipe, including manholes, shall be surveyed.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall provide all labor, materials, and equipment to install the following:
   1. Pump, complete with specified accessories.
   2. Control panel, mounting, necessary conduits and controls.
   3. All related electrical works, including wire and conduit, necessary to provide power to the pump control panel.
   4. All related mechanical components, including hose, valves, and fittings necessary to provide a connection from the pump to the leachate force main.
   5. Test and demonstrate operation of system.
   6. Submit operation and maintenance manuals, and warranties.

B. The leachate side slope pump system shall consist of pump, hose, controls, valves, fittings, and related electrical and mechanical works necessary to pump the side slope riser (riser provided by others) to the leachate force main. The pumping system shall be of material and construction to be compatible with the material (leachate) to be pumped. This Specification and the Drawings detail the requirements for the construction of the leachate sump pump system. The leachate side slope pump and controls shall be compatible with the system constructed for each cell.

1.2 Submittals

A. *Pumps and Motors:*
The CONTRACTOR shall submit product data for the pump and motor to the QAC, as specified in Part 2.0 and as shown on the Drawings. Pump data shall include, but is not limited to, characteristic curves, dimensional drawings, and materials of construction for all wetted parts, mechanical seals, packings, and shafts. Pump curves shall indicate efficiency, horsepower, proposed number of impeller stages, and electrical characteristics of the motor. The motor data shall include, but is not limited to, motor manufacturer, motor horsepower, rated speed, service factors, voltage, maximum amperage draw, and phase.

B. *Control Panel:*
The CONTRACTOR shall submit detailed panel layout and electrical diagrams showing the panel enclosure, panel face, and wiring diagrams to the QAC for approval. The CONTRACTOR shall also submit product data for transformers, relay modules, motor controllers and starters, circuit breakers, level switches and related controls, receptacles and devices, and other items as specified in Part 2.0, and as shown on the Drawings.

C. *Piping and Related Works:*
The CONTRACTOR shall submit to the QAC product data for all hose, piping, fittings, valves, check valves, and other piping related materials as specified in Part 2.0, and as shown on the Drawings. The product data shall include, but not limited to, materials of construction, pressure ratings, flow ratings, and physical dimensions.

D. *Electrical Works:*
The CONTRACTOR shall submit to the QAC product data for all wire, conduit, breakers, explosion proof fittings, sealing compounds, and other materials as specified in Part 2.0 and as shown on the Drawings

E. *Operation and Maintenance Data:*
The CONTRACTOR shall provide three (3) sets of operation and maintenance (O&M) manuals for the leachate sump pumping system. The O&M manuals shall include at a minimum, all drawings, equipment lists (with manufacturer's name and model number), equipment manuals, recommended spare parts inventory, detailed description of controls sequence of operation, and troubleshooting guide.

1.3 <u>Codes and Regulations</u>

A. Comply with the latest editions of following works, including all supplements thereto and any other authority having jurisdiction within requirements of this specification.
1. Local Codes
2. National Electrical Code, as amended (NFPA No. 70, 71, 72, 72C)
3. Occupational Safety and Health Administration (O.S.H.A.)
4. BOCA Code
5. ASME and ASTM Standard for Materials of Construction.

B. In the event the Drawings or Specification require materials, workmanship, arrangement or construction of higher standard or larger size than is required by codes and regulations, the Drawings and Specifications shall take precedence.

C. Except as described in 1.3.B, should there be direct conflict between above-mentioned regulations and Drawings or Specifications, regulations shall govern.

D. All electrical materials and equipment shall bear the label of Underwriters Laboratories' listed by them in their list of electrical fittings; and approved by them for which they are to be used, unless material and equipment is of type for which Underwriter's Laboratories do not list or provide label.

1.4 <u>Quality Assurance</u>

The CONTRACTOR shall provide a one (1) year warranty on all products.

PART 2 PRODUCTS

2.1 General

A. These Specifications provide an outline of the general requirements for the Work. The CONTRACTOR shall submit to the QAC for approval all necessary product data for the material proposed, for the construction and installation of the leachate Pumping System as described, and as shown on the Drawings.

2.2 Pump and Motor

A. *Pump Models.* The CONTRACTOR shall furnish and install one (1) submersible, pump and motor, suitable for side slope riser installation, capable of delivering the flow rate at the specified total head in Table 1 below. Submersible electric motor shall be suitable for operating on 3-Phase, 460 Volt, 60 Hz service with 100-feet of power cable. CONTRACTOR shall also provide one spare pump and motor of same model described here.

TABLE 1 – LEACHATE SUMP PUMPS

Cell or Sub-cell	Total Head (feet)	Selected Pump EPG Models	Cell or Sub-cell	Total Head (feet)	Selected Pump EPG Models
1	108.9	Model 18-4 HP 5.0	7	107.1	Model 18-3 HP 5.0
2	50.2	Model 18-2 HP 3.0	8	99.1	Model 18-3 HP 5.0
3	35.2	Model 18-1 HP 1.5	9	97.1	Model 18-2 HP 3.0
4	35.3	Model 18-1 HP 1.5	10	107.8	Model 18-3 HP 5.0
5A	93.4	Model 18-1 HP 1.5	11	59.2	Model 18-2 HP 3.0
5B	89.2	Model 18-2 HP 3.0	12	59.3	Model 18-2 HP 3.0
5C	89.4	Model 18-2 HP 3.0	13	55.2	Model 18-1 HP 1.5
5D	87.2	Model 18-2 HP 3.0	14	53.2	Model 18-1 HP 1.5
5E	89.3	Model 18-2 HP 3.0	15	51.5	Model 18-2 HP 3.0
5F	87.1	Model 18-3 HP 5.0	16	51.2	Model 18-1 HP 1.5
6	101.3	Model 18-3 HP 5.0			

B. Each unit shall be fitted with 100-feet (minimum), more as needed, of stainless steel lifting cable of sufficient strength to permit the removal of the unit.

C. Design Parameter:

1. The pump shall be capable of pumping leachate.
2. The pump shall permit the unit to operate on a slope of three (3) feet horizontal to one (1) foot vertical.

3. The pump shall be able to "pump down" to within 1.0 vertical foot of the sump bottom without any loss in performance or damage to the pump.
4. Pump unit, including guide wheels shall not exceed 15.5-inches in diameter.

D. *Materials of Construction:*

1. Major components shall be manufactured of 304 stainless steel, seal rings shall be made of Teflon. All fasteners shall be 304 stainless steel.

E. *Check Valve:*

1. Each unit shall include an integral check valve. The check valve housing and disc shall be constructed of 304 stainless steel and the check valve seat shall be constructed of Teflon.

F. *Shaft*:

1. The pump shaft shall be constructed of 304 stainless steel and rotate on product lubricated bearings.

H. *Diffuser Chamber:*

1. Diffuser chamber for each impeller shall be constructed of 304 stainless steel and fitted with Teflon impeller seal rings.

I. *Impeller*:

1. The impeller shall be a closed design and constructed of 304 stainless steel.

J. *Motor*:

1. The motor shall be a submersible, hermetically sealed motor manufactured by Franklin Electric, or approved equivalent. The motor shall be designed for continuous duty, capable of sustaining up to 300 starts per day. The motor shall be connected to the pump via a motor adapter and coupling in 304 stainless steel. The motor shall have thermal protection in the motor windings to protect the windings from overload. The unit will restart automatically after the motor cools down.

K. *Motor Lead Wire*:

1. The lead wire shall contain no splices, be Teflon coated, and be of the length specified previously. The motor leads shall be a minimum copper wire size of AWG #10.

L. *Cathodic Protection*:

1. Pumps shall be provided with a replaceable cathodic protection system.

2.3 Controls Panels and Controls

A. Complete automatic pump control system shall be furnished by the pump manufacturer or certified representative and installed near the top of the side slope riser by the CONTRACTOR as shown on the Drawings and specified herein. The control system shall consist of a pump control panel for housing the controls for the side slope riser pump over a range of 0 to 12.5 feet of leachate depth. The CONTRACTOR shall provide all materials for mounting and wiring the pump control panel.

B. Level Control System:

1. The level control system shall be a point measurement system using a level sensor transducer. Level sensor shall be a fully submersible pressure transmitter.
2. The level sensor shall be 316 stainless steel, compatible with leachate, mounted on the pump carriage.
3. The system shall be easy to maintain and not require recalibration or specialty equipment to maintain.
4. The cable shall be severe duty rated, oil and water resistant, jacketed for submergence in leachate
5. Chemical resistant atmospheric pressure compensating vent tube. The level transducer shall be equipped with 75-feet of continuous, without splices, control cable.
6. Range: 0 – 15 Feet W.C. (0-7 PSIG).
7. Accuracy: 1.25% of operating range.
8. Manufacturer: EPG Level Master, or approved equivalent.

C. Control Panel:

1. The pump controls and electrical equipment shall be housed in a NEMA 4X enclosure. The enclosure shall be equipped with an inner door, stainless steel drip shield, and lock. Two milled keys shall be furnished with each lock. All indicating lights, switches, and indicators shall be mounted on the inner door. The enclosure shall be sized and assembled to provide 20% free space for future controls relays and wires. All components shall be clearly identified by suitable name plates.
2. Control panel shall designed for 3-phase; 460 volts; 60 hertz with conductors sized to accommodate the pump motor and auxiliary usage. Phase monitor lighting and surge suppression shall be installed on all incoming power lines to protect the control panel equipment. The control panel shall be equipped with a main disconnect and fuses/circuit breakers to de-energize the complete control panel, including controls. The control panel enclosure shall be designed to allow access to indicating lights, breakers, receptacles and meter without de-energizing the control panel. The control panel shall include separate auxiliary circuit breakers for pump, alarm and control circuits, GFCI receptacle and space for one (1) future 120 volt breaker.

3. Controls - The pump shall be operated by a HOA selector switch and related controls. The controls shall include a “soft start” motor starter with overload relays with ambient compensated, quick trip characteristics with manual reset and shall be sized for the motor being used. Each starter shall have a minimum of two auxiliary contacts. Panel shall include an anticondensation heater. The panel shall include all necessary relays, low voltage power supplies, transformers and interlocks required for operation of the system as described above.

   The control panel shall include an intrinsically safe level control system to start and stop the leachate pump as required and for high level alarm indication or pump seal failure. The level control system shall maintain the leachate level in the bottom of the side slope riser at below 24 inches.

4. Lights/Indicators
   The control panel shall include:
   a) Pump “running” light;
   b) Pump “fault” light;
   c) Pump “leakage” light;

   d) Leachate level indicator;
   e) Resettable elapsed pump run time meter;
   f) NEMA 4 amber flashing alarm light mounted on top of the control panel (100 Watts) shall illuminate on “High Leachate Level”.
   g) Audio alarm for “High Leachate Level”

2.4 Electrical Works

A. The CONTRACTOR shall provide electric service to the pump panels from the existing service panels by means of underground conduit, cables and connections.
B. The CONTRACTOR shall provide all conduit, cables, enclosures and terminations as shown on the contract documents or as required in this specification.

C. Wire
   a) All wiring with the exception of motor lead wires of the submersible pump, shall be Type THWN copper wire having 600 volt insulation. Wiring for light or power shall be not smaller than #12 AWG. The main electrical service shall be sized as appropriate. Aluminum wire shall not be allowed. All main feeders and branch circuits shall be color coded as required by Code. Wire shall be as manufactured by Phelps-Dodge, General Cable, Triangle, Crescent Insulated Wire and Cable Company or Essex Wire & Cable Co. Wire to the pumps and level controls shall be submersible as provided by the pump manufacturer.

b) Properly identify and tag all mains, feeders, and branch circuits in all pull boxes, gutters, troughs, junction boxes, etc., in which they connect. Similarly, identify and tag wires where two or more circuits run to or pass through the same outlet or junction box.

c) On all circuit wiring, allow sufficient slack at splices and outlets to permit connections without straining, generally not less than 6" of slack in junction or outlet boxes and 10" in ducts, troughs or pull boxes. Joints and splices shall only be made in pull boxes, junction boxes and outlet boxes in a mechanically and electrically secure manner using only approved solderless connectors, lugs, etc., as approved by Code.

d) Grounding and bonding shall be in accordance with the NEC and with the requirements of the local Utility Company. All exposed non-current carrying metallic parts of the electrical equipment, and neutral conductor of wiring systems shall be grounded. All grounding conductors shall be of copper. The CONTRACTOR shall provide test results that demonstrate that the resistance to ground for the grounding system is not more than 15 ohms.

D. Conduit

a) Rigid nonmetallic conduit, PVC Schedule 40, may be used underground and under slabs. All PVC conduit passing under roadways shall be Schedule 80. All exposed conduit and upturn elbows and conduit passing through the ground or masonry shall be rigid galvanized steel conduit. Exposed conduit fittings shall be hot-dip galvanized malleable iron fittings, for elbows, unions, and switch boxes; type FS or FD, manufactured by Appleton or Crouse-Hinds. When entering boxes, fittings or cabinets the fittings shall be double-lock-nut-and-bush except at threaded hubs. All conduit, fittings, connections, etc. shall be water tight. Bushings larger than 1" shall be insulating type with plastic, fiber, or bakelite insulating rings molded into hot-dip galvanized malleable iron threaded bushings. All conduit and fittings from the pump control panel down to the pumping area shall conform to Class 1, Division I standards with explosion proof seal off fittings for conduit entrance into the control panels. Conduit size shall be as shown on the contract documents and at a minimum 3/4" in diameter.

b) Where required for proper execution of work, provide all junction and/or pull boxes, each of proper size, gauge and type for location and use, complete with screw covers of size convenient and adequate for proper installation of required number of cable or wires; to conform with code requirements.

PART 3 EXECUTION

A. All installation procedures for the specified pumping system component including but not limited to pumps, couplings, flow meters, valves, controls, and electrical equipment shall be installed per manufacturer's recommendations and instructions.

B. The CONTRACTOR shall utilize a licensed electrician to make all electrical power and control wiring connections between all new and existing electrical distribution equipment, control panels and equipment as specified in this specification and as shown on the Drawings. All power and control conduit runs between control panels and the pumps and level controls located in the Side Slope Riser shall include seal fittings for hazardous locations. The seal fittings shall be properly installed and sealed in accordance with relevant electrical codes for a Class 1, Division I location to prevent the migration of landfill gas (methane) into the Control Panels. These wiring connections shall utilize explosion proof junction boxes or other equipment as required and shall be located to allow disconnection and removal of the pump and level control equipment without entering the Side Slope Riser.

C. Upon completion of the installation, the CONTRACTOR shall test all circuits, control systems and devices, including all condition signals, in the Presence of the OWNER's Representative. All apparatus shall be cleaned, adjusted and made ready for operation after testing. The CONTRACTOR shall make such changes in wiring or connections and such adjustments, repairs or replacements as are necessary to make the circuits, device or control system to function as specified and otherwise comply with the specifications or data on Drawings. The CONTRACTOR shall supply all necessary material labor and equipment for these tests. The pump shall be tested in the presence of the OWNER's Representative to insure that the pumps are adjusted and in proper running order and that said pumps will meet the rated capacities specified. The field test shall include pumping at least three cycles at normal starting levels to check the operation of the pump. Pump tests shall include plotting of pump curve based on field data for each pump. Points on pump curve shall include shutoff head and three (3) other points. During pump testing, inspections shall be performed m the presence of the OWNER's Representative to insure free passage of liquid into the force main. Any problems shall be promptly repaired at the CONTRACTOR's expense.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish and install two leachate storage facilities as shown on the Contract Drawings and described herein. Each leachate storage facility shall consist of, but not be limited to the following:
   1. Two 500,000 gallon leachate storage tanks.
   2. Secondary containment area shall be concrete floor and walls as specified in the Contract Drawings.
   3. Loadout pad for tanker trucks that pump leachate from the storage tanks shall be provided on the leachate facility access roads shown on Permit Drawings.
   4. Master Pump Control Panel in site entrance maintenance building area (see Contract Drawings for depiction of site entrances).
   5. Pipe and pipe fittings, including bends, tees, check valves, shut-off valves and all other pipe appurtenances, as required.
   6. All related electrical work and accessories.

B. Master Pump Control Panel shall be provided by the manufacturer of submersible pumps in cell sumps.

1.2 System Operation

A. Submersible Pumps in Cell Sumps
   1. Submersible pumps are equipped with level sensors to measure the depth of leachate in each cell sump.
   2. When the leachate depth reaches 12 inches above the bottom of the sumps, the submersible pump will automatically be activated.
   3. When the leachate level reaches a depth of 6 inches above the bottom of cell sump, the pump will automatically shut off.
   4. If leachate reaches 16-inches above the bottom of the cell sumps, a red alarm light shall be activated, and the system will trigger an auto-dialer to alert a landfill on-call employee.

B. Leachate Storage Tanks
   1. Leachate storage tanks will be equipped with a float system to monitor the liquid level in each tank.
   2. When the level in a tank with an overflow pipe connection to a full tank reaches the depth at the top of the overflow pipe, a red alarm light will be activated, submersible pumps will automatically shut off, and an auto-dialer will alert a landfill on-call employee.
   3. The landfill manager shall be apprised and shall assess the actions needed to assure adequate containment of the leachate, and implement such actions.

C. *Secondary Containment Area*
1. If leachate spills into the secondary containment area, the leachate must be removed and property stored. The containment area must then be cleaned by pressure washing. The wash water must be pumped to a leachate storage tank.
2. Clean precipitation that accumulates within the secondary containment area shall be pumped to an adjacent perimeter ditch.

D. *Leachate Storage Facility Access Road*
1. A tanker truck loadout pad and appurtenant pumping equipment is provided via leachate storage facility access roads.
2. A landfill staff member shall select the leachate tank to be pumped at the master pump control panel, where opening of piping valves required to pump the tank is activated.
3. Once the tanker truck is filled, the piping valves shall be closed at the master pump control panel.

1.3 <u>Submittals</u>

A. *Shop Drawings*
Submit the following Shop Drawing information to the DESIGNER for approval, prior to fabrication.
1. Leachate Storage Facilities
   a. The CONTRACTOR shall submit detailed drawings showing Leachate Storage Facility layout. Detailed layout shall include leachate storage tanks, secondary containment areas, and all appurtenances required to operate the leachate storage system.
   b. Submit Tank Manufacturer's Literature, including but not limited to:
      i. Tank Construction Drawings
      ii. Tank Construction Specifications
2. Master Pump Control Panel
   a. The CONTRACTOR shall submit a detailed panel layout and electrical diagrams showing the panel enclosure, panel face and wiring diagrams to the DESIGNER for approval prior to fabrication. Detailed wiring diagrams shall show point-to-point wiring information, including wire and terminal numbering system. Field connections shall be clearly denoted. Submit detailed layout of panel face and internals. Detailed layout shall indicate the location of each control and electrical component, including relays, transformers, panel displays, controllers, breakers, and other required items.
   b. Submit supplier's product data for all controls and electrical components including:
      i. Panel displays.
      ii. Relays.
      iii Power conditioners.

iv. Control power transformers.
v. Panel heaters.
vi. Circuit breakers.
vii. Switches, push buttons, lights, etc.
viii Panel Enclosures
ix. Other electrical components as specified in Section 16050.

3. Piping and Valves
Submit supplier's product data including:
a. Ball valves, check valves, electric actuators.
b. Piping, tees, all fittings.

B. *Submit in accordance with Section 01300.*

PART 2 PRODUCTS

2.1 Leachate Storage Tanks

Leachate Storage Tanks shall be 45-foot diameter, 47-foot height glass coated, bolted steel tanks, manufactured by Aquastore., or similar. Refer to Technical specification Section 13211.

2.2 Master Pump Control Panel

Master Pump Control Panel shall be provided by the manufacturer of submersible pumps in cell sumps.

PART 3 INSTALLATION

3.01 General

A All installation for leachate storage tanks, pumps, valves, controls, pipe, and electrical equipment shall be per manufacturer's recommendations.

B. Install pipe, fittings, and all appurtenances in accordance with recognized industry practices achieving permanently leak-proof piping systems, capable of performing each indicated service without piping failure. All joints shall be installed in accordance with the following:

i. Welds shall be sound and free from embedded scale of slag, have tensile strength across weld not less than that of thinner of connected sections, and be watertight.
ii. Use butt-welds for welded joints in the pipe assemblies and fabrication of bends and other specials.
iii.. Use filled welds for flange attachment, in accordance with AWWA C207.

iv. Conform field welding of joints and preparation of pipe ends to AWWA C206 and ASTM A139.

C. The CONTRACTOR shall make all electrical power and control wiring connections between all new and existing electrical distribution equipment, control panels, and equipment. All work shall be performed in accordance with all applicable Codes and Regulations. The CONTRACTOR shall schedule all required inspections, and obtain all required permits.

D. All piping shall be pressure tested in accordance with Section 02650.

E. Upon completion of the installation, all circuits, control systems and devices, including pumps, sensors, and all alarm condition signals, shall be tested in the presence of the QAC by the CONTRACTOR. All apparatus shall be cleaned, adjusted, and made ready for operation after testing. The CONTRACTOR shall make such changes in wiring or connections and such adjustments, repairs or replacements as are necessary to make the circuits, device or control system to function as specified and otherwise comply with the specifications or data on Permit Drawings. The CONTRACTOR shall supply all necessary material, labor, and equipment for these tests.

***** END OF SECTION *****

PART 1 - GENERAL

1.01 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment and appurtenances required for the installation of a complete chain-link fence system. Fencing and gates shall be installed in the locations shown on the Contract Drawings and as otherwise required by the CONTRACTOR and favorably reviewed by the QAC.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, Commonwealth, or Federal authorities having jurisdiction. The CONTRACTOR is responsible for identifying and obtaining all appropriate licenses, approvals, and permits to complete the Work of this Section. The CONTRACTOR shall provide a "Competent Person" to implement, supervise, and inspect the Work.

1.02 Submittals

A. Shop Drawings

1. The CONTRACTOR shall submit to the QAC, at least ten (10) days prior to construction, catalog cuts, MANUFACTURER's installation instructions, and dimensioned drawings for fencing, gates, and associated details for installation.
2. Submit detailed layout drawing showing the location of each fence post.

B. Submit in accordance with Section 01300 of these Specifications.

1.03 Delivery and Handling

A. Deliver materials with the MANUFACTURER's tags and labels intact.

B. Handle and store materials in such a manner that will avoid damage.

1.04 Quality Assurance

A. Comply with the standards of the Chain Link Manufacturers Institute and these Specifications.

B. Provide fencing as a complete unit produced by a single manufacturer including the required erection accessories, fittings, and fasteners.

1.05 Codes and Standards

The latest edition of the publications listed below are included as a part of these Specifications.

A. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
A123/A123M	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A153/A153M	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A392	Zinc-Coated Steel Chain-Link Fence Fabric
A641/A641M,	Zinc-Coated (Galvanized) Carbon Steel Wire

PART 2 - PRODUCTS

2.01 General

A. Height for new fencing shall be six (6) feet as shown on the Contract Drawings. Posts shall be set at no more than 10-foot centers, in concrete footings, poured the full size of the excavated holes. Corner posts shall have the necessary strut and tie bracing. Gates shall be provided as specified the Contract Documents.

B. Where fencing crosses ditches, steep grades, and other unusual conditions, make special provisions to insure that the security, appearance, maintainability and permanence of the standard fencing are maintained.

2.02 Materials and Construction

A. Fence Mesh and General Note: 9 gauge wire, woven to 2-inch squares, zinc-coated (hot-dip galvanized), galvanized after weaving, 6-foot wide roll. Continuous tension wire shall be provided at the lower and upper edges of the mesh. Fence mesh shall be of one continuous piece from top to bottom and between posts. Zinc-coated fabric shall conform to ASTM A392, Class 2.

B. Line Post: 2-1/2-inch O.D. ASTM A53 standard weight Galvanized Pipe (3.65 lbs/ft.)

C. Corner Post: 3-inch O.D. ASTM A53 standard weight Galvanized Pipe (5.79 lbs/ft.)

D. Gate Post: 4-inch O.D. ASTM A53 standard weight Galvanized Pipe (9.11 lbs/ft.)

E. Top Rail: 1-5/8-inch O.D. ASTM A53 standard weight Galvanized Pipe (2.27 lbs/ft.) with extra long pressed steel sleeves.

F. Tension Wire: No. 7 gauge steel spring coil tension wire, zinc-coated (hot-dip galvanized). Zinc-coated wire shall conform to ASTM A641, Class 3.

G. Swing Gates:

1. Frame shall be 2-inch O.D. ASTM A53 standard weight galvanized pipe with galvanized pressed steel or galvanized malleable iron corner ells riveted or bolted at corners.
2. Internal bracing shall be NPS 1 ASTM A53 standard weight galvanized pipe with 3/8-inch diameter galvanized adjustable truss rods and truss fasteners.
3. Bottom hinge shall be galvanized malleable iron pivot type.
4. Top hinge shall allow gate to swing 90° to 180°.
5. Gate shall be complete with padlocking device, center rest, and semi-automatic catch to secure gate in open position.
6. Gates shall be provided to match fence height and with the following minimum widths:
   a. Man Gates: Provide a single gate of 3 feet width.
   b. Vehicular Gates: Provide dual gates of equal width to provide an overall gate width of 16 feet.

H. Hardware, fasteners, and accessories: galvanized and compatible with other fence system components.

I. Brace rail: ASTM A53 standard weight galvanized pipe with 3/8-inch diameter galvanized steel truss rods and truss tighteners.

J. Lifting Eyes: Provide at each end of removable panels of adequate strength and attachment to allow fence panel removal. Provide galvanized steel or stainless steel. Repair damage to galvanized surfaces with Galv-Alloy or other means.

K. Extension Arms (where required):

1. Line Post arms shall be fabricated of pressed steel or malleable iron base with pressed steel extension riveted on.
2. Corner Posts arms shall be fabricated of 11-gauge (minimum) pressed steel or heavy malleable iron base with 11-gauge (minimum) pressed steel extension riveted on.
3. Arms shall be galvanized in accordance with ASTM A123.
4. Arms shall be able to withstand a minimum pull down weight of 300 pounds and of the barbed wire stretched to proper tension.
5. Arms shall be securely fastened to post.

L. Tension Bars and Bands: Tension bars for pulling fence fabric to terminal posts shall be 3/4-inch steel bars, hot-dip galvanized in accordance with ASTM A123. Bands for fastening tension bars to terminal posts shall be 11 gauge by 1-inch wide steel; hot-dip galvanized in accordance with ASTM A123.

M. Barbed Wire: Provide galvanized barbed wire with barbs spaced not more than 10 inches apart.

N. Concrete: Concrete for setting of fence posts shall have a minimum 28-day compressive strength of 3000 psi. Concrete shall be a MD DOT standard mix. CONTRACTOR may propose use of high early strength concrete (Type III) for approval by the QAC.

PART 3 - EXECUTION

3.01 General

A. Fence shall be installed to the lines and grades indicated in the Contract Documents. The area on either side of the fence line shall be cleared to the extent required for proper installation. Line post shall be spaced equidistant at intervals not exceeding 10 feet. Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Fabric shall be continuous between terminal posts, however, runs between terminal posts shall not exceed 500 feet.

3.02 Posts

A. Posts shall be set plumb and in alignment. Except where solid rock is encountered, posts shall be set in concrete to the depth of 36 inches. Where solid rock is encountered with no overburden, posts shall be set to a minimum depth of 18 inches in rock. Where solid rock is covered with an overburden of soil or loose rock, posts shall be set to a minimum depth of 36 inches unless a penetration of 18 inches in solid rock is achieved before reaching the 36-inch depth in which case depth of penetration shall terminate. All portions of posts set in rock shall be grouted. Portions of posts not set in rock shall be set in concrete from the rock to ground level. Posts set in concrete shall be set in holes not less than 16 inches in diameter for terminal post and 10-1/2 inches in diameter for line posts. Diameters of holes in solid rock shall be at least 1 inch greater than the largest cross section of the post. Concrete and grout shall be thoroughly consolidated around each post so as to be free of voids and finished to form a dome. Concrete and grout shall be allowed to cure for 72 hours prior to attachment of any item to the posts.

3.03 Braces and Truss Rods

A. Braces and truss rods shall be installed as required and in conformance with the standard practice for the fence furnished. Braces and truss rods shall extend from terminal posts to line posts. Diagonal braces shall form an angle of approximately 40 to 50 degrees with the horizontal.

3.04 Tension Wires

A. Tension wires shall be installed along the bottom of the fence line and attached to the terminal posts of each stretch of the fence. Top rails shall be installed as shown on the drawings. Bottom tension wire shall be installed within the bottom 6 inches of the installed fabric. Tension wire shall be pulled taut and shall be free of sag.

3.05 Chain-Link Fabric

A. Chain-link fabric shall be installed on the side of the post indicated. Install fabric on the Site side of the posts if side is not indicated. Fabric shall be attached to terminal posts with stretcher bars and tension bands. Bands shall be spaced at approximately 15-inch intervals. Fabric shall be pulled taut to provide a smooth uniform appearance free from sag. Fabric shall be fastened to line posts at approximately 15-inch intervals and fastened to tension wires at approximately 24-inch intervals. Fabric shall be cut by untwisting and removing pickets. Splicing shall be accomplished by weaving a single picket into the ends of the rolls to be joined. The bottom of the installed fabric shall be 2 inches (plus or minus ½-inch) above the ground.

3.06 Barbed Wire Supporting Arms and Barbed Wire

A. Barbed wire supporting arms and barbed wire shall be installed as indicated in the Contract Documents similar to the existing fence and as recommended by the MANUFACTURER. Barbed wire shall be pulled taut and attached to the arms with clips or other means that will prevent easy removal.

3.07 Gates

A. Gates shall be installed at the locations shown in the Contract Documents. Hinged gates shall be mounted to swing as indicated in the Contract Documents. Latches, stops, and keepers shall be installed as required in the Contract Documents. Padlocks shall be attached to gates or gate posts with chains to prevent padlock removal.

3.08 Grounding

A. Fences crossed by power lines of 600 volts or more shall be grounded at or near the point of crossing and at distances not exceeding 150 feet on each side of crossing. Ground conductor shall consist of No. 8 AWG solid copper wire. Grounding electrodes shall be ¾-inch by 10-foot long copper-clad steel rod. Electrodes shall be driven into the earth so that the top of the electrode is at least 6 inches below the grade. Where driving is impracticable electrodes shall be buried a minimum of 12 inches deep and radial from the fence. Top of electrode shall be not less than 2 feet nor more than 8 feet from the fence. Ground conductor shall be clamped to the fence and electrodes with bronze grounding clamps so as to create electrical continuity between fence posts, fence fabric, and ground rods. After installation the total resistance of fence to ground shall not be greater than 25 ohms.

3.09 Cleaning

A. Perform cleaning during installation of the Work and upon completion of the Work. Remove from the Site all fence debris and equipment. Repair all damage resulting from the installation of the chain-link fence system as directed by the QAC or QUALITY ASSURANCE OFFICIAL, at the CONTRACTOR's sole expense.

***** END OF SECTION *****

PART 1 – GENERAL

1.1 Description

A. The Contractor supply all material, labor, equipment required for soil preparations and placement of seeding, in locations as directed by the QAC, or as shown on the Permit Drawings. This work shall include maintenance of established lawns until final acceptance. The CONTRACTOR shall provide and place all topsoil necessary to complete the work.

B. Apply lime, fertilizer, seed, and mulch to all topsoiled areas disturbed by the work not receiving a specific surfacing.

1.2 Requirements of Regulatory Agencies

Pesticides, herbicides, and fungicides shall be used in accordance with the requirements of the prevailing Public Health Authority.

1.3 Submittals

A. Submit full and complete information on vegetative layer sampling and fertility testing results prior to amending topsoil with lime and fertilizer.

B. Submit, to the QAC, certification that seed complies with the Specifications.

C. Submit hydroseed procedure and application rates for approval by QAC.

D. Submit full and complete written maintenance instructions for proper care and development of seeded areas to OWNER, prior to substantial completion.

E. Submit material certification for seed mulch to the QAC.

1.4 Product Handling

Deliver seed, lime, and fertilizer in new, clean, sealed containers.

1.5 Scheduling

A. Schedule planting of seeding areas for optimum germination as follows:
   1. Spring planting schedule is March 15th to June 15th
   2. Fall planting schedule is August 15th to October 15th

B. Seeding dates other than listed above are to be approved by the DESIGNER.

PART 2 – PRODUCTS

2.1 Fertilizer

The fertilizer shall consist of 12-24-24 and 46-0-0 commercial grade fertilizer, unless otherwise needed based on fertility test of vegetative layer.

2.2 Seed

A. Seed shall be brought to the site unmixed unless the mixture is certified and stated on the package as to the quality and mixture. Mixing shall be done at the project site from the original unopened packages. Seed mixtures and application rates shall be as follows:

Common Name	Total Lbs per Acre
Kentucky 31 Fescue	128 lbs
Ladino Clover	2 lbs
Red Top Grass	2 lbs
Season Nurse Crop *	20 lbs

Use seasonal nurse crop in accordance with seeding dates as stated below:

February 16th through April	Annual Rye
May 1st through August 15th	Foxtail Millet
August 16th through October	Annual Rye
November through February 15th	Winter Rye

1 Weeping Lovegrass may be added to the seeding mix during the warmer seeding perids; add 10-20 lbs./acre in mixes.

B. Labels and contents shall conform to all State and Federal regulations.

2.3 Agricultural Ground Dolomitic Limestone

A. Agricultural ground dolomitic limestone shall conform to the standards of the Association of Official Agricultural Chemists, and must comply with all existing State and Federal regulations.

B. The material must comply with the following gradation:

Square Mesh Sieves	Percent Passing by Weight
Pass # 10	100
Pass # 20	90
Pass #100	40

C. The minimum calcium carbonate equivalent shall be 90.
D. The DESIGNER reserves the right to draw such samples and perform such tests as he deems necessary to assure that these Specifications are met.

2.4 Seed Mulch

A. Provide erosion control or hydro-mulch, as required, in areas to be seeded.
B. Seeding mulch shall be wood fiber, straw, or non-woven fibers free from weeds and coarse matter.

PART 3 EXECUTION

3.1 General

Construction methods shall be those established as agronomically acceptable and feasible, as approved by the DESIGNER.

3.2 Seed Bed Preparation

A. The areas shall be made friable and receptive to seeding by approved methods, which will not disrupt the line and grade of the slope surface. In no event will seeding be permitted on hard or crusted soil surface.

B. Fine grade areas to a firm even surface, free from lumps or stones 1-inch or more in any dimension. Installation of grass areas may be done immediately after finish grading provided the seeding bed is in a good condition, and not muddy or hard. If it is hard, till to a friable condition again.

3.3 Seeding Operations

A. Seed areas within the areas disturbed by the CONTRACTOR, as directed by the QAC and Permit Drawings. After cleaning the seeding area of coarse material, maintain finish grades as shown on the Permit Drawings and spread fertilizer and lime uniformly over the areas using an approved mechanical spreader. Fertilizer shall be applied at a rate required to provide one (1) lb. of nitrogen per 1,000 square feet, or as indicated by soil test results. Harrow and rake into topsoil to a depth of 2- inches.

B. The lime application rate will be based on soil fertility test results, and will be broadcasted prior to harrowing and raking of topsoil prior to fertilizing to achieve a soil pH of 6.5 to 7.0. The maximum application rate allowed is 100 lbs per 1,000 square feet.

C. Do not undertake seeding in windy or unfavorable weather, or when the ground is too wet to rake easily, frozen, or too dry. Uniformly sow seed at a rate specified, using drills, seeders or hydroseeding. If hydroseeded, add 10 percent to seeding mixture requirement.

D. If drilled, apply the specified seed mixture uniformly at the rate specified, using a press drill equipped with individually mounted, adjustable spring load, double disk furrow openers fitted with depth control banks, or drums. Make two (2) passes at right angles to one another.

3.4 Replanting

A. The CONTRACTOR shall be required to replant areas damaged by water, wind, fire, equipment or pedestrian traffic, as necessary, or when ordered by the QAC at no cost to the OWNER.

B. All areas and spots that do not show a prompt catch within 60 days shall be reseeded at fifteen (15) day intervals until a growth of grass is established (minimum 70% coverage one (1) year after initial seeding) over the entire area, at no additional expense to the OWNER.

3.5 Compaction

The CONTRACTOR shall keep all equipment, and vehicular and pedestrian traffic off areas that have been seeded to prevent excessive compaction and damage to young plants. Where such compaction has occurred, the CONTRACTOR shall rework the soil to make a suitable seedbed, then reseed and reblanket such areas with the full amounts of the specified materials, at no extra expense to the OWNER.

3.6 Mulching

A. If seeding is done with hydro-mulching, then seeding mixture shall be increased 10 percent.
B. Hydro-mulching of seeding areas shall have approved mulch applied at a rate as recommended by the manufacturer of tacking agent.
C. Other methods of mulching shall not be applied prior to approval by the QAC.

3.7 Maintenance of Grass Areas

A. Water, weed, and reseed throughout the construction contract and/or acceptance by the QAC after seeding areas are substantially established turf areas.
B. Install and maintain temporary protection fences, barriers, and signs, where deemed necessary.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish and install concrete formwork as required to form reinforced concrete working pads for miscellaneous drainage structures and foundation, and as shown and indicated on the Permit Drawings, as specified herein, or as otherwise required to complete the Work. The CONTRACTOR shall provide a “Competent Person” to implement, supervise and inspect all Work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities having jurisdiction. The CONTRACTOR shall provide a “Competent Person” to implement, supervise, and inspect all Work.

1.2 References

The latest editions of the publications listed below are included as a part of these Specifications.

A.	ACI 318	Building Code Requirements for Reinforced Concrete
B.	ACI 347	Recommended Practice for Concrete Formwork
C.	PS 1	US Department of Commerce Product Standard (PS) Construction and Industrial Plywood

1.3 Form Design

The CONTRACTOR shall be responsible for the design and performance of concrete forms. Formwork shall comply with ANSI A10.9 and OSHA Construction Standards, Part 1926, Subpart Q, “Concrete, Concrete Forms, and Shoring”.

PART 2 PRODUCTS

2.1 Form Material

Formwork for all concrete, unless otherwise specified, shall not be less than 5/8-inch, 5-ply Douglas fir plywood of exterior structural grade especially processed to resist moisture and conforming to PS 1, B-B Concrete Form Panels. Patented forms may be used, subject to approval by the DESIGNER, provided they are in new, or like-new condition so as to produce a smooth, even surface free from blemishes, defects, and depressions. Approval of patented forms will be based on the final surface finish, and will not relieve the CONTRACTOR of the responsibility for the design and structural soundness of the forms.

2.2 Accessories

A. Form tie assemblies shall be form clamps with smooth tie rods, with a waterstop at the center, permitting tightening of the forms and be of such type as to leave no metal or other material within 1-1/2-inch of the surface after use. The assembly should provide cone-shaped depressions in the cast surface at least 1-inch in diameter and 1-1/2-inch deep to allow filling and patching.

B. Form releasing agent shall be a non-staining form coating compound such as “Cast-Off” by Sonneborn Products Division (Contech, Inc.), or an equal product as approved by the DESIGNER.

PART 3 EXECUTION

3.1 Form Construction

Formwork shall be in accordance with ACI 347 and as follows:

A. Forms shall conform to shape, lines and dimensions of members required and shall be sufficiently rigid and tight to prevent leakage of the cement binder. Forms shall be properly braced or tied together so as to maintain position and shape. Construct forms so that they can be removed readily without hammering or prying against the concrete. Forms for exposed concrete shall be carefully made and accurately placed to obtain correct shape and lines.

B. Joints shall be butted tight on solid bearings. Arrangements of panels shall be orderly and symmetrical, and use of small pieces shall be avoided. Forms shall be chamfered for external corners of concrete, including top of walls, which will be exposed in the finished work.

C. The CONTRACTOR shall be fully responsible for the adequacy of formwork in its entirety. Forms shall support the anticipated loading while maintaining their dimensional and surface correctness to produce members with the required geometry.

D. Block-outs for slots, chases, recesses or other openings shall be provided by the CONTRACTOR as needed by the work of this and any other trades.

E. Install all the inserts to be supported by the formwork as required by the work of this and other trades as needed.

3.2 Tolerance for Formed Surfaces

A. Variation from Plumb: Not more than ±1/4 inch in any 10 feet of length with a maximum for the entire length of ±1/2 inch.

B. Variation from the Level or from the Grades Specified in the Permit Drawings: Not more than ±1/4 inch in any 10 feet of length with a maximum for the entire length of ± 3/4 inch.

C. Variation in the Sizes and Location of Openings and Thickness of Walls: ±1/4-inch.

3.3 Inspection

CONTRACTOR shall give the QAC at least 48 hours notice before any concrete is to be cast. Concrete shall not be cast until the QAC has observed and given approval of the Work to be cast including, but not limited to, the placement of all the reinforcing, accessories, forms and the surfaces to be cast against. Such observations are in the nature of assisting the CONTRACTOR to minimize errors and in no case will they serve to relieve the CONTRACTOR of the responsibility to provide the materials and workmanship required by the Contract Documents.

3.4 Application of Form Coating

Immediately before the placing of reinforcing, faces of all forms in contact with the concrete shall receive a thorough coating of the liquid form-releasing agent specified, applied in compliance with the Manufacturer's instructions.

3.5 Removal of Forms

A. The CONTRACTOR shall assume full responsibility for removal of formwork and forms shall be removed in such a manner as to insure complete integrity and safety of the structure. Forms and shoring for mass concrete, walls, columns, and beams shall remain in place a minimum period of 7 days after casting the concrete. Forms for slabs shall remain in-place a minimum of 24 hours after casting.
B. Wood forms shall be completely removed from all concrete cast to avoid termite infestation.

3.6 Surveying

A. Prior to pouring concrete, accurately survey and measure the size and location of all structures to be placed in the concrete. Survey and record measurements in accordance with Section 01050 of these Specifications.
B. Provide drawings showing surveyed measurements, dimensions, and locations necessary to locate accurately anchors, pipes, tanks, conduit, and other structures buried in or below concrete.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish and install the concrete reinforcement as shown and indicated on the Permit Drawings, as required by these Specifications, and as specified in this Section. The CONTRACTOR shall provide a "Competent Person" to implement, supervise and inspect all Work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

The latest edition of the publications listed below are included as part of these Specifications.

A. ACI 318 - Building Code Requirements for Reinforced Concrete

B. ACI 315 - Manual of Standard Practice for Detailing Reinforced Concrete Structures

C. ASTM A82 - Specification for Cold Drawn Steel Wire for Concrete reinforcement

D. ASTM A185 - Specification for Welded Steel Wire Fabric for Concrete Reinforcement

E. ASTM A496 - Deformed Steel Wire for Concrete Reinforcement

F. ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement

G. ASTM A615 - Specification for Deformed and Billet-Steel Bars for Concrete Reinforcement

H. AASHTO-M284 - Epoxy Coating

1.3 Submittals

A. Shop Drawings to be submitted with the CONTRACTOR's Detailed Design submittal. Shop drawings shall show the required bar sizes, spacing, and splice length for all reinforcement; reinforcement placing plans; and, bending details, and complete bar lists. Shop drawings will not be reviewed without such information. Wall reinforcing shall be shown in elevation. Location and arrangement of accessories shall be clearly indicated. Placing drawings, detail drawings and bar lists shall be checked by the fabricator and the CONTRACTOR before being submitted to the QAC for review.

B. Mill tests of reinforcing steel shall be submitted prior to use for each 15 tons or less shipped to the Site. Tests shall be conducted in conformance with ASTM A615, and methods prescribed therein.
   1. Cost of tests shall be borne by the CONTRACTOR.
   2. Three copies of each test report stating whether the material meets the requirements of the ASTM specifications shall be submitted to the QAC.
   3. Certified copies of the mill tests may be considered evidence of compliance provided such tests are regularly conducted by the

reinforcement supplier by experienced, competent personnel using appropriate testing equipment. In case of doubt as to the adequacy or accuracy of the mill tests, the QAC may require the CONTRACTOR to furnish, at no additional cost to the OWNER, test results from an independent testing laboratory acceptable to the QAC on mill samples or delivered steel reinforcement.

PART 2 PRODUCTS

2.1 Reinforcing Bars

Bar reinforcement shall be deformed-type bars conforming to ASTM A615. Reinforcement shall be manufactured from new billet steel of American manufacture, Grade 60, yield strength 60,000 psi, minimum.

2.2 Welded Wire Fabric

Welded wire fabric shall be in flat sheets conforming to ASTM A185 (A497), with wire conforming to ASTM A82 (A496).

2.3 Accessories

A. All chairs and bolsters shall have plastic-covered or galvanized steel legs.
B. For slabs on grade, all reinforcing shall be supported on continuous chairs and/or bolsters as required to properly support the reinforcing steel. The chairs and/or bolsters shall be supported on precast concrete pads bearing on the subgrade. The concrete pads shall be at least 6-inch x 6-inch and no more than 1-inch thick. Pads shall be cast from Class "A" concrete or from mortar made up of one part cement and two parts sand, with tie wires embedded.

PART 3 EXECUTION

3.1 Storage of Materials

Reinforcing steel delivered to the Site shall be stored on clean well draining flat surface. All reinforcing steel shall be stored in bundles with tags. Reinforcing steel shall not be exposed to the elements.

3.2 Inspection of Steel Placement

CONTRACTOR shall give the QAC at least 48 hours notice before any concrete is to be cast. Concrete shall not be cast until the QAC has observed and given approval of the work to be cast including, but not limited to, the placement of all the reinforcing, accessories, forms and the surfaces to be cast against. Such observations are in the nature of assisting the CONTRACTOR to minimize errors, and in no case will they serve to relieve the CONTRACTOR of the responsibility to provide the materials and workmanship required by the Contract Documents.

3.3 Tolerances

A. Allowable tolerances for fabricating steel reinforcement shall be as follows:

Item	Maximum Tolerance
Sheared length of bars	± 1-inch
Location of bends	± 1-inch

B. Allowable tolerances for placing steel reinforcement shall be as follows:

Item	Maximum Tolerance
Concrete cover from outside of bar to finished surface	+ 1/4-inch
Lateral spacing of bars in plane of reinforcement in slabs and walls	± 1-inch
Height of bottom bars in slabs	± 1/4-inch
Height of top bars in slabs	± 1/4-inch

3.4 Shop Fabrication

A. Reinforcing steel shall be fabricated to required shapes and dimensions in compliance with applicable provisions of ACI 315 and ACI 318.
B. Bars shall be bent cold. Bars shall be prefabricated to detail and delivered to the site plainly tagged and ready to set.

3.5 Epoxy Coating

A. Reinforcing bars shall be coated after fabrication is complete.
B. Epoxy coating shall be satisfactory repaired by wire brush cleaning and painting with an approved epoxy paint provided by the bar coater, using the manufacturers approved procedure.
C. Bars with more than 5% of the coating damage shall be replaced.
D. Bars shall be fastened by the use of epoxy-coated wire only.

3.6 Field Fabrication

A. Field fabrication of reinforcing steel will not be permitted without the approval of the DESIGNER.
B. Field cutting of reinforcing steel shall be performed by shearing or abrasive cutting wheel. Cutting by flame is prohibited.
C. Damaged epoxy coating shall be removed and coating repaired.

3.7 Placement and Anchorage

A. Space metal chairs, bolsters, spacers and hangers in accordance with ACI 315.
B. Reinforcement, at the time concrete is placed, shall be free from any abrasions or damage to the epoxy coating. Repairs shall be made immediately upon discovery.
C. Reinforcement shall be accurately placed in accordance with the shop drawings and shall be adequately secured in position with not less than 16-gauge annealed wire or suitable clips at no less than 50% of the bar intersections. Reinforcement shall be held securely at the required distance from the forms. Nails shall not be driven into outside forms to support reinforcement.
D. Install welded wire fabric reinforcement for concrete sidewalks, equipment pads, and as otherwise indicated. Lap all joints 6-inches and wire securely. Extend mesh to within 2-inches of sides and ends of slabs. Unless otherwise specified, place welded wire fabric between the upper third-point and the mid-point of the slab. Sheets that do not lay flat when in their intended position will be rejected. Tags designating the wire size and spacing shall be left on each sheet until ready for use. Tuck ends of welded mesh well down into edge of beams or walls. Do not leave unreinforced border strips. Welded wire fabric shall not contain loose rust.

3.8 Concrete Cover

Metal reinforcement shall be protected by concrete cover in accordance with ACI 318.

3.9 Splicing

A. Splices shall be Class “C” splice minimum. The location and type of splices desired by the CONTRACTOR must be specifically requested and must meet the approval of the DESIGNER before they can be used.
B. Splices shall not be made at point of maximum stress and shall provide sufficient lap to transfer stress between bars by bond.
C. Splices in top reinforcement shall be made as shown of the reinforcement drawing, and approved by the DESIGNER.
D. Mechanical splices may be used instead of lap splices, provided that their location and type meets with the approval of the DESIGNER.
E. Splice locations shall be staggered with adjacent bars and bar bundles.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish and install the concrete as shown and indicated on the Permit Drawings, as required by these Specifications, and as specified in this Section. The CONTRACTOR shall provide a “Competent Person” to implement, supervise and inspect all Work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

The latest edition of the publications listed below form a part of these Specifications:

A. *American Concrete Institute (ACI) Publications*

211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
301 Specifications for Structural Concrete for Buildings
302.1R Guide for Concrete Floor and Slab Construction
304 Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete
305R Hot Weather Concreting
306R Cold Weather Concreting
318 Building Code Requirements for Reinforced Concrete

B. *U.S. Army Corps of Engineers (COE) Waterways Experiment Station Publications*

CRD-C-621 Handbook for Concrete and Cement, Specifications for Non-shrink Grout, Volume II

C. *American Association of State Highway and Transportation Officials (AASHTO) Publication*

M 182 Burlap Cloth Made From Jute or Kenaf

D. American Society for Testing and Materials (ASTM) Publications

C 31 Making and Curing Concrete Test Specimens in the Field
C 33 Concrete Aggregates
C 39 Compressive Strength of Cylindrical Concrete Specimens
C 94 Ready-Mixed Concrete
C 143 Slump of Portland Cement Concrete
C 150 Portland Cement
C 171 Sheet Materials for Curing Concrete
C 172 Sampling Freshly Mixed Concrete
C 173 Air Content of Freshly Mixed Concrete by the Volumetric Method

C 231	Air Content of Freshly Mixed Concrete by the Pressure Method
C 260	Air-Entraining Admixtures for Concrete
C 309	Liquid Membrane-Forming Compounds for Curing Concrete
C 494	Chemical Admixtures for Concrete
C 595	Blended Hydraulic Cements
C 618	Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
C 881	Epoxy-Resin-Base Bonding Systems for Concrete

PART 2 PRODUCTS

2.1 Cement

Cement shall be standard Portland cement of American manufacture, conforming to ASTM C-150, Type I. Only one (1) brand of commercial Portland cement shall be used in the exposed concrete of the structure. Cement reclaimed by cleaning bags or from leaking containers shall not be used. Each bag shall weigh approximately 94 pounds and contain one (1) cubic foot.

2.2 Concrete Aggregates

A. Fine aggregate shall be sand having clean, hard, durable, uncoated grains, be free from deleterious substances, and conform to ASTM C-33.

B. Coarse aggregate shall be crushed stone having clean, hard, durable, uncoated particles conforming to ASTM C-33.

2.3 Water

Water used in mixing concrete shall be clean, potable, and free from deleterious amounts of acids, alkalis, or organic materials.

2.4 Waterstops

Where shown on the Permit Drawings in expansion joints and construction joints, waterstops shall be polyvinyl chloride (PVC), and shall incorporate a galvanized steel wire along both edges, which shall be used to secure the waterstop in position by tying to reinforcement during concrete placement. The waterstop shall be of the size noted on the Permit Drawings. The waterstop shall be equal to Wirestop CR-9380, or Burke. The waterstop shall extend the entire length of the joint and all splices shall be heat welded and tested in accordance with the manufacturer's instructions.

2.5 Non-Shrink Grout

Non-shrink grout shall be a ready-to-use non-metallic aggregate product requiring only the addition of water at the jobsite, and shall conform to COE CRD-C-621.

2.6 Admixtures

A. Water reducing admixture shall conform to ASTM C-494, Type A.
B. Water reducing, retarding admixture shall conform to ASTM C-494, Type D.
C. Non-Corrosive, Non-Chloride Accelerator shall conform to ASTM C-494, Type C.
D. Air entraining admixture shall conform to ASTM C-260.
E. High range water reducer (HRWR) shall conform to ASTM C494, Type F or G.
F. Calcium chloride or admixtures containing more than 0.1 percent chloride ions are not permitted.

2.7 Curing and Sealing Compounds

A. Curing compound shall be acrylic based, conforming to ASTM C-309.
B. Sealing-hardener compound shall conform to ASTM C-309.

2.8 Bonding Compounds

Bonding Compound shall conform to ASTM 881.

PART 3 - EXECUTION

3.1 Concrete Quality

All mix designs shall be proportioned in accordance with ACI 211.1. The proportioning shall be based on the requirements of a well-graded, high density, plastic, and workable mix within the slump range and strengths required. The following class of concrete is required:

Class of Concrete	Compressive Strength @ 28 Days	Slump Range
A	4000	4-inch max.

A. Air Content: All concrete shall have an air content of 5 to 7 percent.
B. Water-Cement Ratio: All concrete shall have a maximum water-cement ratio of 0.45.
C. Admixture Usage: All concrete shall contain a water-reducing admixture or water reducing-retarding admixture, and an air-entraining agent. All concrete placed at air temperatures below 50° F shall contain the specified non-corrosive, non-chloride accelerator.

3.2 Mix Designs

A. The testing laboratory shall be paid for by the CONTRACTOR.
B. The CONTRACTOR shall submit samples, in adequate quantities for each mix design and verification, of all concrete materials to be used on the project to the designated testing laboratory. The CONTRACTOR shall not use any concrete in

this work without acceptance and verification of design mix by the testing laboratory, and the approval of the QAC.

C. The testing laboratory shall make strength tests from trial batches in the laboratory, using materials and mix designs proposed for use by the CONTRACTOR. The testing laboratory shall prepare trial batches in accordance with ACI 211.1.

D. The proposed mix design and supporting data must be submitted, in triplicate, to the testing laboratory for their review and comments at least 21 days prior to the expected start of concreting operations. Within 10 days of receiving this information, the testing laboratory will forward two (2) copies of the submittal to the DESIGNER with their comments. The DESIGNER will review the submittal and return one (1) copy to the CONTRACTOR with the DESIGNER's comments.

E. Compression test specimens made to verify the mixes shall be made in accordance with ASTM C-192. Aggregates shall be tested in accordance with ASTM C-33. All compression test specimens shall be tested in accordance with ASTM C-39.

3.3 Plant Mixing

A. *Proportioning Concrete*
   1. Proportions shall be in compliance with approved design mix for each class of concrete.
   2. The mixing plant shall be provided with adequate equipment and facilities for accurate measurement and control of the quantities of material and water used in the concrete.
   3. Concrete materials shall be measured by weight except that admixtures shall be measured by volume.

B. *Batching*
   1. The CONTRACTOR shall provide all necessary equipment to accurately determine and control actual amount of materials entering into the concrete mix. Individual ingredients shall be weighed separately for each batch. Accumulative weighing will be allowed if equipment is in acceptable working order, as determined by the testing laboratory and approved by the DESIGNER. Accuracy of all weighing devices shall be such that successive quantities can be measured to within one (1) percent of the desired amount.
   2. Completely discharge contents of the mixer before each new batch is loaded. Use of retempered concrete is not permitted.
   3. Ready-mixed concrete shall be mixed and delivered in accordance with requirements of ASTM C-94 and to the following:
      a. A separate water-metering device (not truck tank) shall be used for measuring water added to the original batch.
      b. Use of wash water as a portion of the mixing water is not permitted. Wash water added to empty drums after discharging shall be dumped before a new batch is received.

c. Centrally mixed concrete shall be mixed for the length of time specified herein, not "shrink-mixed".
d. Mixing drums shall be watertight.
e. Concrete shall be discharged within one and a half (1.5) hours from the time concrete was mixed, if centrally mixed, or from time the original water was added, if transit-mixed.
f. Furnish delivery ticket with each load of concrete delivered under these Specifications. Delivery ticket shall show clearly the class and strength of concrete, size of coarse aggregate, water per cubic yard, the slump ordered, quantities of all admixtures, and the date and time of departure from the batching plant.

3.4 Conveying Equipment

A. If concrete is to be transported in carts or buggies, the carts or buggies shall be equipped with pneumatic tires.
B. Equipment for chuting or other methods of conveying concrete shall be of such size and design as to insure a practically continuous flow of concrete at delivery, without segregation of materials.

3.5 Conveying

A. Concrete shall be conveyed from mixer to place of final deposit by methods that will prevent separation or loss of the material.
B. Runway supports shall not bear upon reinforcing steel or fresh concrete.
C. All conveying equipment shall be thoroughly cleaned before each run of concrete is begun.

3.6 Delivery and Protection of Materials

Deliver ready-mixed concrete in compliance with requirements set forth in ASTM C-94.

3.7 Severe-Weather Provisions

A. *Hot-Weather Concreting*
1. Provide adequate methods of lowering temperature of concrete ingredients so that the temperature of concrete when placed does not exceed 90° F.
2. When the weather is such as to raise concrete temperature, as placed, consistently above 90° F, Pozzolith retarder shall be used.
3. Subgrade and forms shall be wetted with water before placing of concrete. All excess water shall be removed before concrete is placed.
4. Curing shall start as soon as practicable to prevent evaporation of water. Flat work shall be protected from dry winds, direct sun, and high temperatures.

B. *Cold-Weather Concreting*

1. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather. No frozen materials, or materials containing ice, shall be used.
2. All concrete materials and all reinforcement, forms, fillers and ground with which concrete is to come into contact shall be free from frost.
3. Whenever the temperature of the surrounding air is below 40° F and falling, all concrete placed in the forms shall have a temperature of between 70° F and 80° F, and adequate means shall be provided for maintaining a temperature of not less than 70° F for three (3) days, or 50° F for five (5) days, or for as much more time as is necessary to insure proper curing of the concrete. If high early strength concrete is used, the requirement for maintenance of 50° F can be reduced to three (3) days.
4. Use only the specified non-chloride accelerator. Calcium chloride or admixtures containing more than 0.1 percent chloride ions are not permitted.
5. Housing, covering or other protection used in connection with curing shall remain in place and intact at least 24 hours after the artificial heat is discontinued.

3.8 Construction Joints and Expansion Joints

Construction Joints: Early in the construction program, the CONTRACTOR shall review with the DESIGNER any construction joints proposed for use that are not indicated on the Permit Drawings. The CONTRACTOR shall not use any construction joints not approved by the DESIGNER. In all cases, construction joints shall occur at sections of minimum shear. Where construction joint is to be made, surface of the concrete shall be roughened (construction joints detailed with key ways in slabs and walls do not need to be roughened) and thoroughly cleaned of foreign matter and laitance. In addition to the foregoing, joints shall be dampened with water, and the specified bonding compound applied, or a slush coat of neat cement grout shall be applied. Additional construction joints requested by the CONTRACTOR and approved by the DESIGNER shall be of the type shown and/or noted on the Permit Drawings for the specific element(s) being considered (i.e., wall slabs, etc.).

3.9 Waterstops

Waterstops shall be installed as indicated and noted on Permit Drawings and, as applicable, shall be made continuous by fusion welds.

3.10 Inspection of Work before Placing

A. The CONTRACTOR shall inspect the forms to receive concrete for any deficiencies that would prevent proper placing of concrete. Do not proceed with placing concrete until such deficiencies are corrected.

B. Give the QAC at least 48 hours notice before any concrete is to be cast. Concrete shall not be cast until the QAC has observed and given approval of the work to be cast including, but not limited to, the placement of all the reinforcing, accessories, forms and the surfaces to be cast against. Such observations are in the nature of assisting the CONTRACTOR to minimize errors and in no case will they serve to relieve the CONTRACTOR of the responsibility to provide the materials and workmanship required by the Contract Documents.

C. Do not place concrete on earth until the fill or excavation has been prepared as set forth under applicable Sections of the Specifications for that work.

D. The CONTRACTOR shall not place in the concrete any item that is not authorized to be placed by the Permit Drawings and Specifications. The CONTRACTOR shall insert all the items as required by the other trades and properly position and secure them in their intended location. Openings other than those that are facilitated by sleeves shall be properly formed and positioned, as required by the other trades.

E. Do not place concrete in forms until all foreign matter has been removed from forms and the reinforcing steel is in proper condition for placement of concrete.

F. Remove hardened, or partially hardened, concrete on forms or reinforcement before placing concrete.

3.11 <u>Placing</u>

A. Deposit concrete as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Do not deposit concrete on work that has partially hardened or been contaminated by foreign material, and do not use retempered concrete.

B. Concrete shall be placed to avoid the displacement of reinforcing, and coating or spattering the reinforcing steel. The placing of concrete within formwork shall be regulated so that the pressure within formwork does not exceed the design pressure. In placing concrete each layer shall be placed following the preceding layer to prevent lines of separation or "cold joints" in the work. After the concrete reaches its initial set, jarring the formwork or placing strain or vibration on the ends of projecting reinforcing bars shall be carefully avoided.

C. Concrete shall not be dropped more than four (4) feet. For greater distances of drop, concrete shall be handled with metal chutes or tremie pipes.

D. Once concreting is started, it shall be carried on as a continuous operation until placing of the concrete between construction joints is completed. The top surface will be finished to the required alignment.

E. Concrete shall be placed in layers not over 12-inches deep and each layer shall be compacted with the aid of mechanical internal-vibrating equipment supplemented by hand spading. Vibrators shall in no case be used to transport concrete. Use of form vibrators will not be permitted. Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the concrete. At least one (1) spare vibrator shall be maintained as a relief. Provide backup power source. Duration of vibrator use shall be limited to that necessary to produce satisfactory consolidation without causing objectionable segregation. Vibrator shall not be lowered into courses that have begun to set. Apply vibrator at uniformly spaced points not further apart than the visible effectiveness of the machine.

F. Type and use of vibrators shall be in accordance with ACI 301.

3.12 Protection

Protect freshly placed concrete from damage or injury due to water, falling objects, persons or anything that may mar or injure finish surface on concrete. Only light use of any floors shall be permitted for the first seven (7) days after placing of concrete.

3.13 Curing

A. All Concrete. After placement and finishing, concrete shall be maintained in a moist condition for at least seven successive days during which the temperature of the concrete is 50° F, or above. For temperatures of 50° F and below, curing period shall be 14 successive days.

B. Concrete shall be kept moist by any one, or combination, of the following methods:

1. Ponding or Immersion: Continually immerse the concrete in water throughout the curing period. Lowest temperature water shall not be more than 20° F colder than the temperature of the concrete.
2. Fog Spraying or Sprinkling: Provide uniform and continuous application of water throughout the curing period.
3. Impervious Sheeting: Wet the entire exposed surface of the concrete thoroughly with a fine spray of water and cover with impervious sheeting throughout the curing period. Lay sheeting directly on the concrete surface and overlap edges 12-inches minimum. Provide sheeting not less than 18-inches wider than the concrete surface to be cured. Secure edges and transverse laps to form closed joints. Repair torn or damaged sheeting or provide new sheeting. Inspect surface of concrete daily for wetness. The surface shall be kept continuously wet during the curing period.

C. Concrete in Formed Surfaces - Keep forms and exposed surfaces wet with water during the curing period. If forms are removed before the end of the curing period, apply a curing compound within one (1) hour after form removal.

3.14 Patching

A. Any concrete which is not formed as shown on the Permit Drawings, or for any reason is out of alignment or level or shows a defective surface, or shows defects which reduce the structural adequacy of a member or members, as determined by the QAC, shall be considered as not conforming with these Specifications and shall be removed from the project by the CONTRACTOR at CONTRACTOR's own expense, unless the QAC grants permission to patch the defective area, which shall be done in accordance with the following procedure:

1. Permission to patch any such area shall not be considered a waiver of the QAC right to require complete removal of the defective work if the patching does not, in the QAC's opinion, satisfactorily restore the quality and appearance of the surface or the structural adequacy of the member or members.

B. After removing the forms, all concrete surfaces shall be inspected and any joints, voids, stone pockets or defective areas permitted by the QAC to be patched and all tie holes, shall be patched. Defective areas shall be chipped away to a depth not less than 1-inch with the edges perpendicular to the surface. Remove defective areas to sound concrete with clean, square cuts. Dampen concrete surfaces to be in contact with patching concrete and apply the specified bonding compound. Place patching concrete over the bonding compound as specified by the manufacturer. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete. Before patching mix is applied, the prepared surface shall first be approved by the QAC.

C. Patching concrete mix (or mortar) shall be subject to the approval of the QAC. The patching concrete shall be compacted into place and screed off so as to leave the patch higher than the surrounding surface. It shall then be left undisturbed for a period of one (1) to two (2) hours to permit initial shrinkage before being finished. The patch shall be finished to match the adjoining surface. All patches shall be cured as specified for the original concrete.

D. Tie holes left by withdrawal of rods or the holes left by removal of ends of wall ties shall be filled solid with mortar after first being wetted. For holes passing through the wall, a plunger-type grout gun shall be used to force the mortar through the wall starting at the back face. A piece of burlap or canvas shall be held over the hole on the outside and when the hole is filled, the excess mortar shall be struck off with the cloth flush with the surface. Holes not passing through the walls shall be filled with a small tool that will permit packing the hole solid with mortar. Any excess mortar at the surface of the wall shall be struck off flush with a cloth.

3.15 <u>Finishes on Formed Surfaces</u>

Upon completion of patching, surfaces of concrete shall be finished as follows:

A. Rubbed stone finish shall be produced by casting concrete against plywood forms and by rubbing the surfaces with carborundum stone and water, after patching of tie holes and depressions, to a true, even and smooth finish of uniform color and texture. No slush coat of cement grout or cement wash will be permitted at any state of the finishing.

B. Areas to be rubbed shall be finished as soon as forms can be stripped. Strip only those forms on areas that can be finished in the same day as the forms are stripped.

C. Common finish shall be produced by filling all tie holes, honeycomb, and depressions, and knocking off and evening of burrs and form marks. All concrete surfaces not receiving a stone-rubbed or rough finish shall receive a common finish.

D. Rough finish shall be produced by filling all tie holes and honeycomb, and in other respects leaving the surface as formed. All concrete surfaces which will be covered by earth and which will not be visible in the completed structure, shall receive a rough finish.

3.16 Testing Laboratory

A. The testing laboratory shall be paid by the OWNER. The laboratory shall have access to all places where concrete materials and concretes are manufactured, stored, proportioned, mixed, placed and tested. Duties shall include, but not necessarily be limited to the following:
   1. Make, store, transport, cure and test compression specimens made during placing of concrete. Compression test specimens shall be tested in accordance with ASTM C-39. Test reports shall show all pertinent data, such as class of concrete, exact location of pour, air temperature, date of pour, time of pour, truck number for ready-mixed concrete, date on which specimen was broken, age of specimen, compressive strength of specimen, slump test results, and air content of pour from which the specimen was made. One (1) copy each of all tests shall be sent to the CONTRACTOR and two (2) copies each to the QAC.
   2. For each class of concrete, take four standard test cylinders from each 100 cubic yards or fraction thereof of concrete placed, not less than four (4) cylinders for each 5,000 square feet of surface area placed in any single day. Two (2) of these cylinders shall be designated for the 28 day test, and shall comprise a test under the definition of these Specifications. One (1) cylinder will be broken at seven (7) days and will be used as an aid in determining the early strength of the concrete and the 28-day strength, and one (1) cylinder retained in reserve for later testing if required.
   3. Periodically inspect the batching plant and file a report with the DESIGNER stating whether the supplier's equipment and methods meet the requirements of these Specifications.

B. Temperature and Placing Record: Temperature record shall be made each day during the concreting operations. Records shall also include location, quantity and starting and finishing time of placement for all concrete work. Copy distribution shall be as specified above for test reports.

3.17 Evaluation of Compression Tests

A. Evaluation of compression test results shall be as follows:
   1. For each class of concrete, compression-strength tests for laboratory-cured cylinders shall be considered satisfactory if the averages of the results of all sets of three consecutive compression-strength tests equal or exceed the 28-day design compression strength specified.
   2. No individual cylinder strength test falls below the required compression strength by more than 500 psi.

3. Strength tests of specimens cured under field conditions may be required by the QAC to check the adequacy of curing and protecting of the concrete placed.
4. Specimens shall be molded by the field quality-control laboratory at the same time and from the same samples as the laboratory-cured specimens.

B. Faulty Concrete: Failure to meet any of the specified conditions constitutes faulty concrete. Unless otherwise directed by the QAC, faulty concrete shall be removed and replaced with concrete as specified, at no expense to the OWNER.

C. Additional Testing: If permitted by the QAC, additional testing shall be subject to the approval of the QAC and at no expense to the QAC. Load test, if permitted by the QAC, shall be conducted in accordance with the loading criteria as required by the design of the structure, as determined by the QAC.

D. Neither the results of laboratory verification tests nor any provision in the Contract Documents shall relieve the CONTRACTOR of the obligation to furnish concrete of the class and strength specified.

3.18 Non-Shrink Grout

All applicable locations noted on the Permit Drawings or in these Specifications shall be grouted with the specified non-shrink, non-metallic grout.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Section Includes

A. Design Criteria for leachate storage tank.
B. Structural steel components for the leachate storage tank.
C. Accessories for the leachate storage tank.
D. Coating materials and procedures for leachate storage tank.
E. Erection materials and procedures for leachate storage tank.

1.2 Related Sections

A. Section 03300 Cast in Place Concrete.

1.3 References

A. AWWA D 103 Standards of the American Water Works Association
B. API 12B – American Petroleum Institute
C. ANSI
D. ASTM
E. SSPC
F. NSF Additives Standard No. 61

1.4 Submittals

A. Shop drawings of tank, anchorage (if required), accessories, appurtenances and coatings shall be submitted.

1.5 Qualification/Experience

A. The tank manufacturer shall be a specialist in the design, fabrication with a minimum of (5) years documented experience and erection of factory coated bolted steel tanks. The manufacturer shall be quality certified, having an active API-Q1 and an ISO 9001 registration.

1.6 Delivery, Storage and Handling

A. All plates, supports, members, and miscellaneous parts shall be packaged for shipment in such a manner to prevent abrasion or scratching of the finish coating.

1.7 Warranty

A. The tank manufacturer shall warrant the tank against any defects in workmanship and materials for a period of one (1) year from date of shipment. In the event a defect should appear, it shall be reported in writing to the manufacturer during the warranty period.

B. 1 year Limited Warranty on interior TRICO BOND EP™ coating.

PART 2 PRODUCTS

2.1 Leachate Storage Tank

A. Acceptable Manufacturers

1. Columbian TecTank, Kansas City, KS
2. Aquastore, DeKalb, Illinois

B. *Bolted Tank Design Criteria* – (See Drawings).

C. Bolted Tank Structure

1. The materials, design, fabrication, and erection of the bolted steel tank shall conform to the Principles of Standard Specification 12B of the American Petroleum Institute, or to the manufacturer's specifications which are derived from engineering principles, industry experiences, and the aforementioned standards and specifications.
2. Standard shell height and diameter meeting requirements for the selected capacity.
3. Storage Capacity:
   Minimum Design Volume = 500,000 per tank
   Depth at Minimum Design Volume = 43 feet
4. Tank Diameter: 45'-00"
5. Tank Height: 47'-00"
6. Steel
   a. Hot Rolled Steel Sheets and Plates
      1) Hot Rolled Steel Sheets and Plates shall meet or exceed the requirements of ASTM A1011 Grade 40 with a minimum yield strength of 40,000 psi.
      2) Minimum thickness shall be 12 gauge (0.0972 in.)
   b. Structural Shapes
      1) Structural shapes shall conform to ASTM A36 or ASTM A992.
      2) Other grades of carbon steel that meet or exceed these standards may be utilized.
7. Bolts/Nuts/Washers
   a. Galvanized Bolts
      1) Galvanized bolts, nuts, washers used in tank joints shall be minimum ½" diameter and shall meet or exceed the requirements of API 12B or AWWA D103.
   b. Encapsulated Bolts
      1) Encapsulated bolt heads shall be used for additional corrosion protection.
   c. Anchor Bolts
      1) Anchor bolts shall meet or exceed the requirements of ASTM A36 or ASTM A325.

d. Other Bolts
   1) Other bolts shall meet or exceed the requirements of ASTM A307 or ASTM A325.
e. Washers
   1) Neoprene backed steel washers shall be provided at all bolts in contact with the stored leachate.

8. Gaskets
   a. All bolted connections shall incorporate an EPDM prefabricated gasket with a minimum width of 1-3/4”.
   b. A single piece double punched gasket shall be used at vertical seams which require two vertical rows of punching.
   c. Field caulking (NSF Standard 61 Approved) will be allowed when joining a discontinuous gasket section and at certain joint connections.
   d. All tanks that are to be completely sealed with a mastic coating system only, for long-term service, are not acceptable.

D. Coating

1. All metal plates, supports, members, and miscellaneous parts, except bolts, certain accessories, and appurtenances, shall be factory coated in accordance with the provisions of these specifications.
2. Field coating, except for touch-up will not be permitted.
3. Surface Preparation
   a. Tank parts are to be thoroughly washed (Alkaline at 130 deg F) and rinsed to remove grease, oil and foreign matter.
   b. Parts are then to be immediately oven dried.
   c. Parts are to be grit-blasted to SSPC-SP 10 (Near-White Blast Cleaning) to 1-2 mils profile, minimum.
   d. All parts must be coated by Automated Powder Applicators on both sides within two (2) hours after blasting, and no further processing other then coating application shall be done.
4. Interior Coating
   a. Thermally cured modified epoxy powder, Trico-Bond EP by Columbian TecTank Company (includes underside of the steel floor)
   b. First coat is to be a powder application of NSF approved modified epoxy Trico-Bond EP, 7.0 mils average dry film thickness.
5. Exterior Coating
   a. Thermally cured modified epoxy powder, Trico-Bond EP and acrylic polyurethane by Columbian TecTank Company
   b. First coat is to be a powder application of modified epoxy Trico-Bond EP, 3.0 mils average dry film thickness.
   c. Second coat of acrylic polyurethane, 1.5 mil average dry film thickness.
   d. Coating system to have 4.5 mils average dry film thickness.
6. Curing
   a. Baking ovens to be used after each coat
   b. Initial curing shall take place after powder is applied. A combination of IR boosters and convection ovens will be used to heat parts to approximately 300 deg. F to gel the powder (partial cross-linking).

c. Final curing shall take place after top coat is applied. A combination of IR boosters and convection ovens will be used to heat parts to approximately 350 deg. F for 5-6 minutes to finish curing powder and topcoat.

7. Inspection
   a. MEK rub test to verify proper curing of coating.
   b. Wet sponge test (sponge attached to an electrode with a battery attached and producing a spark, buzzer or bell) to check for holidays (pinhole in coating). Holidays are repaired. 100% of interior sheet coating system is checked for holidays.
8. Preparation for Transport
   a. Material to be marked or tagged with part number for ease of field assembly.
   b. Tank materials to be placed in racks or on pallets to facilitate transportation to jobsite.
   c. Touch-up paint with instructions for application by erection personnel.

E. *Appurtenances*

1. The contractor shall furnish and install the appurtenances as shown in the contract drawings and as specified below. Unless otherwise noted, standard appurtenances shall be as follows:
2. Hatch
   a. The tank roof hatch shall have a curbed, upward opening 24” square.
   b. The curb shall extend at least 4” above the roof surface.
   c. The hatch cover shall be hinged and have provisions for locking.
   d. The hatch cover lip shall extend 2” below the top of the 4” curb.
3. Inlet and Outlet Connections
   a. Inlet, outlet, and overflow connections shall conform to the sizes and locations specified on the contract drawings.
4. Vent
   a. A mushroom screened vent shall be furnished above maximum water level of sufficient size to accommodate normal inlet and outlet flow.
   b. The overflow pipe shall not be considered to be a tank vent.
   c. The vent with stainless steel screen is so designed and constructed as to prevent the entrance of birds, animals, or insects.
5. Flush Cleanout Door/Shell Manway (Optional)
   a. The flush cleanout door shall measure 24” x 46” and be located as shown on the contract drawings.
   b. The shell manway shall have a 36” opening complete with hinged cover, and shall be located as shown on the contract drawings. (Optional)
6. Outside Ladder
   a. An outside galvanized ladder, meeting OSHA specifications, shall be furnished at the location shown on the contract drawings.

7. Guardrail and Toeboards
   a. Galvanized guardrail with toeboard shall be furnished as shown on the contract drawings.

PART 3 EXECUTION

3.1 Installation

A. Erection

1. Field erection of factory coated bolted steel tanks shall be in strict accordance with the tank manufacturers recommendations.
2. Particular care shall be exercised in handling and bolting of the tank plates, supports, and members to avoid abrasion or scratching of the coating.
3. Touch-up coating shall be done in accordance with the tank manufacturer's recommendations where and as directed.

B. Testing

1. Following completion of erection and cleaning of the tank, the tank shall be tested for leachate tightness by filling the tank to it's' overflow elevation.
2. Any leaks disclosed by this test shall be corrected by the erection contractor in accordance with the tank manufacturer's recommendations.
3. The Owner shall provide clean water free of charge at the time of erection completion, for hydrostatically testing the tank.
4. Filling and emptying the tank shall be the responsibility of the Contractor.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

This specification defines the sequence of operation and controls required for the leachate pumps and storage tanks.

PART 2 PRODUCTS

2.1 This specification provides only performance criteria. Contractor shall provide actual system components.

2.2 Contractor shall provide 5 copies of submittals of all system components for review and approval by the Engineer.

2.3 Contractor shall coordinate with Owner and install power supply to the cell leachate sump pumps, the leachate storage tanks, the operations office, and the leachate control building.

2.4 All products, system components, and assembled systems shall be in conformance with all applicable local, State, and Federal regulations, ordinances, codes, laws, and industry standards.

PART 3 GENERAL SYSTEM COMPONENTS AND OPERATION REQUIREMENTS

3.1 Leachate Sumps at Landfill Cells

A system control panel shall be provided at each of the leachate riser location that have the following general components:

A. Time and Date display;
B. Flow meter that displays current and totalized leachate flow;
C. Manual pump on/off control switch; and,
D. Red alarm light display.

3.2 Leachate Sumps Flood Lights

A. Contractor shall provide a flood light near the control panels at the leachate riser locations that have the following general components:
   1. The flood light shall be of a pole type arrangement approximately 12 feet in height or per manufacturer’s requirements. The flood light shall operate on 120 VAC and be provided with automatic dust-to-dawn operation, high pressure sodium and mercury-vapor lights at 150 watts.
   2. Flood light shall be McMaster-Carr part number, 1643K85 or equivalent.

3. The contractor shall provide a step down transformer of 120 volts in the control panel at each of the leachate riser locations.

3.3 Leachate Pump House

A. Contractor shall provide a minimum 10' x 20' leachate pump house at the top of the Leachate Side Slope Risers to each cell.
B. This pump house will provide shelter to workers servicing and monitoring the pumps operation at each cell sump.
C. The pump house shall have temperature controls to maintain temperatures above 50-degrees Fahrenheit and below 90-degrees Fahrenheit year-round.
D. Methane detectors with alarms shall be located in the building.
E. An overhead door will be provided to heavy equipment (e.g., heavy-duty pickup truck, D-3 bulldozer, etc.) can drive into the pump house to support pump serving and removal, as well as leachate line cleanout efforts, as needed.

3.4 Leachate Storage Tanks

A. A system control panel shall be provided at leachate load-out pad that has the following general components:
   1. Time and Date display;
   2. Liquid level in each leachate storage tank and the sump tank;
   3. Flow meter that displays current and totalized leachate flow (pumped out);
   4. Manual cell leachate sump pump on/off control switches; and,
   5. Red alarm light display.

3.5 Leachate Storage Facility Control Building

A. Contractor shall provide a minimum 30'x20' prefabricated building with concrete slab at each Leachate Storage Facility, to contain the main leachate control panel. This building shall be appropriately heated, cooled, ventilated, and secured. The leachate control building shall have a master control panel that allows for full and complete control of the leachate pumping and storage system, associated with that leachate storage facility.
B. The master control panel shall have the following components:
   1. Time and Date display;
   2. Liquid level in each leachate storage tank and the sump tank;
   3. Flow meters that display current and totalized leachate flows into and out of leachate tanks;
   4. Manual cell pump on/off control switches; and,
   5. Red alarm light display.

3.5 System Operation

A. Leachate Sump Pumps

1. The leachate pumps shall be equipped with transducers to measure the depth of leachate build-up in the cell sump.
2. When the depth measured in the cell sump reaches a depth of 2.5 feet, the leachate pump shall automatically be turned on.
3. If the depth measured in the cell sump reaches a depth of 3.0 feet, a high-level alarm will be triggered and the autodailer will contact the landfill manager.
4. When the leachate level in the sump reaches a depth of 9 inches, the leachate pumps shall be automatically turned off.
5. If automatic pump on and off events fail, the red alarm light shall turn on, and the system shall activate an auto-dialer to alert a landfill on-call employee by pager or cell phone.

B. Leachate Tanks

1. The leachate tanks shall be equipped with a float system to monitor the liquid level in each tank.
2. When the level in either tank reaches a depth of 33 feet, the red alarm light shall light, and the system shall activate an auto-dialer to alert a landfill on-call employee by pager. This is the High Level Alarm.
3. When the level in either tank reaches a depth of 37 feet, the red alarm light shall light, the leachate pumps shall automatically be turned off, and the system shall activate an auto-dialer to alert a landfill on-call employee by pager. This is the High-High Level Alarm.
4. When the level in either tank reaches a depth of 40 feet, the red alarm light shall light, the leachate pumps shall automatically be turned off, and the system shall activate an auto-dialer to alert a landfill on-call employee by pager. This is the Overflow Level Alarm.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. This specification is provided to the CONTRACTOR to define the sequence of operation and controls interconnection between the leachate cell pump and leachate storage tanks.

1.2 Related Sections

A. Section 02220 - Excavation
B. Section 13214 - Leachate Pumping and Storage Control System

PART 2 PRODUCTS

Not Used.

PART 3 INSTALLATION METHODS

3.1 Description

Each cell in the Rubble Landfill shall have one sump, each with one (1) primary leachate pump. Contractor shall provide a second leachate pump for each cell at the time of construction, to be stored in the pumphouse for ready installation when the primary pump is swapped out for service or repair. Each pump shall have three (3) modes of operation.

1. Empty cell - (semi-automatic)
2. Working or full cell (automatic)
3. Off - the pump may be "off" for servicing or operational problems

Semi-Automatic
The purpose of the semi-automatic mode is to allow rainwater to be pumped from an inactive cell approximately twice per week. This mode of operations shall be controlled by a seven-day time clock. An inactive cell's pump mode switches are to be left in the semi-automatic mode.

Automatic
When a new cell is opened, its pump mode switches are set to automatic. This mode automatically starts each pump to run until “dry” (i.e., liquids level are at the pump intake level). This allows the leachate accumulated in the cell to be pumped out until pumpable leachate is removed. In automatic mode, each pump is also regularly restarted with the pump controller's capability of providing an adjustable preset time period from six (6) minutes to four (4) hours. Adjustment will be required to initially set

the preset time and to change this time period based on cell's production of pumpable leachate.

General Information
All leachate pumps are disabled if a high-high level condition in the associated leachate storage tanks occurs, and are enabled for semi-automatic or automatic operation with no alarms are at the tanks. Alarm indicators for the cell pumps are reported on the system duplicate control panel at the Leachate Storage Facility Control Building.

3.2 Leachate Storage Tanks

A. During normal leachate pumping operation to the leachate storage tanks, one of the two inlet valves (Valves V-104 or V-204) is open and the other is closed.

B. When high level, high-high, or overflow level alarm is reached, an alarm signals the auto dialer to dial the pre-programmed series of telephone numbers using a pre-programmed message that an alarm has been triggered.

C. If a high-level alarm occurs in either holding tank, the auto dialer is activated and the appropriate inlet valve closes (V-104 or V-204) and the appropriate inlet valve opens to direct flow to the second holding tank.

D. Cell pumps are automatically shut-off if any of the following conditions occurs:

1. A high-high level condition in either of the leachate storage tank occurs;
2. A high level alarm occurs in both leachate storage tanks; or,
3. Overflow into secondary containment occurs.

E. Both outlet valves (Valves V-105 and V-205) remain closed under normal operations. The outlet valves are only opened upon command of the loadout truck operator.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Scope of Work

A. The CONTRACTOR shall furnish and install Pump Houses located on the landfill perimeter berm top width, perpendicular to each cell sump, as shown on Permit Drawing. Each Pump House shall have appurtenances consisting of, but not limited to, the following:

1. Two (2) electric submersible pumps, complete with flexible hoses, disconnects, and stainless steel pulling cables.
2. Lower level (with leachate leak detection device) and force main connection.
3. Pump control panel.
4. Stainless steel pipe and fittings, including, bends, tees, check valves, shut-off ball valves, and supports for pipes and fitting, as required.
5. All related electrical work and accessories, including junction boxes.

B. The Pump Manufacturer shall furnish a Pump Control Panel, with equipment specified under Specifications Section 02652.

1.2 Submittals

A. *Shop Drawings*

Submit the following Shop Drawing information to the QAC for approval, prior to fabrication.

1. Cell Leachate Pump House
    a. The CONTRACTOR shall submit detailed drawings showing Pump House layout. Detailed layout shall include all items required to construct the Pump House, including the locations of pump, carrier pipes, pipes, pipe connections, doors, and other required appurtenances.
    b. Submit Pump Manufacturer's Literature for all pumps and required equipment, including, but not limited to the following.
        1) Pump and motor performance curves, including NPSH, efficiency, horsepower, impeller size, and pump materials of construction for all fluid contact parts, mechanical seals, packings, and shafts.
        2) Pump outline drawing.
        3) Detailed electrical drawing.
        4) Typical installation guides.
        5) Technical manuals.
        6) Parts list.
        7) Printed warranty.
        8) Manufacturer's equipment storage recommendations.

9) Manufacturer’s standard recommended start-up report form.

2. Pump Control Panel
   a. The CONTRACTOR shall submit a detailed panel layout and electrical diagrams showing the panel enclosure, panel face and wiring diagrams to the QAC for approval prior to fabrication. Detailed wiring diagrams shall show point-to-point wiring information, including wire and terminal numbering system. Field connections shall be clearly denoted. Submit detailed layout of panel face and internals. Detailed layout shall indicate the location of each control and electrical component, including relays, transformers, panel displays, controllers, breakers, and other required items.
   b. Submit supplier’s product data for all controls and electrical components including:
      1) Panel displays.
      2) Relays.
      3) Power conditioners.
      4) Control power transformers.
      5) Panel heaters.
      6) Circuit breakers.
      7) Switches, push buttons, lights, etc.
      8) Panel Enclosures
      9) Other electrical components as specified in Section 16050.
3. Piping and valves.
   Submit supplier’s product data including:
   a. Ball valves, check valves, electric actuators.
   b. Piping, tees, all fittings.
4. Level Sensor and level display.
   Submit Pump Manufacturer’s product data including:
   a. Equipment supplier cut sheets.
   b. Mounting requirements.
   c. Instrument manufacturer’s specifications.
   d. Wiring and power requirements.

B. *Manufacturer’s Pump Operation and Maintenance Manual*
1. Include record copies of the Shop Drawing information to be provided in accordance with Part 1.2A of this Section.
2. Submit Pump Operation and Maintenance Manual, containing the following minimum information:
   a. Installation guide.
   b. Technical manuals.
   c. Parts list.
   d. Printed warranty.
   e. Manufacturer’s equipment storage recommendations.
   f. Manufacturer’s standard recommended start-up report form.

3. Pump Manufacturer's Sample O&M Manual is provided in Section 10.0, Appendix A.

C. *Submit in accordance with Section 01300.*

1.3 Quality Assurance

A. The Leachate Pump House and Pump Control Panel shall be designed to meet all applicable Codes, Laws, and Regulations.

B. All electrical materials and equipment shall bear the label of Underwriter's Laboratories, unless material and equipment is of type for which Underwriter's Laboratories do not list or provide label.

C. Start-Up Service
The CONTRACTOR shall provide Pump Manufacturer's representative services at the Site to inspect the installation and instruct the OWNER's personnel on the operation and maintenance of the pumps and appurtenances.

D. During the initial inspection, the Pump Manufacturer's service representative shall review recommended operation and maintenance procedures with the OWNER's personnel.

PART 2 PRODUCTS

2.1 Leachate Pump Houses

Leachate Pump Houses shall be constructed to meet dimensional and material requirement specified on Drawing 26. Shop drawings (per Part 1.2A of this Section) shall be signed and sealed by a Professional Engineer, registered in Maryland.

2.2 Submersible Pumps

A. *Manufacturer* – All submersible pumps shall be manufactured by EPG Companies. Pump sizes were determined per description in Specifications Section 02652. Pump(s) to be installed in each landfill cell are shown on Contract Drawings.

B. *Requirements* – Furnish and install pump(s) in each cell sump per Specification Section 02652. Pumps shall be provided with equipment specified in Specification Section 13215.

2.3 Pump Control Panel

A. Pump Control Panel, in accordance with Pump Manufacturer's Literature, shall be mounted inside the associated Cell Leachate Pump House.

B. The controls and electrical equipment shall be housed in a NEMA 4X enclosure.

PART 3 EXECUTION

A. All installation procedures for Leachate Pump House, pumps, couplings, valves, controls, pipes, and electrical equipment shall be per Pump Manufacturers' recommendations.

B. All wire and cable for pumps and floats shall be arranged in an organized manner, and hung from a coated rack. Locations of rack, floats, and level transmitter shall be accessible without confined space entry.

C. Install pipe, fittings, and all appurtenances in accordance with recognized industry practices achieving permanently leak-proof piping systems, capable of performing each indicated service without piping failure. All joints shall be installed in accordance with the following:

1. Welds shall be sound and free from embedded scale of slag, have tensile strength across weld not less than that of thinner of connected sections, and be watertight.
2. Use butt-welds for welded joints in the pipe assemblies and fabrication of bends and other specials.
3. Use filled welds for flange attachment, in accordance with AWWA C207.
4. Conform field welding of joints and preparation of pipe ends to AWWA C206 and ASTM A139.

D. The CONTRACTOR shall make all electrical power and control wiring connections between all new and existing electrical distribution equipment, control panels, and equipment. All work shall be performed in accordance with all applicable Codes and Regulations. The CONTRACTOR shall schedule all required inspections, and obtain all required permits.

E. All piping shall be pressure tested in accordance with Section 02650.

F. Upon completion of the installation, all circuits, control systems and devices, including pumps, sensors, and all alarm condition signals, shall be tested in the presence of the QAC by the CONTRACTOR. All apparatus shall be cleaned, adjusted, and made ready for operation after testing. The CONTRACTOR shall make such changes in wiring or connections and such adjustments, repairs or replacements as are necessary to make the circuits, device or control system to function as specified and otherwise comply with the specifications or data on Permit Drawings. The CONTRACTOR shall supply all necessary material, labor, and equipment for these tests.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description

A. CONTRACTOR shall furnish and install work specified in this Section, including:
1. Thermal insulation for piping and storage tank.
2. Electrical heat tracing temperature controllers to the extent indicated in the Contract Documents and this Section.

1.2 References

A. National Fire Protection Agency (NFPA) Standards
1. NFPA 255 Method of Test of Surface Burning Characteristics of Building Materials

B. National Electric Code (NEC)
C. American Society of Testing and Materials (ASTM)

1.3 Quality Assurance

A. Insulation products shall be NFPA rated materials having a Flame Spread Rating not exceeding 25 and Smoke Developed Rating not exceeding 50.
B. Installation shall be performed by workers skilled in the fitting and installation of heat tracing and insulation products.

1.4 Submittals

A. *Shop Drawings*:
1. Submit manufacturer's installation instructions, catalog cuts, performance data, and all other information required to demonstrate compliance with the Contract Documents. Provide product data for all components including insulation, heat tracing, temperature controllers, support pins, and bands. Provide the following information:
a) Materials of construction.
b) Thicknesses.
c) Thermal conductivity and water permeability.
d) Power requirements and ratings.
e) Temperature ratings.
f) Certification of hazardous classification ratings.

B. *Samples*
1. Not Required

C. *O&M Manual*
1. Include record copies of the Shop Drawing information to be provided in accordance with Part 1.4A of this Section.

D. *Submit above in accordance with Section 01300.*

PART 2 PRODUCTS

2.1 Pipe Insulation

A. *Materials*

1. Premolded fiber glass thermal insulation in accordance with ASTM Standards, fabricated for standard pipe sizes, fittings and valves. Fiberglass insulation shall be rigid one-piece construction with jacket constructed of high density, white kraft bonded to aluminum foil, reinforced with fiberglass yarn.
2. Maximum thermal conductivity of 0.28 BTU.in/h.ft 2.F at 75 degrees F in accordance with ASTM C335.
3. Maximum water vapor permeability of 0.02 perm-in when tested in accordance with ASTM E96.
4. Meet NFPA fire safety requirements.
5. Utilize installation adhesives and joint sealants as recommended by the insulation manufacturer.
6. For all piping, install minimum of 24 gauge stainless steel jacketing over insulation. Retain jacketing by stainless steel bands.
7. Insulation products shall be Schuller, CertainTeed, Knauf, Owens-Corning, or equal, as approved by the DESIGNER.

B. *Description*

1. Insulate and heat trace all outside aboveground piping, valves and fittings and all piping less than 4 feet below grade.
2. Piping insulation thickness shall be minimum of 1-1/2-inches.

2.2 Electric Heat Tracing

A. *Self-Regulating Heat Tracing*

1. 16 AWG copper bus wire with self-regulating, semi-conductive core
2. Stainless steel overbraid over bus wire and core
3. Thermoplastic jacket over shield
4. Nominal wattage of 5 watts/foot at 50 degrees F. Maximum temperature shall not exceed recommended operating temperature of pipe.
5. Nominal service voltage is 120 volts AC unless noted otherwise
6. Coordinate circuit sizing with available electrical circuits shown on the Contract Drawings
7. Provide power connection kits, splice kits, end seals and other accessories required for a complete operating system. Electrical accessories shall meet requirements for Division I, Class II, Groups C and D hazardous locations.

8. Provide aluminum tape under and overheat tracing to be installed on pipes.
9. System shall be designed, and installed for Division I, Class II, Groups C and D hazardous locations.
10. Heat trace system shall be suitable for FRP piping systems.
11. Heat trace all outside above ground condensate piping, valves, fittings.
12. Heat trace system shall be BriskHeat, Raychem, Thermon, or equal.

B. *Temperature Controllers*
1. Nominal service voltage is 120 volts AC unless noted otherwise
2. Temperature controller shall be epoxy-sealed and installed for Division I, Class II, Groups C and D hazardous locations.
3. Setpoint shall be preset and have an operating range of 45 F to 55 F.
4. Temperature controller shall have a power rating of up to 120/240Volts AC at 25 amps.
5. Provide temperature controllers in accordance with the following schedule:

Controller	Equipment
One	Aboveground leachate piping outside Leachate Pre-Treatment Building
Two	Aboveground leachate piping at Leachate Storage Tank

6. Temperature controllers shall be BriskHeat, Raychem, Thermon, or equal.

PART 3 EXECUTION

3.1 Pipe Insulation

A. Install on all above-grade piping.
B. Insulation shall be installed in accordance with manufacturer's recommendations.
C. Seal edges of pipe insulation with approved plastic and/or sealant to create water-proof and vapor-proof seals.
D. Insulation bonding must be by glue, self-adhesive lap or tape. Staples are not permitted. Seal all vapor barrier punctures.
E. Surface to be insulated shall be clean and dry during installation.

3.2 Electric Heat Tracing

A. Install heat tracing in strict accordance with the heat trace manufacturer's and pipe manufacturer's instructions prior to insulation.
B. Spiral heat tracing around pipe to equalize distribution of heat. Provide additional heat trace around valves and fittings as required to attain wattage densities noted.

C. Provide additional wattage for valves and fittings in accordance with the manufacturer's instructions.
D. Secure heat trace cable to piping and components.
E. Coordinate heat trace installation with the electrical work.
F. Provide aluminum tape under and over heat trace.
G. Provide markers cautioning "DO NOT CUT INSULATION - ELECTRIC HEAT TRACING - SHOCK HAZARD". Apply markers per manufacturer’s installation instructions.

3.3 Temperature Controllers

A. Install heat tracing in strict accordance with the manufacturer's instructions prior to insulation.
B. Secure temperature controllers to equipment.
C. Provide separate circuit breaker for each temperature controller. Coordinate with electrical work.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, material, equipment, tools, and appurtenances required to setup and install all electrical components presented on the Permit Drawings, mentioned herein, or both. The CONTRACTOR shall provide a "Competent Person" to implement, supervise, and inspect all Work.

B. The CONTRACTOR shall comply with all applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities having jurisdiction. The CONTRACTOR shall also comply with all applicable health and safety regulations as required by OSHA and in accordance with the CONTRACTOR's Health and Safety Plan and basic electrical requirements specifically applicable to Division 16 – Electrical, in addition to Division 1 - General Requirements.

1.2 Submittals

Submit under provision of Section 01300 of these specifications.

1.3 Regulatory Requirements

A. Conform to applicable Federal, State, and local Building Codes.
B. Electrical: Conform to NFPA 70.
C. Obtain permit, and request inspections for authority having jurisdiction.

1.4 Project/State Conditions

Install Work in locations shown on the Permit Drawings, unless prevented by project conditions.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used

***** END OF SECTION *****

a Montrose Environmental Group company

SECTION 15

CLOSURE AND POST-CLOSURE PLAN

CLOSURE AND POST-CLOSURE PLAN

FOR
CHESAPEAKE TERRACE RUBBLE LANDFILL
ANNE ARUNDEL COUNTY, MARYLAND

PREPARED FOR:

National Waste Managers, Inc.
2900 Linden Lane
Silver Spring, MD 20910

PREPARED BY:

ADVANCED GeoServices
a Montrose Environmental Group company

1055 Andrew Drive, Suite A
West Chester, PA 19380

PROJECT NO. 2018-3854 **JULY 2020**
Revised September 3, 2021

a Montrose Environmental Group company

TABLE OF CONTENTS

LIST OF TABLES

15.0 CLOSURE AND POST-CLOSURE PLAN

15.1 Closure

15.1.1 General

This Closure and Post-Closure Plan for the Chesapeake Terrace Rubble Landfill has been prepared in accordance with the requirements of COMAR 26.04.07.21-22 Regulations closure of sanitary landfills.

This Closure and Post-Closure Plan describes the closure sequencing, Final Cover, Closure Cap, erosion and sedimentation control, and maintenance of the completed Closure Cap system for the Chesapeake Terrace Rubble Landfill. The closure has been designed to minimize long-term maintenance and minimize infiltration of precipitation into the rubble landfill and other adverse environmental impacts.

The Construction Quality Assurance (CQA) Plan and the Technical Specifications for the materials to be used in the closure construction are provided in Sections 13 and 14, respectively, in the Phase III Application.

A deed notification shall be placed on the property at the time of permitting indicating that the land has been used as a solid waste disposal site. Any future use of the land is restricted, and requires MDE pre-approval.

15.1.2 Closure Activities

15.1.2.1 Closure Plan Time Frame

The landfill, Cells 1-16 will be closed as each cell, or group of cells, reaches its top of waste elevations as shown on Drawings 30 and 31. The Final Cover and Closure Cap system details are provided on Drawings 34 and 35. The size of the individual cells was selected to optimize the floor grading and the disposal volume. The cells designated as Cells 5A through 5F are considered and will function as individual cells, each with their own sump. Cells 1, 7 and 10 are larger and the owner/operator may choose based on waste filling rates to divide these cells into subcells at a later date for operational considerations, but will only do so with prior approval from MDE.

The 24-inch (min.) thick Final Cover shall be placed within 30 days of waste levels reaching the Top of Waste grades presented on Drawings 30 and 31. Installation of the Closure Cap shall begin no later than six (6) months after reaching the Top of Waste grades and shall be completed no later than thirty-six (36) months from the date of completion of the final lift. The area shall be permanently vegetated within 30 days after the final earthen cover is placed. Temporary seeding or stabilization to meet the requirements of the AASCD (see Drawing 62). The designated life span for filling of the landfill is 12 years. Closure of the each landfill cell can begin when the cell reaches its top of waste elevations as presented on Drawing 30 and 31. The current vision of the sequencing is as follows:

- Beginning in the East Section, Cells 11, 16, 12, 13, 14, and 15.

- In the West Section, Cells 2, 3, and 4; Cells 1, 5E and 5F; Cells 10 and 5D; Cells9 and 5C; Cells 8, 5A and 5B; Cell 6 and 7.

More details of the envisioned sequencing are discussed in Section 7.0 of the Phase III Application and Drawings 64 through 81.

Though this permit is for the operation and closure of the entire Chesapeake Terrace Rubble Landfill (East Section and West Section), the East Section may complete final closure and enter into its post-closure period independent of the West Section.

15.1.2.2 Closure Performance

The landfill closure design system isolates the rubble waste from the surrounding environment to minimize infiltration of surface water into the landfill and erosion/sedimentation of the closure area. The erosion and sedimentation controls, such as the erosion control benches, sedimentation ponds, seeding, and downchutes, will be constructed as the completed Closure Cap advances.

15.1.2.3 Inventory Removal and Disposal

The rubble waste landfill equipment should not require decontamination and all routine equipment maintenance would be performed in a manner so as not to result in adding waste to the rubble landfill. All lubricants, fuel, waste oil, and other residues will be properly managed and disposed at an approved off-site facility. All landfill equipment and temporary structures used during normal operations will be removed after their usefulness ends.

15.1.2.4 Closure of Surface Impoundments

The sediment and stormwater management basins constructed as part of the rubble landfill construction will remain after closure. During landfill operations and through Closure Cap construction, the basins will serve in a sediment control capacity. After completion of the Closure Cap construction, the basins will remain to serve as supplemental stormwater management basins to mitigate peak stormwater runoff from the landfill.

15.1.2.5 Closure Cap Design

The closure operation will be performed progressively as each landfill construction phase is completed to fulfill the design requirements depicted in the project design plans and the description below:

- The top of waste elevations are designed to ensure that storm water runoff occurring after addition of the 24-inch (min.) thick Final Cover and 24-inch (min.) thick Closue Cap will be directed to sediment and stormwater basins around the north and east side of the landfill. The drainage areas have been designed to minimize erosion of the landfill following closure. The maximum closure side slopes have been designed not to exceed 4H:1V (Horizontal:Vertical);
- As the rubble material reaches the top of waste grades shown on Drawings 30 and 31, the rubble will be covered with (from top to bottom):

- 6-inch thick layer of vegetative support layer (topsoil or other material capable of supporting vegetation);
- 18-inches of protective cover soils, with a permeability not exceeding $1x10^{-5}$ cm/sec;
- A geocomposite drainage layer, with a triplanar drainage net and 8 oz./s.y. nonwoven geotextile heat-bonded to both sides; and,
- 40-mil textured on both sides, linear low density polyethylene (LLDPE) geomembrane with a permeability less than or equal to 1 x 10^{-10} cm/sec.
- 24-inch layer of intermediate cover.

- Erosion control terraces have been designed into the final cover every 30 (max) vertical feet (120-feet of slope). Downchutes direct the surface water runoff from the erosion control terraces to one of the sediment and stormwater management basins surrounding the landfill.

Construction quality assurance and quality control (QA/QC) procedures for the geosynthetic and soil components of the closure cap system are presented in the Construction Quality Assurance (CQA) Plan (See Section 13 of the Phase III Application). Closure material descriptions and construction methods are included in the project Technical Specifications (see Section 14 of the Phase III Application).

15.1.2.5.1 Erosion and Sedimentation Control Plan

An Erosion and Sedimentation Control Plan, prepared by Century Engineers, was approved by the Anne Arundel Soil Conservation District (AASCD) on April 26, 2010. A revised version of the Erosion and Sedimentation Control Plan is being finalized and submitted to the AASCD concurrently with this revised Phase III Permit Application. Proof of AASCD approval of the revised Erosion and Sedimentation Control Plan will be forwarded to MDE as soon as it is received.

The revised Erosion and Sedimentation Control Plan is prepared to manage surface water, minimize soil erosion, and control sedimentation during construction, operation, and closure. The Erosion and Sedimentation Control Plan was developed following the requirements of the COMAR Regulations for Rubble Landfills and the 2011 Maryland Specifications for Soil Erosion and Sediment Control.

The revised Erosion and Sedimentation Control Plan includes the following:

- The landfill final closure design grades, developed to minimize erosion and subsequent soil loss;
- Erosion control terraces, designed into the final cover every 30 vertical feet (120-feet of slope).
- Downchutes to direct the erosion control bench terrace water flow off of the final cover to one of the sedimentation basins surrounding the landfill;(details shown on Drawings 41 and 42);
- A total of 24-inches of Closure Cap soils (combined thickness of protective cover soil and vegetative support layer) to be placed and seeded for stabilization;
- Runoff concentration areas, such as downchutes have been designed

with energy dissipaters and erosion control structures as shown in plan on Drawings 38 and 39 with details shown on Drawings 41 through 43;

- Temporary and permanent drainage channels, designed to route surface water runoff from disturbed and closed areas and run-on from upgradient areas;
- Culverts, designed to pass drainage under access roads (Drawing 44); and,
- Sedimentation basins, designed to collect surface water runoff, control sediment, and discharge to natural watercourses.

The erosion and sedimentation controls will be constructed in phases as landfill construction and closure progresses. Calculations for the erosion and sedimentation control diversion and collection systems are included in the Design Report.

Erosion and sedimentation control details and notes, updated to meet the requirements of the 2011 Maryland Specifications for Soil Erosion and Sediment Control, are included in the Soil Erosion and Sediment Control Drawings (Drawings 60 and 61).

15.1.2.5.2 Settlement Subsidence and Displacement

The base grade settlement analyses indicate a potential differential settlement of <18 inches beneath the point of maximum refuse height and the perimeter of the landfill. This differential settlement of the base grade should not cause any adverse impacts of the integrity of the geosynthetic liner. The minimum design base grade slope is sufficient to maintain a two percent (2%) slope after settlement occurs. Specifically, the minimum grade at the time of construction is three percent (3%).

The Final Cover and Closure Cap system will experience some settlement relative to the base grade settlement due to waste consolidation. In the event that non-uniform settlement occurs, minor regrading and repair of the soil component above the closure geosynthetics may be required. However, the effectiveness of the closure geomembrane and drainage geocomposite should not be reduced since the synthetic components are flexible. They will retain their integrity under minor differential settlement, which further supports their selection for the barrier layer of the closure cap system.

Landfill slope stability analyses have demonstrated that the landfill slopes and perimeter berms are stable for both static and pseudo-static (i.e., seismic) conditions. The detailed calculations are provided in Section 9.0, Attachment 9J of the Phase III Permit Application.

15.1.2.5.3 Freeze - Thaw

The regional depth of frost penetration is 10 inches per the publication, “Evaluating Cover Systems for Solid and Hazardous Waste” (USEPA September 1982). The extreme depth of frost penetration in the Anne Arundel County, Maryland area is approximately 20 inches for the 5 year return period and 25 inches for the 10 year return period per the “Atlas of Soil Freezing Depth Extremes for the Northeastern United States (the Northeast Regional Climate Center, March 1996). The cover soil depth over the geosynthetic components of the Closure Cap is 24 inch thickness, which includes a minimum six inches of topsoil.

Since the extreme depth of frost is less than the cover soil thickness, the integrity of the composite closure cover will not be damaged by frost action.

15.1.3 Groundwater Monitoring System

The permanent groundwater monitoring system consists of six (6) upgradient and twenty-six (26) downgradient wells in the Unconfined WBZ. Sampling of the groundwater monitoring wells will continue throughout the closure period. Annual and semi-annual groundwater monitoring reports will be submitted to the MDE. Specific details of the groundwater monitoring system and methods are presented in the Groundwater Monitoring Plan, included in Section 16 of the Phase III Permit Application.

15.1.4 Leachate Collection System

The leachate collection system within the landfill area consists of a high permeability, high flow geocomposite drainage layer overlain by 24-inch thickness of sandy soils. The leachate will be collected into the leachate collection sumps and pumped to the on-site leachate storage tanks and subsequently transported by tanker truck to a water treatment facility. The off-site treatment/disposal facility will be Environmental Recovery Corporation (ERC) located in Baltimore. NWM may elect to utilize alternate treatment/disposal facilities, but will notify MDE in advance when or if such a change is made. Depending on the volume and characteristics of leachate being generated, NWM may pursue an on-site treatment alternative. If such an alternative is chosen, NWM recognizes that it will be subject to MDE permitting and approval processes including industrial NPDES permitting and modification of the landfill permit.

The flow of leachate through the closed landfill was modeled with the “Hydraulic Evaluation of Landfill Performance” (HELP) computer simulation developed by the US Army Engineer Waterways Experiment Station. Design details of the leachate collection system are shown on Drawings 17 through 21.

15.1.5 Gas Collection System

Some of the rubble waste is organic and degrades to produce landfill gas. The management of the landfill gas is described in the Chesapeake Terrace Landfill Gas Management Plan (LFGMP) (Section 11 of the Phase III Permit Application). The LFGMP has been prepared assuming that sufficient degradable organic waste is disposed in the landfill and warrants the use of an active landfill gas collection system configuration. Vertical wells will be constructed as shown on Detail 2 of Drawing 88. The landfill gas wells will be situated as shown on Drawings 86 and 87. The headers and laterals required for operation of an active gas recovery system are situated below the Closure Cap geomembrane, therefore; they will be installed prior to capping. The header pipe will include condensate drains tied into sumps set into the waste at locations that coincide with low points in the header pipes (See Detail 4 on Drawing 88). The LFGMP also requires gas monitoring probes located around the perimeter of the waste disposal areas. Gas monitoring probes will be installed in accordance with Detail 3 on Drawing 88.

These probes will be routinely monitored and the results will be reported to the MDE. If actual landfill gas monitoring determines that explosive gases generated by the facility do not exceed 25 percent of the lower explosive limits for the gases in facility structures, and the lower explosive limit for the gases at the property boundary, then the facility may request MDE approval to operate the landfill gas system as a passive system instead of an active system (See Section 11 for additional details).

15.1.6 Schedule for Closure

The rubble waste cells will be developed in a staged manner and closure construction will be conducted as part of normal operating procedures. Final closure will begin after the rubble in each cell is brought to final grade.

Beneficial use of the rubble waste may extend the life of the rubble landfill. Sedimentation and stormwater management basins, intermediate terraces, downchutes, and permanent perimeter channels will remain following landfill closure. The groundwater monitoring system will remain in-place during the closure and post-closure periods.

15.1.7 Posting

One sign will be posted at the site entrance to the rubble landfill notifying all persons of the final closure of the landfill, and prohibition against further receipt of rubble. Unauthorized access to the site will be controlled by a fence and gate. A locked gate at the landfill entrance will prohibit entry to the site after closure. Other signs shall be posted on the perimeter fence at intervals and with information required by other sections of the Phase III Report.

15.1.8 Notification

The facility will be used primarily for the disposal of rubble waste from the State of Maryland. The operation of the landfill is established as 12 years. The closure operations will proceed as an ongoing operation of landfill operation. The landfill filling sequence described on Drawing 63 and the construction/filling stages are depicted in Section 7 of the Phase III Report. Permit Drawings 36 and 37 depict the Top of Final Cover grades for the west and east sections, respectively.

As described in COMAR 26.04.07.21 the construction of the Closure Cap will begin no later than 24 months from the date of completion of the final lift of the landfill and will be completed no later than 36 months from the date of completion of the final lift of the landfill. The 24-inch (min.) Thick Final Cover Layer must be placed within 90 days after placement of the final waste lift. An updated Closure and Post-Closure Plan will be provided to the MDE at least 180 days prior to the cessation of the waste disposal and the landfill will be closed in accordance with the approved closure plan. MDE will inspect the closed facility prior to entering into post-closure.

The Construction Quality Assurance (CQA) Plan and the Technical Specifications for the materials to be used in the closure construction are provided in Sections 13 and 14, respectively, in the Phase III Permit Application.

Within 90 days after completion of the cap NWM will submit a final report, including certified as-built plans, to MDE for approval. This report will certify that the closure of the landfill or cell was completed in accordance with the closure plan, the construction quality assurance plan, construction specifications, and Permit Drawing Sheets. The final report will be certified by a construction Quality Assurance Consultant's professional engineer, registered in Maryland, that the closure construction and the final report meet the requirements of the solid waste permit and regulations.

15.2 Post Closure

15.2.1 Post-closure Contact

The post-closure contact for the rubble waste landfill will be as follows:

Emergency Coordinator
Stephen N. Fleischman, Vice President
National Waste Managers
c/o The Halle Companies
2900 Linden Lane, Suite 300
Silver Spring, MD 20910
(301) 495-1520
(301) 495-9452 Fax
(301) 370-6301 Cell
sfleischman@hallecompanies.com

MDE will be notified if the above information changes.

15.2.2 Security

The landfill entrance/exit gate will be locked when the landfill is closed. No waste will remain exposed after completion of the landfill closure. Although the site will be closed to the public and has no planned alternate end use, the closed landfill will not pose a health hazard in the event that the public or domestic livestock accidentally wander onto the landfill property.

15.2.3 Post-Closure Maintenance Plan

Inspection of the closed landfill facility will be conducted by NWM personnel or their designee(s) to detect deterioration of the facilities. Any damage to facilities will be repaired to maintain the erosion control facilities and prevent a breach of the containment structures. Table 1 includes a schedule for inspection and maintenance and Table 2 includes an inspection checklist.

15.2.3.1 Leachate Collection System

The leachate collection system will require little maintenance during the post-closure period as it will be completely buried by the waste. The sump pumps within the cells will require monitoring and regularly scheduled maintenance. The automatic controls tied to the leachate sump pumps should alert the post-closure maintenance contractor if the system is not performing as it should, through its auto-dialer mechanism. Service to the auto-dialer may be provided through traditional landlines or internet-based service, if available. The leachate collection system will be maintained in an operational state throughout the post-closure period.

15.2.3.2 Leachate Storage System

Initially, during the post-closure period, the leachate storage tanks will be inspected weekly to review the following conditions:

- Determine the liquid levels in the tanks;
- Inspect for possible leaks from the tanks, or corrosion that could jeopardize tank integrity;
- Check for accumulated water in the secondary containment walls; and,
- Assess the performance of the automated controls tied to the sump pumps still in operation in the cells.

The automatic controls tied to the leachate storage system should alert the post-closure maintenance contractor if the system is not performing as it should, through its auto-dialer mechanism.

The frequency of inspections may be reduced with MDE approval over the post-closure period as the generation of leachate dwindles in the last operated cells.

15.2.3.3 Security Devices

Security controls such as locks, gates, and fencing will be inspected on a monthly basis. Security locks will be replaced immediately if damaged. Perimeter fencing will be repaired by a contractor or site personnel after a need has been identified.

15.2.3.4 Erosion Damage

Erosion damage to the vegetative support layer on the final cover system will be repaired when the gullies are greater than six inches deep. The eroded areas will be filled with soil capable of sustaining vegetative growth. The soil surface will then be seeded, fertilized, and mulched to reestablish vegetation. Topsoil used to make erosion repairs will be stockpiled on-site. Straw mulch or other suitable material will also be stored on-site or brought in as required.

The cause of the erosion will be evaluated and a permanent remedy implemented. Possible causes of erosion include:

- Settlement of stormwater channels, allowing overtopping or flow outside of the channel
- Differential settlement of the cover, depressions.

15.2.3.5 Settlement, Subsidence, and Displacement

In areas where settlement, subsidence, or displacement has occurred, the area will be filled with soil and regraded to re-establish the design grades in the surrounding area or re-establishing positive drainage of the area. A stockpile of soil will be maintained on-site during post-closure for repairs. The soil surface will then be seeded, fertilized, and mulched to reestablish vegetation.

15.2.3.6 Run-on and Run-off Control Structures

Routine maintenance of run-on and run-off control structures include cleaning sediment from structures such as ditches, culverts, sedimentation ponds, down-chutes, and, pond outlets. Repair of these structures will typically be performed by outside contractors who will bring in heavy equipment such as backhoes, dump trucks, dozers, and scrapers. Materials such as silt fence, straw bales, and soil will be kept on-site to implement short-term repairs while waiting for permanent repairs.

15.2.3.7 Groundwater Monitoring Wells

Routine maintenance of groundwater monitoring wells such as replacing locks and regrading of soil areas around the wells will be performed by NWM personnel or their designee(s). Other maintenance work such as protective casing repair, well replacement, and repair of sampling pumps will be performed by specialty contractors.

15.2.4 Inspection Plan

Inspection of the closure cap system, drainage system, and monitoring well system will be performed semi-annually and after major storm events for at least five years. Inspection reports will be submitted to MDE within 60 days of the inspection. Inspection of the closed landfill facility will be conducted by NWM personnel or their designee(s) to detect any deterioration of the facilities. Any damage to facilities will be repaired to maintain the erosion control facilities and prevent a breach of the containment structures. Table 15-1 is a Post-Closure Inspection Schedule.

15.2.5 Post-Closure Monitoring Plan

15.2.5.1 Water Quality Monitoring

Water quality monitoring will occur throughout the five year post-closure period and includes groundwater monitoring wells and the stormwater management basins. The groundwater monitoring requirements are included in the Groundwater Monitoring Plan in Section 16 of the Phase III Permit Application. Any requirements for sampling of the surface water sedimentation basins will be a requirement of the Construction NPDES Permit.

15.2.5.2 Gas Control Monitoring

The landfill gas perimeter probes, wells, collection pipes, and flare system will be monitored as described in the in the Landfill Gas Management Plan in Section 11 of the Phase III Permit Application.

15.2.6 Post-Closure Uses

After closure, the landfill will be maintained as grass-covered. Development of the area for uses other than passive recreation will be determined at the time of the closure, and will be subject to MDE approval.

15.2.7 Vegetation Mowing

During the first year of closure, the rubble landfill will not be mowed in order to allow the vegetation to fully establish. After the first year of vegetation growth, the disposal facility will be mowed two times per year.

15.2.8 Training

NWM or their designee(s) will maintain training for the post-closure inspection and maintenance staff. NWM employees or their designee(s) for landfill closure and post-closure operations will receive training to maintain the closed landfill in accordance with the requirements of this Closure and Post-Closure Plan. The training will be performed by the Landfill Supervisor, NWM technical staff, or their designee(s). The subjects to be covered include the following:

- Drainage system inspection and maintenance;
- Groundwater well monitoring and sampling;
- Leachate collection system monitoring, sampling, inspection and maintenance;
- Landfill gas collection system operations and maintenance;
- Operation and maintenance of the closed landfill maintenance equipment; and,
- Site safety and emergency programs.

15.3 Post-Closure Period

The post-closure period shall be for 5 years after the compete installation of the landfill cap, as required by COMAR 26.04.07.22. This period may be extended at the discretion of MDE.

15.4 Plan Revision

This Closure and Post-Closure Plan will be reviewed annually to verify that it accurately reflects site and permit conditions. Revisions will be provided to MDE.

TABLES

TABLE 15-1
CLOSURE AND POST-CLOSURE INSPECTION SCHEDULE
CHESAPEAKE TERRACE RUBBLE LANDFILL
ODENTON, ANNE ARUNDEL COUNTY, MARYLAND

Description	Reason	Frequency	Primary Requirement	Secondary Requirement	Comments
Roads	Preventative Maintenance, Access, and Security	As Needed	Inspect and maintain the road surface for site access.	Grade and place stone as needed	Approximately 2500 lf of paved road and 20,000 linear feet of gravel road
Landfill Cap	Site stability and waste containment.	Semi-Annual and after major storm events.	Traverse cap area by foot or in an ATV looking for signs of damage, erosion, slope instability.	Repair areas of erosion when identified. Report signs of cap instability, such as sliding crackinging or sloughing to MDE.	N/A
Snow Removal	Preventative Maintenance, and Access	As Needed	Plow all roads and asphlalt areas after each 3" snow event where temperatures are expected to stay below freezing for more than 3 days.	N/A	N/A
Mowing	Preventative Maintenance, Erosion and Sedimentation Control, and Access	Semi-Annually	Mowing in May and September.	During the mowing event, the approximatley 12 acres of vegetative cover should be visuallty inspected for any evidence of washout. Repair as necessary	N/A
Fencing	reventative Maintenance, Access, and Security	Semi-Annually	Visual inspection of the perimeter fence at the site.	Repair/Replace as necessary	N/A
Stormwater Basin	Preventative Maintenance and Erosion and Sedimentation Control.	As Needed	Visually inspect the basin and outlet structures and channels.	Clean and repair as necessary	Any sediment removed from the basin will be disposed of in accordance with all applicable regulations
Leachate Collection at Cells	Ongoing Monitoring & Maintenance	Monthly	Check cells for leachate production. Visually inspect the toe of the landfill for leachate seeps.	Continue annual leahate sump pump maintenance.	There will be a leachate management contractor to continuing hauling leachate off-site for disposal
Leachate Storage Tanks	Ongoing Monitoring & Maintenance	Monthly	Record the meter readings in the cells still producing leachate. Inspect tanks and above-ground piping for leak. Turn on heat tracing during periods of temperaturs below 25-degrees F.	Clean and repair as necessary	There will be a leachate management contractor to continuing hauling leachate off-site for disposal
Blower/Flare Station/LFG Wellfield	Requirement, Preventative Maintenance, and Landfill Gas Management	Monthly	Visually inspect the flare. If necessary, reignite the flare. Perform wellfield sampling/tuning	Check propane supply	N/A

TABLE 15-2
CLOSURE AND POST-CLOSURE PLAN - INSPECTION CHECKLIST
CHESAPEAKE TERRACE RUBBLE LANDFILL
ODENTON, ANNE ARUNDEL COUNTY, MARYLAND

Date of Inspection: ________________________ **Personnel On-site:** ____________________________________

On a monthly basis, the following items are to be visually inspected and conditions noted on this form/checklist. If a condition on-site exists that may result in a regulatory non-compliance issue and/or site security issue, contact site Project Manager immediately. To make identification of the site area that needs maintenance, a site plan with grids is attached. In addition to the regularly scheduled inspections, the Landfill Cap Closure Inpsection should be completed as soon as possible after major storm events.

Area of Concern	Action	Yes	No	Grid
Landfill Closure Cap Inspection	Disturbance of cover? Poor Vegetation (areas of any size with < 30% vegetation)? Presence of woody vegetation? Erosional Features Cracks (> 1/4 inch in width and 2 inches in depth)? Other Disturbances of the soil cover? Ponding Water?			
Landfill Paved Driveway Inspection	Differential settlement? Ponding of water? Potholes? Splitting or cracking of asphalt?			

TABLE 15-2
CLOSURE AND POST-CLOSURE PLAN - INSPECTION CHECKLIST
CHESAPEAKE TERRACE RUBBLE LANDFILL
ODENTON, ANNE ARUNDEL COUNTY, MARYLAND

Date of Inspection: ________________________ **Personnel On-site:** ____________________________________

On a monthly basis, the following items are to be visually inspected and conditions noted on this form/checklist. If a condition on-site exists that may result in a regulatory non-compliance issue and/or site security issue, contact site Project Manager immediately. To make identification of the site area that needs maintenance, a site plan with grids is attached. In addition to the regularly scheduled inspections, the Landfill Cap Closure Inpsection should be completed as soon as possible after major storm events.

Area of Concern	Action	Yes	No	Grid
Security Fence	Is security fence maintenance required? Security fence maintenance issues include removal of deadfall, vegetation clearing, outwash of soil at base of fence. If maintenance is required, please specify.			
Stormwater Basins	Visually inspect the basin and outlet structure and channel monthly. Is maintenance required on the basin, outlet, and/or channel? Any evidence of erosion upgradient or downgradient? Any bare spots where vegetation is required? Any debris blocking the outlet?			
Leachate Storage Tanks	Visually inspect these tanks. Is maintenance required on either tank? Is water ponded in the secondary containment area? **Record the levels in the tanks below.**			

TABLE 15-2
CLOSURE AND POST-CLOSURE PLAN - INSPECTION CHECKLIST
CHESAPEAKE TERRACE RUBBLE LANDFILL
ODENTON, ANNE ARUNDEL COUNTY, MARYLAND

Date of Inspection: ________________________ **Personnel On-site:** ____________________________________

On a monthly basis, the following items are to be visually inspected and conditions noted on this form/checklist. If a condition on-site exists that may result in a regulatory non-compliance issue and/or site security issue, contact site Project Manager immediately. To make identification of the site area that needs maintenance, a site plan with grids is attached. In addition to the regularly scheduled inspections, the Landfill Cap Closure Inpsection should be completed as soon as possible after major storm events.

Area of Concern	Action	Yes	No	Grid
Perimeter Road and Closure Cap Road Maintenance	Does any roadway need maintenance, repair, and/or resurfacing? If yes, which area of roadway needs maintenance and what type of maintenance is required (such as additional stone, grading, drainage, etc..)			
Mowing	The capped area should be mowed at least twice per year. One mowing event should be performed on or around mid-September of each year. Is mowing of the capped area required? Is mowing needed around the security fence and remediation compounds/equipment?			
Signage	Is replacement of "No Trespassing" signs needed? Is maintenance/replacement of site notice (property ownership) sign needed?			
Manholes & Protective Casings	Visually inspect toe drain manhole and gas tuning wells and gas monitoring probes and protective casings. Is maintenance required on any manhole/well, if so specify?			

TABLE 15-2
CLOSURE AND POST-CLOSURE PLAN - INSPECTION CHECKLIST
CHESAPEAKE TERRACE RUBBLE LANDFILL
ODENTON, ANNE ARUNDEL COUNTY, MARYLAND

Date of Inspection: ______________________ **Personnel On-site:** __________________________________

On a monthly basis, the following items are to be visually inspected and conditions noted on this form/checklist. If a condition on-site exists that may result in a regulatory non-compliance issue and/or site security issue, contact site Project Manager immediately. To make identification of the site area that needs maintenance, a site plan with grids is attached. In addition to the regularly scheduled inspections, the Landfill Cap Closure Inpsection should be completed as soon as possible after major storm events.

Area of Concern	Action	Yes	No	Grid
Monitoring Wells	Visually inspect the off-site monitoring wells for enclosure conditions: ie. Does the fence need repaired? Does brush need to be cleared? **Specifiy what and where work needs to be performed.**			
Snow Removal	Snow removal is required after each 3-inch snowfall. Has this snow removal been completed? Is snow removal required?			

ADVANCED GeoServices
a Montrose Environmental Group company

SECTION 16

GROUNDWATER MONITORING PLAN

GROUNDWATER MONITORING PLAN

FOR
CHESAPEAKE TERRACE RUBBLE LANDFILL
ANNE ARUNDEL COUNTY, MARYLAND

PREPARED FOR:

National Waste Managers, Inc.
2900 Linden Lane
Silver Spring, MD 20910

PREPARED BY:

ADVANCED GeoServices
a Montrose Environmental Group company

1055 Andrew Drive, Suite A
West Chester, 19380

PROJECT NO. 2018-3854
July 2020
Revised September 3, 2021

TABLE OF CONTENTS

SECTION PAGE

LIST OF TABLES

Tables

TABLE OF CONTENTS
(continued)

LIST OF FIGURES

Figure

LIST OF ATTACHMENTS

Attachment

16.0 GROUNDWATER MONITORING PLAN

16.1 INTRODUCTION

National Waste Managers, Inc. (NWM) proposes to construct a 114.4 acre Rubble Waste Landfill on a 480-acre parcel located near Odenton, Maryland. Pursuant to the requirements of the Code of Maryland Regulations (COMAR) for Rubble Waste Landfills the proposed facility will be an engineered landfill with composite liner system, leachate collection and removal system, composite cap, storm water management system and groundwater monitoring network.

This Groundwater Monitoring Plan (GWMP) has been prepared by AGC Montrose to present the configuration of the proposed groundwater monitoring network, the procedures for collecting and analyzing samples collected from the groundwater monitoring network, and criteria for data evaluation and reporting. The purpose of the GWMP is to monitor groundwater quality in the vicinity of the landfill before, during and after the operating life of the landfill. If groundwater monitoring identifies negative impacts to groundwater quality then appropriate measures can be taken to identify and mitigate the source of such impacts. This GWMP has been prepared in accordance with the Maryland Department of the Environment (MDE) technical guidance and procedures, and current industry standards.

16.2 SITE BACKGROUND

16.2.1 Site Description

The proposed Chesapeake Terrace Rubble Landfill Site is located in western Anne Arundel County between the Patuxent and Little Patuxent Rivers. The parcel of land which contains the Chesapeake Terrace Rubble Landfill is approximately 480 acres. The parcel is bordered on the northeast by Patuxent Road, on the west by the Amtrak railroad tracks, and on the southwest by Conway Road. The boundary of the proposed rubble fill area within the property is shown on Exhibit 1. The total proposed waste fill area is approximately 114.4 acres. The total operations area (fill area, access roads, stormwater management, etc.) will be approximately 140 acres.

16.2.2 Geology and Hydrogeology

The Site has been the subject of multiple investigations for the purpose of defining the site-specific geologic and hydrogeologic conditions. Those investigations have documented that unconsolidated deposits associated with the cretaceous Potomac Group are the predominant geologic unit beneath the Site. However, quaternary deposits represent a significant portion of the surficial geology in the eastern portions of the Site.

The Site is underlain by two primary water bearing zones. These are referred to in the Phase II Report as the unconfined water bearing zone (Unconfined WBZ), and the confined water bearing zone (Confined WBZ). The Unconfined WBZ is the shallower of the two zones, and represents the remnants of the Upper Patapsco Aquifer (UPA) and saturated quaternary terrace and alluvial deposits (Quaternary Deposits). The Confined WBZ represents the deeper of the two zones and is the Lower Patapsco Aquifer which exhibits a vertically upward hydraulic gradient across the entire Site. A clay unit, referred to as the Middle Confining Unit (MCU) separates the Upper and Lower Patapsco Aquifers (UPA and LPA, respectively).

The Unconfined WBZ exists as a perched zone over the MCU in the western portions of the site where the surface of the MCU is present at or above elevation 70+/- ft amsl. The Unconfined WBZ becomes part of the regional surficial water table when the top of the MCU is below elevation 70 +/- ft amsl. Hard lateral boundaries for the perched portion of the Unconfined WBZ exist at outcrops of the contact between the UPA and MCU along the railroad right-of-way, located along the west boundary of the Site, and at the area of exposed MCU at the ground surface towards the north. To the east, the contact between the bottom of the UPA and the top of the MCU dip below elevation 70 and becomes part of the regional surficial water table found in the quaternary alluvial deposits in the floor of the Little Patuxent River valley.

For the purposes of groundwater monitoring it is beneficial to consider the Site as two separate areas. These areas are designated as Areas A and B. Area A represents those portions of the Site connected to the regional surface water table. Area B represents those portions of the Site where the Unconfined WBZ is perched atop the MCU and vertically separated from the Confined WBZ. Additionally, within Area A, the potentiometric surface of the Confined WBZ protrudes into the regional surface water table (i.e., discharges vertically into the Quaternary deposits/remnants of the UPA), while the potentiometric surface of the Confined WBZ exists within the MCU in Area B. The contact between “Area A” and “Area B” is presented on Exhibit 1.

The proposed landfill bottom elevations are designed to be a minimum of 3 feet above the highest observed groundwater elevations for the Unconfined WBZ. The presence of the MCU and the natural upward gradient of the Confined WBZ mean that if impacts from the proposed operations were to occur, they will be identified in the Unconfined WBZ. Therefore, this GWMP focuses on the Unconfined WBZ.

16.2.3 Baseline Groundwater Quality from Phase II Application

Pursuant to COMAR 26.04.07.15, the Phase II Permit Application (Advanced GeoServices Corp, June 2020) presented and discussed the results of groundwater samples collected from the Unconfined WBZ and Confined WBZ during sampling events completed in January/February 2020 and March 2020. Those groundwater samples were collected from eighteen (18) wells screened in the Unconfined WBZ, and nine (9) wells screened in the Confined WBZ and Transition Zone. Additional sampling events were completed in May 2020 and July 2020, and those results were compiled with the January/February and March 2020 data in an Addendum to the Phase II Permit Application t submitted to MDE on September 9 2020.

Low level VOC detections of acetone and chloroform were identified in the Unconfined WBZ; and low level VOC detections of tetrachlorethene and cis-1,2-dichloroethene were identified in the Confined WBZ. Only one VOC sample result was above its respective screening criteria (tetrachloroethene = 7 µg/L, Confined WBZ well MW-14 February 3, 2020). Arsenic, barium, chromium, lead and zinc were detected in unfiltered samples obtained from the Unconfined WBZ, but were never above their corresponding screening levels. Barium, chromium, lead and zinc were detected in unfiltered samples obtained from the Confined WBZ, but were never above their corresponding screening levels. Based on the results of groundwater sampling conducted in 2013 and 2014, total inorganic concentrations in groundwater from either WBZ are sensitive to the amount of turbidity present in the sample. Based on this observation, proper groundwater sampling utilizing low flow sampling techniques, or other techniques intended to minimize turbidity, is critical to obtaining representative groundwater samples. The use of bailers should only be utilized as a last resort and when used filtered samples should be used for evaluation of inorganic constituents.

16.3 PERMANENT GROUNDWATER MONITORING NETWORK

16.3.1 Proposed Groundwater Monitoring Network

As stated above, the proposed permanent groundwater monitoring network will focus on the Unconfined WBZ. The permanent groundwater monitoring network will consist of one (1) existing and fifteen (15) new wells around the perimeter of the Area A disposal cells (Cells 11 through 16), and sixteen (16) new wells around the perimeter of the Area B disposal cells (Cells 1 through 4, 5A through 5E, and 6 through 10). The proposed well locations are shown on Figure 16-1, which also shows the highest observed/predicted water levels for the Unconfined WBZ. As presented on Figure 16-1, the wells for the permanent groundwater monitoring network along the downgradient sides of the proposed Area A and Area B disposal areas are spaced at approximately 300 feet on center perpendicular to the direction of groundwater flow. Up gradient wells are located approximately 750 feet on center.

All of the wells for the permanent groundwater monitoring network will be new wells, except existing well PMW-6. The wells will target the saturated interval corresponding to the Unconfined WBZ. Table 1 (attached) lists the proposed wells with their approximate anticipated ground surface elevation, estimated elevation of the top of the MCU and highest observed/predicted groundwater elevation. The typical well will be constructed with a 5 foot long screened interval (beginning approximately at the highest observed/predicted groundwater elevation). At those locations where the highest observed/predicted groundwater surface is within 5 feet of the ground surface, the top of the screen will begin 5 feet below the ground surface.

The new wells will be installed following approval of the requested waste disposal permit. The new wells will be installed under the supervision of a professional geologist, in accordance with the procedures described in Attachment 16A. Soil samples will be collected continuously, and the lithology will be recorded as the permanent monitoring wells are installed.

Table 1 provides a summary of the proposed Permanent Groundwater Monitoring Wells.

16.3.2 Abandonment of Existing Wells

Existing groundwater monitoring wells screened in the Unconfined WBZ will remain in-place as long as possible for depth to groundwater measurements, as described below. With the exception of PMW-6, no existing wells will be subject to groundwater sampling as part of the GWMP. Wells screened within the Confined WBZ (and Transition Zone), and located outside of the footprint of the waste disposal area shall remain in-place and be maintained in the event that future groundwater sampling of the Confined WBZ is necessary.

Wells located within the footprint of the proposed waste disposal area, and wells interfering with supporting roads, facilities and appurtenances shall be abandoned before the well is lost or damaged during construction. Any wells which are to be abandoned, will be abandoned in accordance with the applicable requirements in the following regulations:

- Maryland Code 26 04.04.34 – Well Abandonment and Sealing Standards – General

- Maryland Code 26 04.04.35 – Well Sealing Materials
- Maryland Code 26 04.04.36 – Well Sealing Procedures

The abandonment procedure for the wells will include:

- Measure the depth to water and total well depth using a water level indicator for the presence of any obstructions inside the well casing.
- Remove the concrete pad and flush-mount or above-grade protective cover and cut the well casing so the top is 0.5-1 foot below grade.
- Casing will be removed, drilled out and the entire well and sand pack completely filled with Portland cement grout from the base of the former boring to the ground surface using the tremie method.
- After completing the field activities, a completed Water Well Abandonment Sealing Report will be prepared for each well and submitted to MDE by a Maryland licensed well driller in accordance with the appropriate section of the Well Drilling regulations.

16.4 GROUNDWATER MONITORING PROCEDURES

16.4.1 Groundwater Potentiometric Surface

Prior to all groundwater sampling events, depth-to-water will be measured in each permanent groundwater monitoring well and all remaining existing wells screened in the Unconfined WBZ. Depth to water levels shall be measured using an electronic water level indicator. The synoptic measurements will include the measurement of water levels in as short a timeframe as possible to determine the potentiometric surface across the Site. Existing groundwater monitoring wells screened in the Unconfined WBZ will remain in-place as long as possible after installation of the new monitoring wells to provide as many data points for estimation of the potentiometric surface of the Unconfined WBZ as possible. In addition, depth to water measurements will be obtained for the months when sampling is not performed to provide monthly water level data during construction and operation of the landfill.

The potentiometric surface will be mapped for each gauging event within 2 weeks of the completion date of data collection, and the results compared against the highest observed/predicted groundwater levels established in the Phase II Permit Application. If the newly mapped surface is higher than the observed/predicted groundwater surface developed in the Phase II Permit Application a more detailed review shall be performed to determine if the new levels will be within 3 feet of the bottom of the liner system in any portion of the landfill (closed, active or proposed). If the groundwater level is less than 3 feet from the bottom of the liner system the MDE shall be notified in writing within 5 business days and meetings/discussions held to determine appropriate measures to address the issue.

16.4.2 Monitoring Well Maintenance

The sampling team is responsible for making a physical inspection of the monitoring wells for damage during each sampling event. They will document the results of the inspection on the field book. If there is a problem, it will be their responsibility to bring it to the attention of the NWM site manager at the end of the sampling event. It is the NWM site manager’s responsibility to make arrangements to correct any problems within 30 days of identification of the problem.

16.4.3 Groundwater Sampling and Analysis

Groundwater from the permanent groundwater monitoring network wells will be sampled a minimum of 4 consecutive quarters prior to the start of waste placement. The results from the 4 initial sampling events (plus any previous results from PMW-6) will be used to establish a statistical database for groundwater quality. The first sampling event will begin approximately 2 to 3 weeks after the completion of well installation and development. Subsequent sampling events will be performed once each calendar quarter.

The groundwater samples collected from the permanent monitoring wells will be analyzed for the parameters specified by the MDE in the Permit. All parameters measured will be analyzed to their Practical Quantitation Limits (PQLs) (see Tables 2 and 3).

16.5 Groundwater Sampling Protocols

16.5.1 General Procedures

Groundwater sampling will be performed in accordance with the procedures in Attachment 16B.

16.5.2 Field Measurements

Field measurements that will be performed during well purging will include pH, specific conductivity, temperature, oxidation/reduction potential (ORP), dissolved oxygen (DO), and turbidity. Measurements will be collected by inserting the appropriate probe in a closed non-dedicated plastic container (flow-through-cell) that is rinsed with deionized water prior to purging the well. Turbidity samples will be collected from the flow through cell outflow. pH, temperature, specific conductance and turbidity will be utilized to determine completeness of purging efforts.

16.5.3 Meter Calibration

Calibration of the instruments will be completed at the beginning of each sampling day, checked in the middle of the day, and as otherwise necessary based on the functioning of the meters and equipment. The following items outline the calibration of each meter. Each meter will be field calibrated in accordance with the manufacturer's specifications and appropriate calibration solutions. All calibrations will be recorded in the field logbook. Field calibration procedures at a minimum will include the following:

- Calibration of the field instruments will be performed by trained technicians prior to the start of sampling and half way through the day. All the instruments will be calibrated as specified by the manufacturer. Standard solutions will also be checked to determine stability. All results of field calibrations and measurements will be maintained in bound field logbooks. The recorded calibration information will include date and time of calibration results, name of the person performing the calibration, reference standards used and instrument readings. If equipment fails calibration or equipment malfunction is noted during calibration or use, the equipment will not be used.
- Turbidity meter will be calibrated with one standard of known turbidity, as prepared by the manufacturer of the instrument, daily prior to use.

- Pump and equipment will be decontaminated before and between each well. sampling

16.5.4 Sample Labeling and Field Notes

The sample containers will be identified by the use of sample tags/labels with the well identification (e.g., BW-3-DATE, etc.). Each sample label will be completed by the sampler to avoid possibility of sample misidentification and attached to the sample container. Indelible ink shall be used to complete the sample labels. Each sample label will be labeled at the time of collection with, at a minimum, the following information:

- Sample identification number,
- Initials of the sample collector,
- Time and date of the sample collection,
- Site name and location number,
- Requested analyses,
- Any preservative added or field preparation performed, and,
- Sample designation if this sample is a quality assurance sample.

A new pair of gloves will be used at each sample location by each member of the sampling team.

Containers for collecting samples for volatile organics will be filled to slightly more than full before the cap is placed on the container to ensure that it is headspace free.

All sampling procedures, measurements, and observations will be recorded on the Field Sampling Field Book and Purge Sheets, which will include the following information:

- Facility site name, sample point identification number, and other pertinent identifiers;
- Depth to groundwater;
- Information regarding purging the well prior to sampling (see Attachment 16B);
- Time of sample collection;
- Sampling method;
- Filtration, if used;
- Field test results, including pH, temperature, specific conductance, dissolved oxygen, and turbidity;
- Field observations (e.g., well condition);
- Appearance of sample (i.e., color, turbidity, sediment, or soil on surface); and,
- Sampler's identity and signature.

16.6 Sample Preservation and Shipment, Duplicates, and Blanks

16.6.1 Sample Preservation

Since multiple analyses will be required, use of different types of containers and preservatives will be necessary. Multiple pre-labeled containers will be supplied by the laboratory for each sampling point. The appropriate preservatives will have been added to each container (as required) during sample bottle preparation.

16.6.2 Blanks and Duplicate Samples

To ensure internal laboratory quality control, field blanks and blind duplicate samples will be collected during each sampling event. These samples will be analyzed for the same parameters as the other samples. A trip blank for volatile organic analysis will also be collected.

16.6.3 Chain-of Custody Forms

A Chain-of-Custody Form will be completed and placed in the sample chest. Upon transfer of sample possession to subsequent custodians, the Chain-of-Custody Form will be signed by the person taking custody of the sample container. Upon receipt of the samples at the laboratory, the date and time of arrival will be noted on the Chain-of-Custody Forms.

The custody records will be included in the analytical report prepared by the laboratory, and will be considered an integral part of that report.

16.7 Responsibilities of Site Personnel for Groundwater Monitoring

16.7.1 Sampling Team

A qualified groundwater scientist will sample or oversee qualified environmental technicians who sample the wells semiannually at the intervals specified in the approved Groundwater Monitoring Plan.

The Sampling Team will have the following responsibilities:

- Inspecting the wells during the sampling events, documenting any damage or problems, and reporting needed repairs to the NWM Site Manager.
- Sampling the wells in conformance with the groundwater sampling protocols.
- Maintenance and decontamination of sampling equipment.
- Insuring that appropriate containers and preservatives are used for each of the analytical parameters.
- Preparation of chain-of-custody forms and shipment to the lab within analyte holding times.

16.7.2 Site Manager

The Site Manager, or his designee, will have the following responsibilities:

- Verification that the monitoring wells have been installed in accordance with procedures described in Attachment 16A – Permanent Monitoring Well Installation Specifications.
- Maintenance, repair, and protection of the monitoring wells as well as maintenance of the access roads to the wells.
- Documentation and reporting to the MDE of any sampling or reporting delays.
- Informing the sampling team of any changes in the well conditions, or accessibility.

16.8 Data Evaluation and Reporting

A groundwater quality data report will be submitted to the MDE within 60 days of the close of each sampling event. The report will be signed by a qualified groundwater professional and include the following:

1. A laboratory report indicating the analytical method on each data sheet and the detection limits.
2. Presentation of the analytical data from each well in a numerical table formatted so that the water quality data for each well can be observed simultaneously, emphasizing the analytes above the reporting limit. Where applicable, the table will show corresponding groundwater standards and/or criteria.
3. Intrawell control charts will be used to monitor the inherent statistical variation of the data collected within a single well, and to flag anomalous results. In addition to allowing statistical analysis, control charts provide a quick visual evaluation of the data.
   a. Time series analysis (plotting concentrations over time) is extremely useful for identifying trends in monitoring data.
   b. Combined Shewhart-cumulative sum (CUSUM) control charts will be constructed for each detected constituent at each well to provide a visual tool of detecting both trends and abrupt changes in concentration levels. The mean of replicate values at a point in time will be computed and plotted together with upper and/or lower predetermined limits on a chart where the x-axis represents time. If a result falls outside these boundaries, then the process will be declared to be “out-of-control”; otherwise, the process will be declared to be “in control”. Data points lying outside the established boundaries will be investigated.
   c. A significant positive trend in the data from a downgradient monitoring well may provide sufficient evidence to conclude that the landfill unit is affecting the well. Such trends should be evident in several parameters since contaminant migration from the landfill would likely result in an influx of multiple constituents into the groundwater flow system.
4. Groundwater surface maps and an analysis of variations in groundwater levels.

If primary groundwater standards are exceeded then the MDE will be notified within 24 hours of receipt of the laboratory report detecting the occurrence and the monitor well(s) will be resampled within 30 days of the date of receipt of the laboratory analysis. The data from the resampling will be submitted to the MDE no later than the 15th day of the following month. Failure of the Landfill to resample is acknowledgement that the exceedance of the primary standard is representative of current groundwater conditions at the facility and the groundwater contamination contingency plan will go into effect.

16.9 Groundwater Contamination Contingency Plan

The groundwater quality data generated by the groundwater monitoring program will be evaluated for exceedance of groundwater standards and/or baseline groundwater quality. If exceedances are identified then the following actions will be taken to identify and address potential releases of contaminants from the landfill to groundwater:

1. Implement an accelerated (monthly) sampling schedule for the affected well(s) to confirm or refute the elevated concentrations.
2. Install additional monitoring wells as required to define the extent of confirmed elevated concentrations.
3. Determine whether groundwater standards are being exceeded.
4. Perform modeling or flow calculations to determine the source of the elevated concentrations and predict concentrations at the site boundary and at potential receptors.
5. Install additional wells as required to calibrate the model/flow calculations.
6. Identify and evaluate human and ecologic exposure pathways.
7. Implement remedial action to block exposure pathways if excessive risk is identified. Remedial actions such as pump and treat, in situ bioremediation, venting, etc. will be considered. The remedy selected will be contingent on the nature of the contaminant and the hydrogeologic framework at the point of release.

16.10 Residential Well Water Level Monitoring and Contingency Plan

The purpose of residential well monitoring is to determine whether operations at the landfill will have an impact on off-site residential wells through lowering of the perched water table.

The proposed permanent monitoring well network will be maintained and used to evaluate the impact of the landfill on perched water levels. Four (4) permanent groundwater monitoring wells (PMWs-120, 121, 122 and 123) are proposed between the landfill and the shallow residential wells along Conway Road and Collins Avenue (screened in Unconfined WBZ).

Water levels in the new permanent groundwater monitoring wells will be measured monthly following issuance of the refuse disposal permit. These water level data will be used to prepare a series of Unconfined WBZ water table contour maps. NWM and the MDE will use these contour maps to evaluate whether landfill activities have impacted the perched water table along Conway Road and Collins Avenue.

Water levels in the residential wells will be monitored in accordance with the protocols described in Section 16, Attachment 16C. Eight potentially impacted wells are identified and the circumstances under which mitigation measures will be provided (at the landfill's expense) are described. Specific response criteria as listed in Attachment 16C, are as follows:

- The well is not capable of meeting either daily or cycle demand previously determined for each well.
- The water level in the well is below the drought water level as determined during the baseline period, and/or the water level is low relative to landfill monitoring/observation wells.
- A special exception may be made for inaccessible wells (e.g. buried wells) if there is evidence of drawdown in onsite monitoring wells or nearby residential wells and the well is unable to meet daily needs.

The water level monitoring plan described in Attachment 16C pertains to eight residences south of the landfill where the Unconfined WBZ water table may be impacted by landfill operations. Monitoring of the water supply wells for these residences will be contingent upon (1) verification that they are screened in the Unconfined WBZ and (2) the owner's approval and agreement to abide by the protocol in Attachment 16C.

The Unconfined WBZ under the western portion of the landfill was modeled during earlier submissions of the Phase 2 investigation when dewatering of the Unconfined WBZ was being proposed, to predict the impact of the dewatering on the sources of drinking water supply for the nearby residents. The final landfill design does not penetrate the Unconfined WBZ and dewatering is not required; therefore, the modeling is considered to be an overly conservative representation of the impacts to groundwater levels in the Unconfined WBZ when the Area B disposal area is constructed. Despite the overly conservative nature of the modeling, NWM is still proposing to perform the previously agreed upon residential water level monitoring to confirm that the reduction in pervious area caused by the proposed cell liner systems do not negatively impact the neighboring Unconfined WBZ wells.

The amount of lowering of the Unconfined WBZ predicted by the previously completed groundwater flow model is shown on Figure 1, in Attachment 16C. There are eight residences located with the area in which 1-foot of drawdown was predicted that could potentially be impacted, either because well completion reports indicate they have wells completed in the Unconfined WBZ (2944 and 2987 Conway Road) or because detailed information regarding the depth of the well screened interval was not available. Information on the wells supplying water to these eight residences is as follows:

Well	Map		Total	Screen			Pumping		Level	Level
Permit	No.	Address	Depth	Top	Bot.	Dia	Hrs	GPM	Before	During
A	58	1245 COLLINS	-	-	-	-	-	-	-	-
A	60	254A COLLINS	-	-	-	-	-	-	-	-
A	62	1257 COLLINS	-	-	-	-	-	-	-	-
AA738073	48	2944 CONWAY	105	64	69	2	1	10	75	80
A	46	2946 CONWAY	90(b)	-	-	-	-	-	-	-
A	47	2948 CONWAY	315(b)	-	-	-	-	-	-	-
a	43	2973 CONWAY	c	-	-	-	-	-	-	-

AA811580	40	2987 CONWAY	72	60	72	4	3	18	40	51

a. No permit tag on well. b. Depth reported by resident.
c. Well depth of 30 feet reported by owner Albert Rollins in 1990; however, at hearing on 12/3/01 Mr. Rollins stated his well is 335-feet deep.

In the unlikely event that the residential wells are shown to be impacted as described in Attachment 16C, the landfill will contact a commercial provider within one hour of the determination to request delivery of water from a water tank truck at a rate that equals or exceeds the affected well's baseline yield. The landfill will arrange and pay for the action. This water delivery will continue until the residential well(s) recover to their baseline yield(s), or until mitigation measures are implemented, whichever comes first. Mitigation measures include, but are not limited to: installation of pressure tank(s) and modified pump; lowering the pump; redeveloping the well; and/or drilling a new well.

16.11 References

Advanced GeoServices Corp, “Phase II Permit Application, Chesapeake Terrace Rubble Landfill,” dated June 2020.

MSA. 12/5/03. *Phase 2 Addendum for Chesapeake Terrace Rubble Landfill*. prepared for National Waste Managers for submission to the Maryland Department of the Environment.

MSA, 12/22/04. *Responses to Comments on Phase 2 Addendum Report for Chesapeake Terrace Rubble Landfill*. prepared for National Waste Managers for submission to the Maryland Department of the Environment.

MD DNR, 1982, *The Quantity and Natural Quality of Groundwater in Maryland*, MD DNR, 1982),

Mack, F, and D. Andreasen. 1991. Geohydrologic Data for the Coastal Plain Sediments Underlying Broadneck Peninsula, Anne Arundel County, Maryland. MGS Open File Report No. 92-02-6, Mack and Andreasen, 1991).

a Montrose Environmental Group company

TABLES

TABLE 1
SUMMARY OF PERMANENT GROUNDWATER MONITORING WELLS
CHESAPEAKE TERRACE RUBBLE LANDFILL
ODENTON, ANNE ARUNDEL COUNTY, MARYLAND

Monitoring Well IDs	Description	Approx. Elev. (ft MSL)			Well Depth * (feet)
		Proposed Grade	Top of Clay Surface	Potentiometric Surface	
AREA A					
PMW-101	Up gradient	124	47	80	53
PMW-102	Up gradient	136	45	78	67
PMW-103	Up gradient	110	45	77	42
PMW-104	Downgradient	94	35	75	28
PMW-105	Downgradient	84	30	72	21
PMW-106	Downgradient	80	26	71	18
PMW-107	Downgradient	80	28	68	21
PMW-108	Downgradient	76	30	66	19
PMW-109	Downgradient	80	36	67	21
PMW-110	Downgradient	88	36	67	29
PMW-6 (exist)	Downgradient	82	36	63	28
PMW-111	Downgradient	80	39	67	22
PMW-112	Downgradient	80	46	73	16
PMW-113	Downgradient	78	56	72	15
PMW-114	Downgradient	76	54	72	15
PMW-115	Downgradient	88	60	82	15
AREA B					
PMW-116	Up gradient (3 ft screen)	120	112	117	10
PMW-117	Up gradient (possibly dry)	144	118	118	28
PMW-118	Up gradient	149	106	118	40
PMW-119	Downgradient	155	102	117	56
PMW-120	Downgradient	174	94	106	77
PMW-121	Downgradient	192	88	96	105
PMW-122	Downgradient	175	88	94	90
PMW-123	Downgradient	170	85	90	88
PMW-124	Downgradient	182	70	86	105
PMW-125	Downgradient	164	76	93	80
PMW-126	Downgradient	156	86	101	80
PMW-127	Downgradient	150	90	102	57
PMW-128	Downgradient	167	79	94	82
PMW-129	Downgradient	166	70	90	85
PMW-130	Downgradient	155	60	80	84
PMW-131	Downgradient	125	52	81	53

Note: The screened interval for the typical Unconfined WBZ wells will begin at approximately the highest observed/predicted groundwater level as presented on Table 1 (above) or a minimum of 7 feet below the ground surface (whichever is greater). When the interval from the highest observed/predicted groundwater level to the top of the MCU is less than 5feet but greater than 3 feet, utilize the full 5 ft screen length and set the bottom of the screen into the MCU. When the interval is less than 3 feet, set the bottom of the screen 2 feet into the MCU and set the top of the screen above the highest observed/predicted groundwater level, as necessary to maintain the 5 foot screen length. Where the 7 feet of separation between the top of the screen and ground surface cannot be maintained using a 5 foot screen length, reduce the screen length as necessary to maintain the minimum 7 feet of separation.

TABLE 2
GROUNDWATER SAMPLING
MEASUREMENT PARAMETERS AND PRACTICAL QUANTITATION LIMITS
CHESAPEAKE TERRACE RUBBLE LANDFILL
ODENTON, ANNE ARUNDEL COUNTY, MARYLAND

Metals	PQL	General Parameters	PQL
Barium	5 ug/l	Chloride	1 mg/l
Calcium	100 ug/l	Nitrate	0.1 mg/l
Iron	50 ug/l	Phosphate	0.05 mg/l
Magnesium	20 ug/l	Total Dissolved Solids	10 mg/l
Manganese	2 ug/l	Sulfate	1 mg/l
Potassium	500 ug/l	Total Alkalinity	1 mg/l
Sodium	100 ug/l	Ammonia	0.2 mg/l
Antimony*	2 ug/l	Chemical Oxygen Demand	10 mg/l
Arsenic*	2 ug/l	Hardness	0.5 mg/l
Beryllium	2 ug/l	**Field Parameters**	**PQL**
Cadmium	2 ug/l		
Chromium	5 ug/l	pH	NA
Cobalt	5 ug/l	Conductance	10 umhos/cm
Copper	5 ug/l	Temperature (°C)	NA
Lead	2 ug/l	Turbidity	0.1 NTU
Nickel	2 ug/l	Dissolved Oxygen	2 mg/l
Selenium*	2 ug/l	**Volatile Organic Compounds by EPA Method 6260**	
Silver*	1 ug/l		
Thallium*	2 ug/l		
Vanadium	5 ug/l	See Table 3 for individual VOCs and PQLs	
Zinc	5 ug/l		
Mercury	0.2 ug/l		

*ICPMS

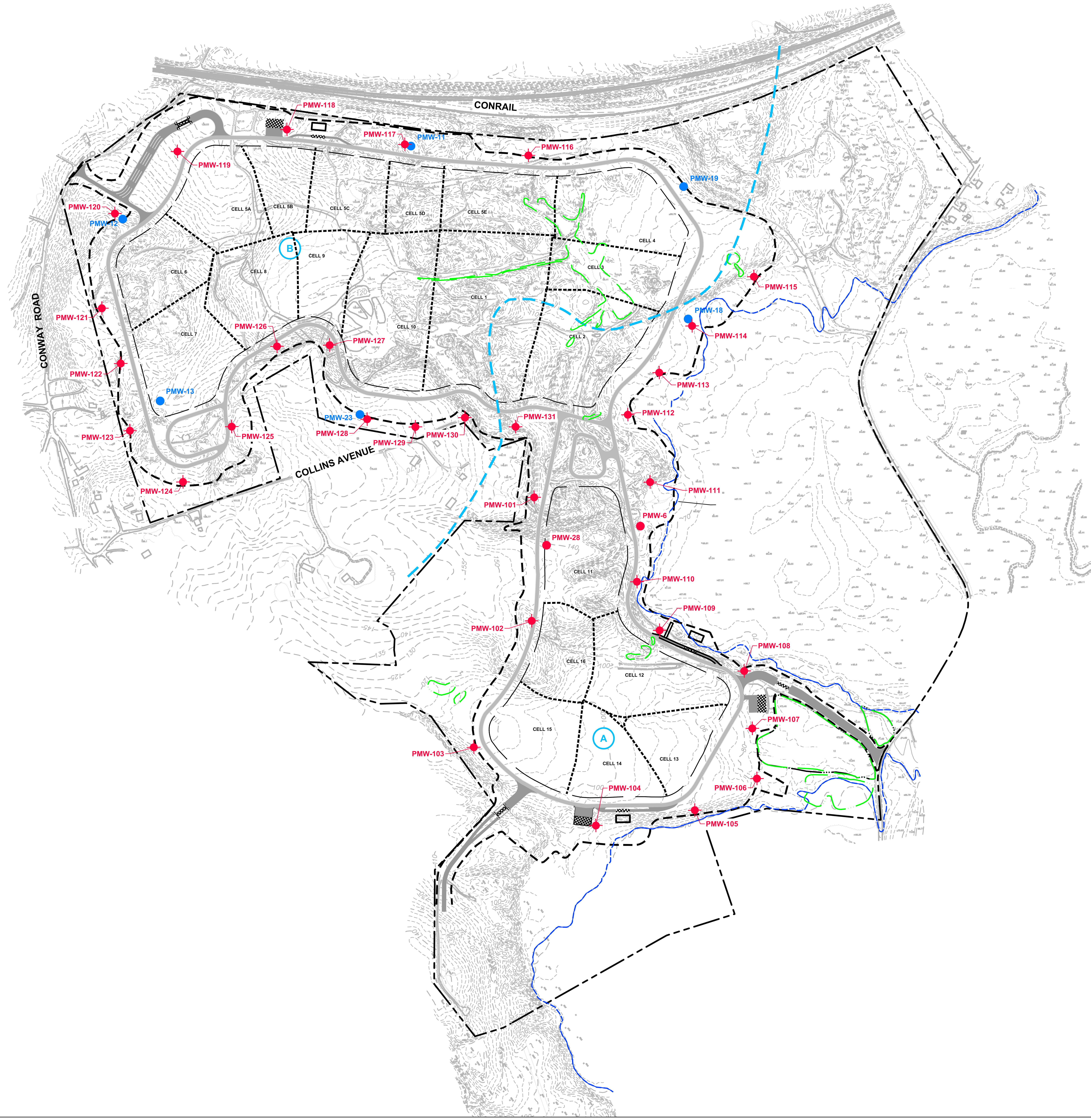
TABLE 3
GROUNDWATER SAMPLING
VOLATILE ORGANIC COMPOUINDS AND PRACTICAL QUANTITATION LIMITS
CHESAPEAKE TERRACE RUBBLE LANDFILL
ODENTON, ANNE ARUNDEL COUNTY, MARYLAND

Parameter	PQL (ug/L)	Parameter	PQL (ug/L)
Acetone	5	Dichloropropane(1,2-)	1
Acrolein	50	Dichloropropane(2,2-)	1
Acrylonitrile	50	Dichloropropane(1,3-)	1
Benzene	1	Dichloropropene(cis 1,3-)	1
Bromobenzene	1	Dichloropropene(trans 1,3-)	1
Bromochloromethane	1	Ethylbenzene	1
Bromodichloromethane	1	Hexachlorobutadiene	1
Bromoform	1	Hexanone(2-)	1
Bromomethane	1	Isopropylbenzene	1
Butanone(2-)(MEK)	5	Isopropyltoluene(4-)	1
Butylbenzene(n-)	1	Methyl(4-)-Pentanone(2-)	1
Butylbenzene(sec-)	1	Naphthlalene	1
Butylbenzene(tert-)	1	Propylbenzene(n-)	1
Carbon Disulfide	1	Styrene	1
Carbon Tetrachloride	1	Tetrachloroethane(1,1,1,2-)	1
Chlorobenzene(Mono-)	1	Tetrachloroethane(1,1,2,2-)	1
Chloroethane	1	Tetrachloroethene	1
Chloroethylvinyl(2-) Ether	5	Toluene	1
Chloroform	1	Trichlorobenzene(1,2,3-)	1
Chloromethane	1	Trichlorobenzene(1,2,4-)	1
Chlorotoluene(2-)/(o-)	1	Trichloroethane(1,1,2-)	1
Chlorotoluene(4-)/(p-)	1	Trichloroethane(1,1,1-)	1
Dibromochloromethane	1	Trichloroethene	1
Dibromoethane(1,2-)	1	Trichlorofluoromethane	1
Dibromomethane	1	Trichloropropane(1,2,3-)	1
Dibromo(1,2-)chloropropane(3-)	1	Trimethylbenzene(1,3,5-)	1
Dichlorobenzene(1,2-)/(o-)	1	Trimethylbenzene(1,2,4-)	1
Dichlorobenzene(1,3-)/(m-)	1	Vinyl Acetate	5
Dichlorobenzene(1,4-)/(p-)	1	Vinyl Chloride	1
Dichlorodifluoromethane	1	Xylene(O-)	1
Dichloroethane(1,2-)	1	Xylene(M&P-)	1
Dichloroethane(1,1-)	1	Xylenes, total (M&P- + O-)	1
Dichloroethene(1,1-)	1	Iodomethane (Methyl Iodide)	1
Dichloroethene(cis-1,2-)	1	Dichloro(trans 1,4-)-butene (2-)	1
Dichloroethene(trans-1,2-)	1	Chloro (3-)-propene (1-)	1
Dichloromethane	1	Methyl-tert-butyl-ether (MTBE)	1
Dichloropropene(1,1-)	1		

Compounds not on 2020 Parameter List

a Montrose Environmental Group company

FIGURE



LEGEND

	PROPERTY LINE
	LANDFILL PERIMETER ACCESS ROAD (FUTURE)
	SITE ENTRANCE (FUTURE)
	LANDFILL LIMITS (FUTURE)
	LANDFILL CELL SEPARATION BERM (FUTURE)
	LIMIT OF DISTURBANCE (FUTURE)
	MODIFIED 100-YEAR FLOODPLAIN
PMW-6	EXISTING PERMANENT MONITORING WELL (SCREENED ABOVE MCU)(SEE REFERENCE 2)
PMW-112	PROPOSED PERMANENT MONITORING WELL (SCREENED ABOVE MCU)
PMW-19	EXISTING PERMANENT MONITORING WELL (SCREENED BELOW MCU) (SEE REFERENCE 2)
	HYDROGEOLOGIC AREA DIVIDE (SEE REFERENCE 2)
A	HYDROGEOLOGIC AREA (SEE REFERENCE 2)
	JURISDICTIONAL DETERMINATION (JD) WETLANDS BOUNDARY (APPROX.) WITH IDENTIFICATION AND AREA (SEE REFERENCE 6)

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

2.) EXISTING MONITORING WELL LOCATIONS DIGITIZED FROM HARD COPY OF DRAWING ENTITLED "PERMANENT GROUNDWATER MONITORING WELL PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED MAY 2008.

3.) ADDITIONAL HISTORICAL BORING LOCATIONS FROM HARD COPY OF DRAWING ENTITLED "PLATE 2, CHESAPEAKE RUBBLE LANDFILL HYDROGEOLOGIC BASE MAP," DATED NOVEMBER 2003, CREATED BY MARK SCHULTZ ASSOCIATES, ANNAPOLIS, MARYLAND.

4.) HYDROGEOLOGIC AREAS & BOUNDARIES TAKEN FROM "PHASE II PERMIT APPLICATION", PREPARED BY ADVANCED GEOSERVICES CORP DATED JUNE 2020.

5.) THE POST-2012 100-YEAR FLOOD PLAIN LIMITS SHOWN ARE BASED ON FEMA NATIONAL FLOOD INSURANCE PROGRAM MAP NUMBER 24003C0136E, DATED 10/16/2012, AND PROVIDED AS PLATE 3.

6.) JURISDICTIONAL WETLAND BOUNDARIES OBTAINED FROM FIGURES ATTACHED TO THE ARMY CORPS OF ENGINEERS PUBLIC NOTICE DATED NOVEMBER 22, 1991, AND AS SUBSEQUENTLY AMENDED IN WRITING BY MCCARTHY AND ASSOCIATES ON APRIL 2, 1997

NOTES

1.) THE CONRAIL TRACKS ARE ALSO SHARED WITH AMTRAK FOR HIGH-SPEED COMMUTER TRAINS BETWEEN BOSTON, MASSACHUSETTS AND WASHINGTON, D.C.

2.) THE PROPERTY WAS PREVIOUSLY USED FOR SAND AND GRAVEL MINING ACTIVITIES. PORTIONS OF THE SITE CURRENTLY HAVE NO VEGETATION AND ARE BARREN.

3.) WATER LEVELS IN WELLS MW-2, MW-7, MW-8, MW-9, MW-11, MW-23, MW-26, AND MW-31 WERE NOT OBTAINED DURING FIELD ACTIVITIES BY GOLDER ASSOCIATES IN 2014 AND ADVANCED GEOSERVICES IN 2019 AS THE WELLS COULD NOT BE LOCATED.

GRAPHIC SCALE

300 0 150 300 600 1200

(IN FEET)
1 inch =300 ft.

VERONICA E. FOSTER
LICENSED PROFESSIONAL ENGINEER
MD # 35645

REVISION:

DATE:

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
a Montrose Environmental Group company
1878 MARLTON PIKE EAST, SUITE 10, CHERRY HILL, NJ 08003
T: 856.354.2273 F: 856.354.8236 www.advancedgeoservices.com

PROPOSED MONITORING WELL LOCATIONS

PROJECT MANAGER: VEF	SCALE: AS NOTED
CHECKED BY: VEF	PROJECT NUMBER: 2018 - 3854
DRAWN BY: KHF	DATE: 06/25/2020

FIGURE 16-1

ADVANCED GeoServices
a Montrose Environmental Group company

Attachment 16A

Permanent Monitoring Well Installation Specifications

a Montrose Environmental Group company

PERMANENT MONITORING WELL INSTALLATION SPECIFICATIONS
Chesapeake Terrace Rubble Landfill

1. All of the monitoring wells will be installed by a Maryland-licensed well-driller in accordance with all pertinent State and local laws and regulations. Permits to drill each well will be obtained from the Anne Arundel County Health Department prior to well installation.

2. All monitoring well casings and screens will be constructed of 2" inner-diameter (ID) pipe composed of Schedule 40 Polyvinylchloride (PVC), joined using threaded couplings. No solvents, glues, or lubricants will be used in the construction of the wells. No reduction fittings will be used in the construction of the wells.

3. The screened intervals of the monitoring wells will consist of 5 feet of pre-constructed, commercially manufactured well screen of the same material and inner diameter as the main well casing. The screened interval for the typical Unconfined WBZ wells will begin at approximately the highest observed/predicted groundwater level as presented on Table 1 (above) or a minimum of 7 feet below the ground surface (whichever distance below the ground surface is greater). When the interval from the highest observed/predicted groundwater level to the top of the MCU is less than 5 feet but greater than 3 feet, utilize the full 5 ft screen length and set the bottom of the screen into the MCU. When the interval is less than 3 feet, set the bottom of the screen 2 feet into the MCU and set the top of the screen above the highest observed/predicted groundwater level, as necessary to maintain the 5foot screen length, provided the 7 feet separation between the top of the screen and the ground surface is maintained. Where the 7 feet of separation between the top of the screen and ground surface cannot be maintained using a 5 foot long screen, reduce the screen length as necessary to maintain the minimum 7 feet of separation. Slot size of the screens will be selected based on the visual classification of the soil sample(s) collected from the targeted screen interval so that, with the sand pack, it will preclude clogging and excessive turbidity in the well. Based on the results of previous sampling the target screen interval in most areas will be variable and require the use of finer screen slot size (generally 0.010"), although the actual size will be selected by the professional geologist. The bottom of the screen will be capped.

4. The diameter of the boring into which the casing is set will exceed the diameter of the casing by at least four inches (4") (e.g., a two inch well must be installed in a hole at least six inches in diameter), so that the gravel pack and grout may be properly placed in the annular space between the casing and the sides of the hole.

5. For wells greater than 50 feet deep, at least three (3) centralizers will be installed to center the well casing in the annular space, with one at the screen and the others spaced evenly along the well casing. The centralizers will be composed of the same material as the casing and screen.

6. The annular space of the typical well will be packed with sand of a size compatible with the selected screen slot size (example for 0.010” slots use #000 (35 mesh sand)) from the base of the well to a level two feet (2') above the top of the screen. The sand pack used will be

selected by the professional geologist so that it prevents fine-grained sediment in the screened formation from clogging the slots in the screen or causing excessive turbidity in the well, and it will have a permeability at least approximately equal to or higher than the permeability of the monitored formation. Two feet (2') of bentonite pellets will be placed above the sand, to prevent the entry of grout into the sand pack, and to act as a long-term barrier to liquid, which might seep down the formation/grout interface. Two (2) hours will be allowed for hydration of the bentonite prior to grout emplacement. All materials used to construct the well including the sand pack, seal, and grout, will be clean, new materials meeting NSF/ANSI Standard 61 and the AWWA Standard B100-09 – cuttings will not be placed back in the hole. In addition, the sand pack will be composed of quartz or a similar inert mineral. If any wastes, contaminated soils or contaminated liquids are produced during the drilling process, they will be disposed of properly. If the sand pack is emplaced with auger flights or temporary casing still in the hole, the augers or casing will be backed out by increments as the sand pack is emplaced to insure that the sand pack sets properly without bridging and without displacing the well casing when the casing or augers are extracted.

7. The annular space of all the wells will be grouted with 100% Portland cement or a 90% Portland cement/10% bentonite slurry from the top of the pelletized bentonite seal to the surface. The grout will be installed by means of a tremie pipe inserted into the annular space of the well to a point just above the bentonite seal, and will not be installed until the two-foot (2') bentonite seal has had two (2) hours to hydrate.

8. After the grout has set up, some additional grout may have to be added to replace grout volume lost due to shrinkage. Regardless of the type of grout used, the top three feet will be composed of 100% Portland cement. All wells will be provided with a means of protection from tampering, vandalism, and accidental damage. All wells will be protected by either, 1) a steel outer casing with a diameter at least 2" greater than the main casing anchored three feet (3') into the cement grout, with a hinged, locking steel cap which allows access to the main casing inside only when open, or 2) a ground-level anti-vandalism manhole with a bolted lid.

   At the ground surface, a concrete form will be provided during grout installation for the construction of a square concrete pad at least 18"x18" centered around the well, which extends from three inches above to three inches below the undisturbed ground surface. The height of the protective casing will be two feet (2') above the top of the cement pad ± two inches (2"), unless otherwise approved. The top of the PVC casing inside will be provided with a removable cap that fits just under the locking protective steel cap, and be accessible for cap removal with normal tools.

   High-traffic areas such as maintenance areas and parking lots may require special installations such as concrete posts (“bollards”) set around the well to prevent damage by vehicles. Such barriers will be painted a highly visible color, and will be spaced so as to protect the well but still allow a vehicle to back up to it for sampling and repairs.

9. After the grout has thoroughly cured, the wells will be developed to insure that a satisfactory hydraulic connection exists between the well and the monitored formation. Development will consist of alternating mechanical- and/or air-surging techniques with pumping, to remove fine materials that may remain in the well, sand pack, and the formation nearest the well,

which would otherwise threaten sample quality. Jetting or other techniques will be employed when necessary to speed this process, particularly when the drilling method used to install the wells is the mud-rotary method, or a variant. Wells will be developed so that the water produced has a measured turbidity of 10 NTUs (Nephelometric Turbidity Units) or less. If the desired turbidity cannot be attained within two (2) hours of development and continued improvement is not being observed, the professional geologist may make the determination that development is considered complete and halt continued efforts to reduce turbidity. If wells pump dry during development efforts, development will be temporarily halted and water levels allowed to recover to at least 75% of the starting water column height before efforts are resumed. If water levels do not achieve at least 75% of the starting water column height within 24 hours, up to 10 gallons of potable water may be added to the well to facilitate development. All wells must be allowed to sit for a minimum of 2 weeks between the completion of development and the start of sampling.

10. All wells will be properly tagged, with the well construction permit number and monitoring well designation (e.g., PMW-102) clearly visible from the outside of the well, and flagged or otherwise made visible so that they can be located for sampling and avoided by on-site heavy equipment. The inner plastic casing will be carefully sealed prior to any spray-painting or any other work on the protective casing, which could introduce contaminants into the well.

11. Well completion reports will be fully completed for each well installed, and a copy of the well completion report forms submitted to the County Health Department will be forwarded to the MDE within thirty (30) days of well completion. A project summary describing the installation procedure will accompany the copies of the completion reports, and will contain an accurate map depicting the precise location of all wells installed at the site in relation to known landmarks; a detailed description of the construction of the wells installed including casing/screen, sand pack and grout intervals; the elevation of the top of the concrete pad installed at the base of the protective outer well casing; the top-of-casing elevation for the protective steel casing or manhole rim elevation, elevation of the top of the PVC casing; and both the static and pumping water levels to the nearest one-hundredth of a foot.

12. The well driller or the supervising engineer or geologist will notify the MDE via telephone at least three (3) work days prior to initiation of drilling, so that representatives may be present to observe the well installation.

13. All regulatory requirements will be met concerning the application for, permitting of, construction of and completion of all monitoring wells. It is understood that wells not constructed in accordance with the regulations (COMAR 26.04.04) and these specifications will not be accepted by the MDE unless a variance is obtained prior to or during well construction.

14. It is recognized that geologic conditions at a site may require that changes to these general specifications be made in order that the monitoring system installed is adequate for monitoring the intended geologic formations, while not creating an additional hazard to groundwater quality. Variances from the specifications described will be sought from the MDE Project Geologist.

15. Any wells which are to be abandoned, will be abandoned so that the appropriate section of the Well Drilling regulations addressing abandonment is carefully followed. Casing will be removed, drilled out, or thoroughly split or pierced, and the entire well and sand pack completely filled with Portland cement grout from the base of the former boring to the ground surface.

16. Wells will not be overdrilled to a depth greater than 5' below the elevation at which the screen is to be set, to avoid cross-contamination of deeper zones and averaging of hydraulic pressure across the open interval. If overdrilling occurs, the hole will be grouted with Portland cement up to the bottom of the selected screened interval and the grout allowed to fully cure before the screen is set. The well will be developed with care to avoid residual cement contamination in subsequent water samples.

17. Split-spoon sampling will be performed so that the correct location of the screen can be verified during drilling. The anticipated zone in which the screen will be set will be established and approved by the MDE prior to drilling. If conditions are not sufficiently well defined to permit absolute identification of the conditions to be encountered beforehand, then a protocol for choosing the proper zone will be established in advance.

18. All monitoring wells will be accessible to 4-wheel drive vehicles. Roads will be maintained such that access to the wells is possible upon reasonable request without prior notice.

a Montrose Environmental Group company

Attachment 16B

Groundwater Sampling Protocols

GROUNDWATER SAMPLING PROTOCOLS
Chesapeake Terrace Rubble Landfill

A. GROUNDWATER PURGING

A.1 Water Level and Purge Volume Determination

Groundwater sampling shall be performed utilizing low flow sampling techniques. The amount of water that must be purged from a well when utilizing low flow sampling techniques is determined by field parameter stabilization.

1 GENERAL EQUIPMENT CONSIDERATIONS

1.1 A bladder type pump will be used to purge the well when utilizing low flow sampling techniques.

2 INITIAL INSPECTION

2.1 Verify the identification of the monitoring well.
2.2 Remove the well cover and remove all standing water around the top of the well casing (manhole) before opening the well cap.
2.3 Inspect the exterior protective casing of the monitoring well for damage, document the results of the inspection if there is a problem and report it to the NWM site manager.
2.4 Inspect the well lock and determine whether the cap fits tightly. Inspect the condition of the bolts and washers as well as the casing threads and document the results of the inspection in the field book, if there is a problem report it to the NWM site manager.

3 WATER LEVEL MEASUREMENTS: Use an electronic probe to determine the water level.

3.1 Use an electronic probe to determine the water level.
3.2 Decontaminate all equipment before use.
3.3 Measure the depth to groundwater from the top of well casing to the nearest 0.01 foot and always measure from the same reference point or survey mark on the PVC well casing. If there is no reference mark, measure from the high side of the PVC casing.
3.4 Record the measurement and the reference point.

4 WATER COLUMN DETERMINATION

4.1 Do not determine the total depth of the well by lowering the probe to the bottom of the well before purging and sampling. If the well must be sounded before sample collection, delay purging and sampling activities for at least 24 hours after the well was sounded. Alternatively, collect samples before sounding the well using the most recent depth to bottom measurement to calculate height of water column.
4.2 Subtract the depth to the top of the water column from the total well depth to determine the length of the water column.

5 WELL WATER VOLUME

5.1 Calculate the total volume of water in gallons in the well using the following equation for a 2” diameter well set in a 6” (nominal) diameter hole with 40% void in sand pack:

$V = (0.022\ ft^3/ft + 0.070\ ft^3/ft) \times (h) \times (7.47\ gals/ft^3)$

Where: V = volume in gallons

h = height of the water column in feet

5.2 Record all measurements and calculations on the purge sheets.

A.2 Well Purging Techniques

The selection of the purging technique and equipment is dependent on the hydrogeologic properties of the aquifer, especially depth to groundwater and hydraulic conductivity. The intent of proper purging is to stabilize the water level in the well and minimize the hydraulic stress to the hydrogeologic formation. Every attempt will be made to match the pumping rate with the recharge rate of the well before evaluating the purging completion criteria.

1 MEASURING THE PURGE VOLUME:

The volume of water that is removed during purging will be recorded by one of the following methods:

1.1 Collect the water in a graduated container and multiply the number of times the container was emptied by the volume of the container, or

1.2 Estimate the volume based on pumping rate. This technique will be used only if the pumping rate is constant. Determine the pumping rate by measuring the amount of water that is pumped for a fixed period of time.

1.3 Make new measurements each time the pumping rate is changed.

2 PURGE RATE:

The depth to water shall be measured at 3 to 5 minute increments at the start of purging to help ensure that purge rate and recharge rates are in equilibrium as determined by a stabilized draw down level <0.33 feet from initial water level measurement (before insertion of sampling equipment), and every 5 to 10 minutes through the completion of sampling. Record purge rates and depth to water on the purge sheet, with stabilization measures. If the initial purge rates result in a drawn down level >0.33 feet, the purge rate shall be set at the lowest possible rate that can sustain a flow and the water level allowed to recover to <0.33 feet before higher purge rates can be resumed.

3 STABILIZATION MEASUREMENT FREQUENCY:

The purge parameters shall be measured at 3 to 5 minute increments and recorded on the purge sheet begin immediately after purge and recharge rates have reached equilibrium.

4 PURGING COMPLETION:

A flow-through container shall be used to measure the stabilization parameters discussed below. Purging is considered complete when the criteria in section 4.1, 4.2 or 4.3 below are satisfied.

4.1 Three (3) consecutive measurements of the four (4) parameters listed below must be within the stated limits. The measurements evaluated must be the last three consecutive measurements taken before sample collection begins. The range between the highest and the lowest values for the last three measurements of temperature, pH and specific conductance cannot exceed the stated limits. The last three consecutive measurements of turbidity must all be at or below the listed thresholds, otherwise filtered and unfiltered samples for inorganics analysis must be collected.

- *Temperature: $\pm$ 0.2° C*
- *pH: $\pm$ 0.2 Standard Units*
- *Specific Conductance: $\pm$ 5.0% of reading*
- *Turbidity: $\leq$20 NTU*
- Document and report the following on the purge sheets (use a separate purge sheet for each well), as applicable:
- *Purging rate.*
- *Drawdown in the well, if any.*
- *Pump or tubing intake placement.*
- *Length and location of the screened interval.*

4.2 If the criteria in section 4.1 above for turbidity cannot be met, then three (3) consecutive measurements for pH, temperature and specific conductance must be within the above stated limits, and the last three consecutive measurements for turbidity shall be:

- *Turbidity: $\pm$ 5 NTUs or 10%, whichever is greater*

4.3 If the stabilization parameters in either section 4.1 or 4.2 cannot be met, and all attempts have been made to minimize the drawdown, check the instrument condition and calibration, purging flow rate and all tubing connections to determine if they might be affecting the ability to achieve stable measurements. All measurements that were made during the attempt must be documented. The sampling team leader may decide whether or not to collect a sample or to continue purging in the event the well purges dry or after 2 hours of purging.

If the decision is to forego additional purging and collect a sample, the well will be allowed to recover to within 0.33 feet of the starting water level, or recover up to the maximum amount possible within 24 hours, before proceeding with sample collection. Sample collection shall be performed utilizing the same bladder pump, tubing and flow through cell utilized for initial purging. When samples are collected field parameters, purge rates, depth to water levels and purge volumes associated with sample collection shall be recorded at the beginning and end of sample collection.

4.4 Collect samples as soon as possible after purging is complete. The time period between completing the purge and sampling cannot exceed twenty-four (24) hours. If sample collection does not occur within one (1) hour of purging completion, re-measure the four (4) field parameters Temperature, pH, Specific Conductance, and Turbidity just prior to collecting the sample. If the measured values are not within 10 percent of the previous measurements, re-purge the well. The exception is “dry” wells (see section 4.3 above).

5. LANYARDS

5.1 Securely fasten lanyards, if used, to any downhole equipment (pumps, etc.).
5.2 Use lanyards in such a way that they do not touch the ground surface.

A.3 Purging Wells

1 PUMP PLACEMENT

- Do not lower the pump to the bottom of the well. Position the intake for the pump at the midpoint of the submerged screened interval.
- The same pump must be used for both purging and sampling,

2 NON-DEDICATED (PORTABLE) PUMPS

Bladder Pump

- Install new or dedicated bladder in pump, following pump manufacturer recommendations.
- Attach new, or dedicated tubing to the discharge side of the pump and the opposite end to the flow through cell.
- Lower pump to middle of submerged screened interval, and begin purging.
- Measure and record the depth to groundwater at 3 to 5 minute intervals.
- Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.
- If the water table continues to drop during pumping, lower the pump at the approximate rate of drawdown so that the water is removed from the middle of the water column.
- Record the purging rate each time the rate changes.
- Measure and record the purge volume.
- Collect samples.
- Obtain and record final water level reading
- Remove pump and tubing from well being careful not to cross contaminate equipment. Remove dedicated bladder from pump and place bladder and dedicate tubing in plastic bag. Close top using twist ties or similar measure to prevent inadvertent opening and label bag with well number on adhesive label applied to bag. Use separate bags for each well.
- Measure and record the purge volume.

B. GROUNDWATER SAMPLING TECHNIQUES

1 EQUIPMENT CONSIDERATIONS

1.1 Collect the sample into the sample container from the sampling device. Do not use intermediate containers.

1.2 In order to avoid contaminating the sample or loss of analytes from the sample:

1.2.1 Handle the sampling equipment as little as possible.

1.2.2 Minimize the equipment that is exposed to the sample.

1.2.3 Minimize aeration of samples collected for VOC analysis.

1.2.3.1 Reduce flow rates to $\leq$ 100 mL/minute when collecting VOC samples.

1.3 Dedicated Sampling Equipment

1.3.1 Whenever possible, use dedicated equipment because it significantly reduces the chance of cross-contamination.
1.3.2 Suspend dedicated bailers above the water column if they are stored in the well.

B.1 Sampling Monitoring Wells

1. SAMPLING WITH PUMPS:

- Teflon or Polyethylene bladder pumps. The delivery tubing must be Teflon, Polyethylene or PP.
- Do not lower the pump to the bottom of the well.

1.1 Bladder Pump

1.1.1 Volatile Organics:

1.1.1.1 Collect samples from the discharge end of the delivery tubing (Remove the discharge end of the delivery tubing from the flow through cell if not already removed for collection of other samples).
1.1.1.2 Carefully allow the groundwater to drain into the sample vials. Avoid turbulence. Do not aerate the sample. The flow rate must be < 100 mL/minute.
1.1.1.3 Preserve (if required), label and complete field notes.

1.1.2 Inorganics

1.1.2.1 Collect samples from the discharge end of the delivery tubing (Remove the discharge end of the delivery tubing from the flow through cell if not already removed for collection of other samples).
1.1.2.2 Preserve (if required), label and complete field notes.

B.2. Filtering Groundwater Samples

1 FILTERING GROUNDWATER FOR METALS:

1.1 Where possible use low-flow sampling techniques to minimize turbidity.
1.2 Measure turbidity at the end of purging. Do not filter if the turbidity is less than 20 NTU.
1.3 Use the following field filtration protocols for samples for metals analysis if the turbidity is greater than 20 NTU:
1.3.1 Use a disposable, high capacity, 0.45-μm in-line filter.
1.3.2 Insert the filter on the end of the delivery tubing. Hold the filter upright with the inlet and outlet vertical. Before collecting the sample, pump water from the aquifer through the filter until all atmospheric oxygen has been removed.
1.4 <u>Do not</u> use the following equipment for filtering groundwater samples for metals:
1.4.1 Any pump and apparatus combination in which the filter is on the vacuum (suction) side of the pump.
1.4.2 Any type of syringe or barrel filtration apparatus.
1.4.3 Any filter that is not encased in a one-piece, molded unit.

ADVANCED GeoServices
a Montrose Environmental Group company

Attachment 16C

Residential Well Water Level Monitoring Program and Mitigation of Impacts

RESIDENTIAL WELL WATER LEVEL MONITORING PROGRAM AND MITIGATON OF IMPACTS
Chesapeake Terrace Rubble Landfill

I. INTRODUCTION

Results of the residential/potable well survey, summarized in the Phase II Application, identified four wells along Conway Road (residential wells 40, 43, 46 and 48) screened in the Unconfined WBZ. These would be considered down-gradient of the proposed landfill based on the groundwater contours for the Unconfined WBZ. None of the wells with known depths on Collins Avenue or Lucinda Lane are shown to be screened in the Unconfined WBZ, however three (3) wells along Collins Avenue (residential wells 58, 60 and 62) are of unknown depth. One well along 5th Ave (residential well 23) and two (2) wells along Patuxent Road at the north end of the Site (residential wells 13 and 14) are screened in the Unconfined WBZ, but are up-gradient or cross-gradient from the proposed landfill footprint. Only one residential well in the Unconfined WBZ is located downgradient of Area A. This well (residential well 27 on Table 2) is reported to be an unpermitted dug well. It is located approximately 1,000 feet downgradient of the proposed landfill footprint.

The purpose of residential well monitoring is to determine whether landfill operations have impacted off-site residential wells through drawdown. This protocol provides mitigation measures at the expense of the Landfill if impacts are determined.

II. PARTICIPATION AND DURATION

A. Private Domestic Wells

The selection of potential participants is based on the results of a computer model of landfill impacts on the perched water table elevation, that was performed as part of previous design configurations that proposed establishing the bottom of the Area B disposal cells in the MCU and dewatering the Unconfined WBZ in Area B. As presented in this version of the Phase III design, the Area B disposal cells will not extend to the MCU and dewatering of the Unconfined WBZ is not required or proposed. Despite the fact that the proposed design no longer penetrates the Unconfined MCU and dewatering is no longer required, NWM will be monitoring wells screened in the Unconfined WBZ for potential water level impacts because the area of infiltration for the Site will be reduced as a result of the impermeable liner system. The reduced area of infiltration means a reduced volume of infiltration reaching the Unconfined WBZ. This may result in a decrease in water levels in the Unconfined WBZ at nearby residential wells. We are proposing to monitor the same residential wells identified in the original computer model as potentially being impacted by a drop in the Unconfined WBZ.

Potentially impacted wells as indicated by the original computer model for Unconfined WBZ dewatering are shown on Figure 1 and are listed as follows:

Well Permit	Map No.	Address	Total Depth	Screen Top	Screen Bot.	Screen Dia	Pumping Hrs	Pumping GPM	Level Before	Level During
a	58	1245 COLLINS	-	-	-	-	-	-	-	-
a	60	254A COLLINS	-	-	-	-	-	-	-	-
a	62	1257 COLLINS	-	-	-	-	-	-	-	-
AA7380 73	48	2944 CONWAY	105	64	69	2	1	10	75	80
a	46	2946 CONWAY	90(b)	-	-	-	-	-	-	-
a	47	2948 CONWAY	315(b)	-	-	-	-	-	-	-
a	43	2973 CONWAY	c	-	-	-	-	-	-	-
AA8115 80	40	2987 CONWAY	72	60	72	4	3	18	40	51

a. No permit tag on well.
b. Depth reported by resident.
c. Well depth of 30 feet reported by owner Albert Rollins in 1990; however, at hearing on 12/3/01 Mr. Rollins states his well is 335-feet deep.

Letters will be sent via certified mail to each of the homeowners soliciting their participation in the monitoring program. Proof of notification will be sent to the Department.

B. Monitoring Wells

Five (5) new Unconfined WBZ monitoring wells (PMWs-120 through 124) are proposed between the landfill and the potentially impacted shallow residential wells along Conway Road and Collins Avenue (screened in Unconfined WBZ).

Water levels in the Unconfined WBZ monitoring wells will be measured monthly for at least a year before the start of any Site landfilling and throughout the operating life of the landfill. These data will be used to prepare Unconfined WBZ water table contour maps. NWM and the MDE will use these contour maps to evaluate whether landfill activities have impacted the Unconfined WBZ water table along Conway Road and Collins Avenue.

III. EQUIPMENT AND TRAINING

The NWM hydrogeologic consultant (currently AGC Montrose) will select the appropriate equipment to measure water levels based on the available technology at the time when monitoring begins (currently that would be a continuously recording submersible pressure transducer) for the residential wells. The NWM site manager will be provided with the appropriate software and training to download the data in the field and change out batteries.

Drinking water grade tubes will be installed in wells that have an unobstructed path for setting the transducer at a fixed point below the anticipated low level groundwater surface, but away from the area from the area of turbulence created by the well pump. The monitoring system will be installed at the expense of the landfill and will not affect residential use.

IV. PROCEDURE

A. Baseline Water Level Measurements

It is important to determine baseline water level readings (static water levels) to determine drought water level conditions in each well. Therefore, with the approval of the homeowners, pressure transducers (or similar measurement and recording device) will be installed by AGC Montrose staff beginning at the start of Area A construction. Based on the currently anticipated landfill construction/filling sequence, this will provide at least 5 years of groundwater data before any cell construction begins in Area B. Willing homeowners will be contacted for participation. The measuring device will be programmed to collect data at 6 hour increments to ensure that levels are collected during periods when the pump has been idled/inactive.

B. Residential Well Assessment

All wells in the monitoring plan will be surveyed for surface and well elevations. Each participating residential well will be inspected to determine specific well specifications, i.e., depth of well, casing depth and diameter, pump intake depth, and discharge rate (i.e., gallons per minute (gpm)), and a well completion tag number. Well completion reports will be obtained if available. If well completion reports are not available, then the wells will be inspected by a licensed well driller to provide the above information. After completion of the well assessment, a determination will be made as to the need to install drinking water grade tubes in the wells as explained in Section III above.

A report will be written and provided to each participating homeowner after completion of the well assessment. The well assessment will provide information to the homeowners regarding well specifications and possible ways to improve the production of the well. Those improvements to the wells will be at the expense of the owners of the landfill. Possible mitigation measures for well improvements are: lowering the pump; replacing the pump; redeveloping the well; or replacing the well.

C. Well Performance Test

The performance test includes pumping each participating residential well for one hour. The purpose of the pumping test will be to determine how the water level in the well responds to pumping, i.e., how long it takes to recover to static or near static. The pumping test will be run at each wells' specific maximum yield. The protocol for the pumping test will include the following:

1. Minimum usage from the homeowner one day prior to the pumping test, no usage overnight prior to the morning of the pumping test, and no usage during the pumping and recovery time. (It will be in the best interest of the owners to use the well as little as possible since this will maximize the baseline well capacity.)

2. Measure the static water level prior to the pumping test.

3. Fully open the outside spigot(s) and measure flow and water levels during the one-hour pumping test. Flow will be reduced if the water level reaches the pump intake.

4. Measure water levels during the recovery for a minimum of one hour or until water levels return to 90 percent of the original static water level.

The results of the pumping and recovery test will determine how long each well must stand idle before water level measurements can be considered representative of the static water level.

D. Long Term Water Level Readings

The pressure transducers will be set to record water levels at 6 hour increments this is expected to provide water levels during the middle of the night when no pumping has occurred for at least 4 hours. Residents will be contacted by landfill personnel regarding the best time(s) that data can be downloaded. These times will be coordinated with the residents' schedules to minimize as much as possible any inconvenience to the residents and account for inclement weather conditions.

E. Demonstration of Hydraulic Connection

Water levels in the Unconfined WBZ monitoring wells (existing and proposed) will be measured monthly following installation of the proposed groundwater monitoring network. Monthly water level measurements will continue through the operating life of the landfill. These data will be used to prepare Unconfined WBZ water table contour maps. NWM and the MDE will use these contour maps to evaluate whether landfill activities have impacted the perched water table along Conway Road and Collins Avenue.

The potentially impacted domestic wells are located on the south side of the landfill (near cells 6 and 7) and landfill operations will begin on the north side; therefore, it will be at least five years before there is any landfill activity near the potentially impacted wells. This will allow the generation of several years of water level data in both the domestic wells and landfill perched-zone monitoring wells PMWs-120 through 124.

The water level data in the domestic wells and the landfill wells may also be compared to hydrograph data for nearby USGS and MGS observation wells. Deviation in water level trends may provide evidence of an impact from landfill activities on the Unconfined zone.

V. REPORTING AND CONCLUSIONS

The NWM manager will download data from the pressure transducers and maintain electronic and hard copies in the facility operating records. An electronic copy will be provided to the Landfill hydrogeologic representative (currently AGC Montrose). An electronic copy will be emailed to the Residential owners when requested by thehomeowner.

Annual reports will be available upon request within two months at the end of a 12 month measurement period. A copy of the annual report will be submitted to MDE and provided to the well owner. Requests for the annual report by other parties must be submitted in writing to the NWM site manager. A copy can also be obtained from MDE through FOIA (Freedom of Information Act). The annual report will include, but will not be limited to, a spreadsheet of water levels of all participants, graphs to show any trends, and a written summary of landfill affects.

VI. CONTINGENCY PLAN

If a residential well is shown to be impacted, the Landfill will assist the well owner. This section presents the criteria that will be used to determine whether the landfill has impacted the well, followed by a description of mitigation measures that will ensue.

A. Response Criteria

The landfill will provide relief for neighbors that meet the following criteria:

- A hydraulic connection between the residential well and the landfill has been demonstrated as described above in section IV(E).
- The well is not capable of meeting either daily or cycle demand previously determined for each well.
- The water level in the well is below the drought water level as determined during the baseline period.

B. Relief Measures

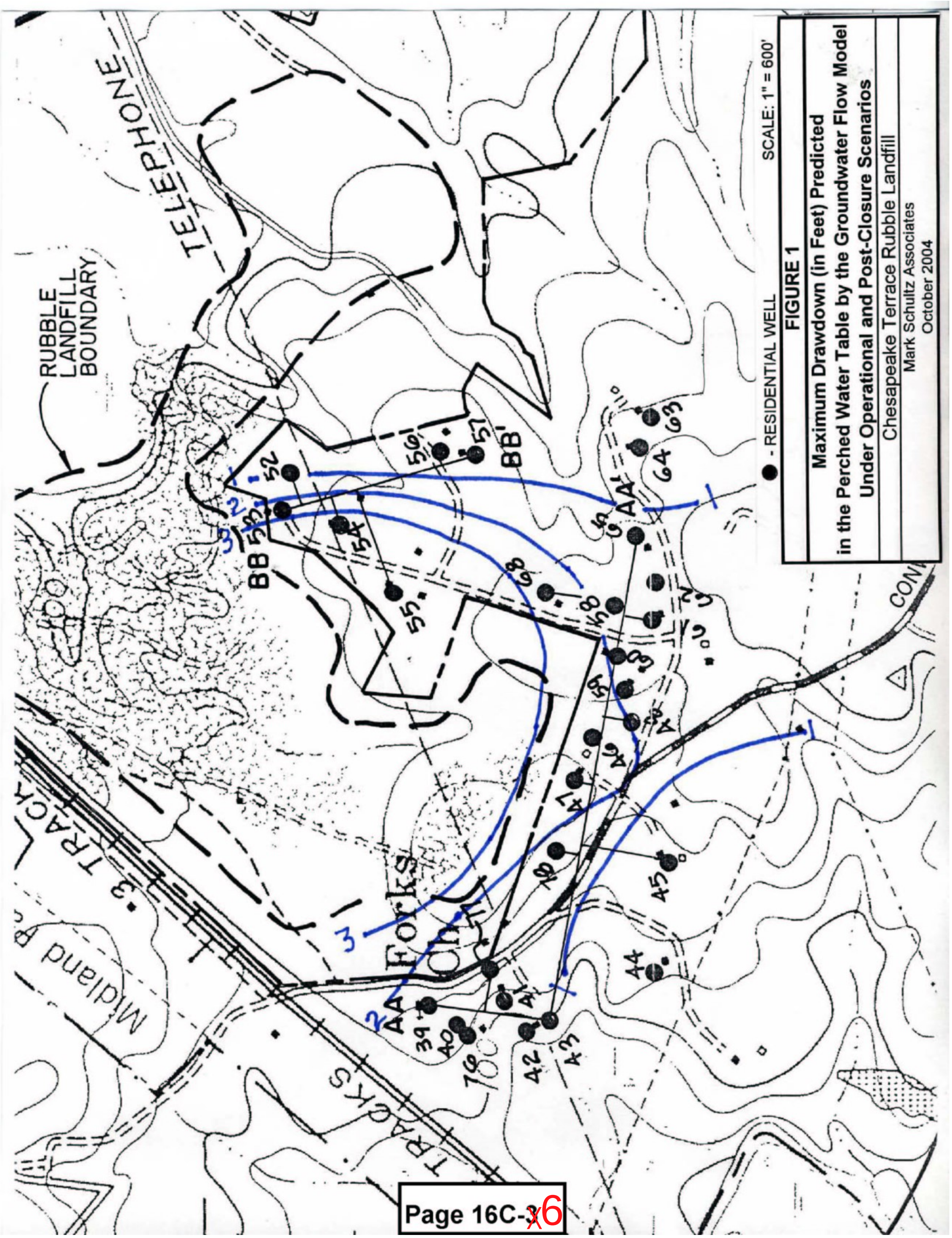
1. Immediate Response

a. Water Supplements

The landfill will contact a commercial provider within one hour of the determination stated above to request delivery of water from a water tank truck at a rate that equals or exceeds the affected well's baseline yield. The landfill will arrange and pay for the action. This water delivery will continue until the residential well(s) recover to their baseline yield(s), or until the mitigation measures listed below are implemented, whichever comes first.

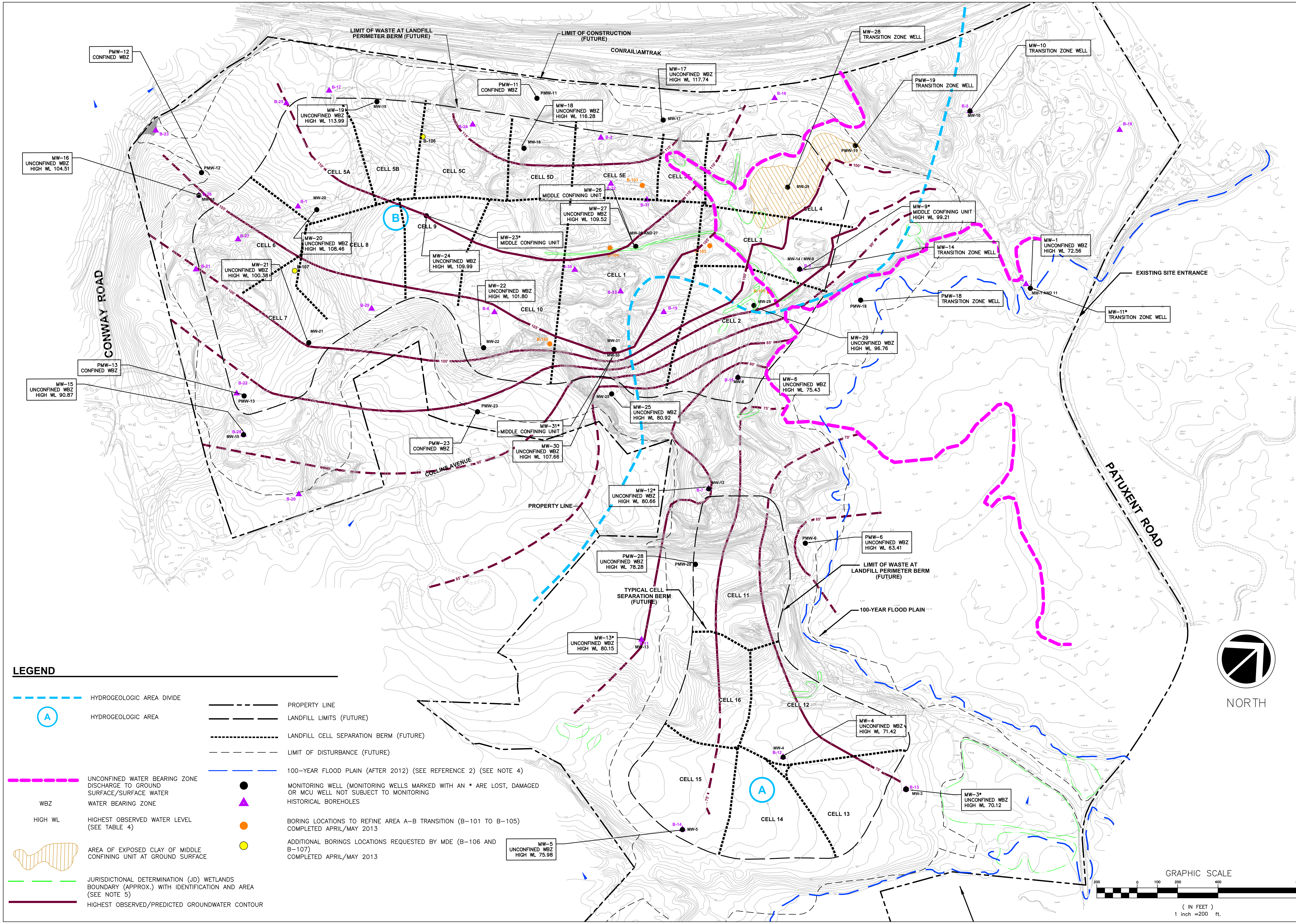
2. Longer Term Response

The landfill will immediately begin to implement one of the mitigation measures described in section IV(B) above. As stated in that section, the appropriate mitigation measure(s) for each well in the program would have been previously selected from a list that includes but is not limited to the following list: installation of pressure tank(s) and modified pump; lowering the pump; redeveloping the well; and/or drilling a new well.


RUBBLE LANDFILL BOUNDARY
TELEPHONE
TRACKS
Midland
SCALE: 1" = 600'
● - RESIDENTIAL WELL
FIGURE 1
Maximum Drawdown (in Feet) Predicted in the Perched Water Table by the Groundwater Flow Model Under Operational and Post-Closure Scenarios
Chesapeake Terrace Rubble Landfill
Mark Schultz Associates
October 2004
BB
BB'
AA
AA'
Page 16C-~~3~~6

Attachment 16D

Maximum Observed Groundwater Elevations Map
(from Phase II Permit Application



LEGEND

(light blue dashed line)	HYDROGEOLOGIC AREA DIVIDE
A	HYDROGEOLOGIC AREA
(magenta dashed line)	UNCONFINED WATER BEARING ZONE DISCHARGE TO GROUND SURFACE/SURFACE WATER
WBZ	WATER BEARING ZONE
HIGH WL	HIGHEST OBSERVED WATER LEVEL (SEE TABLE 4)
(hatched area)	AREA OF EXPOSED CLAY OF MIDDLE CONFINING UNIT AT GROUND SURFACE
(green dashed line)	JURISDICTIONAL DETERMINATION (JD) WETLANDS BOUNDARY (APPROX.) WITH IDENTIFICATION AND AREA (SEE NOTE 5)
(maroon line)	HIGHEST OBSERVED/PREDICTED GROUNDWATER CONTOUR
(dash-dot line)	PROPERTY LINE
(long dashed line)	LANDFILL LIMITS (FUTURE)
(dotted line)	LANDFILL CELL SEPARATION BERM (FUTURE)
(grey dashed line)	LIMIT OF DISTURBANCE (FUTURE)
(blue dashed line)	100-YEAR FLOOD PLAIN (AFTER 2012) (SEE REFERENCE 2) (SEE NOTE 4)
(black dot)	MONITORING WELL (MONITORING WELLS MARKED WITH AN * ARE LOST, DAMAGED OR MCU WELL NOT SUBJECT TO MONITORING
(triangle)	HISTORICAL BOREHOLES
(orange dot)	BORING LOCATIONS TO REFINE AREA A-B TRANSITION (B-101 TO B-105) COMPLETED APRIL/MAY 2013
(yellow dot)	ADDITIONAL BORINGS LOCATIONS REQUESTED BY MDE (B-106 AND B-107) COMPLETED APRIL/MAY 2013

DATE:	REVISION:
4/30/2020	REVISED TO ADDRESS MDE COMMENTS (PGS/VEF)
6/5/2020	EDITORIAL REVISIONS/NEW LANDFILL BOTTOM (PGS/VEF)
9/3/2021	REVISED TO ADDRESS MDE COMMENTS (PGS)

NATIONAL WASTE MANAGERS
PHASE II PERMIT APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
a Montrose Environmental Group company

HIGHEST OBSERVED/PREDICTED GROUNDWATER CONDITION– UNCONFINED ZONE

REPORT CODE:	A
FILE NAME:	2018385440012
PROJECT MANAGER:	VEF
SCALE:	AS NOTED
CHECKED BY:	VEF
PROJECT NUMBER:	2018-3854
DRAWN BY:	EEE
DATE:	7/31/2019

FIGURE 12