Appendix A

Boring Logs

Project No: 101082

Project: UMASS Dartmouth

Client: MA DEP

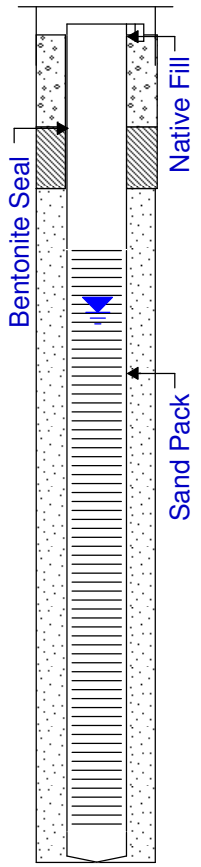
Site Location: Cedar Dell Way, North Dartmouth, MA

Well ID: UMD-5

Field Geologist: DG (MA DEP)

Environmental Strategies & Management, Inc.
184 West Main Street
Norton, MA 02766
508-285-9700

SUBSURFACE PROFILE				SAMPLE
Depth	Symbol	Description	Depth/Elev.	Well Details
0		Ground Surface	0	
		no soil samples collected	0	
14		End of Borehole	-14 14	



Drilled By: AM Drilling Services
Drill Method: Hollow Stem Auger
Drill Date: 8/27/04

Hole Size: 4.25"
Well Diameter: 2"
Sheet: 1 of 1

Project No: 101082

Project: UMASS Dartmouth

Client: MA DEP

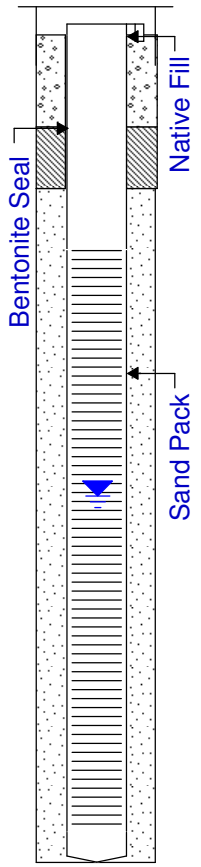
Site Location: Cedar Dell Way, North Dartmouth, MA

Well ID: UMD-6

Field Geologist: DG (MA DEP)

Environmental Strategies & Management, Inc.
184 West Main Street
Norton, MA 02766
508-285-9700

SUBSURFACE PROFILE				SAMPLE
Depth	Symbol	Description	Depth/Elev.	Well Details
0		Ground Surface	0	
		no soil samples collected	0	
14		End of Borehole	-14 14	



Drilled By: AM Drilling Services
Drill Method: Hollow Stem Auger
Drill Date: 8/27/04

Hole Size: 4.25"
Well Diameter: 2"
Sheet: 1 of 1

Project No: 101082

Project: UMASS Dartmouth

Client: MA DEP

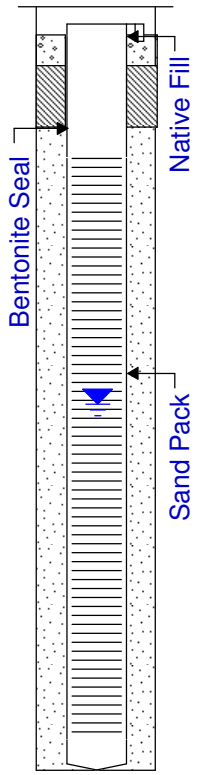
Site Location: Cedar Dell Way, North Dartmouth, MA

Well ID: UMD-7

Field Geologist: DG (MA DEP)

Environmental Strategies & Management, Inc.
184 West Main Street
Norton, MA 02766
508-285-9700

SUBSURFACE PROFILE				SAMPLE
Depth	Symbol	Description	Depth/Elev.	Well Details
0		Ground Surface	0	
			0	
1		no soil samples collected		
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12			-13	
13		End of Borehole	13	
14				
15				
16				
17				
18				
19				
20				



Drilled By: AM Drilling Services
Drill Method: Hollow Stem Auger
Drill Date: 8/27/04

Hole Size: 4.25"
Well Diameter: 2"
Sheet: 1 of 1

Project No: 101082

Project: UMASS Dartmouth

Client: MA DEP

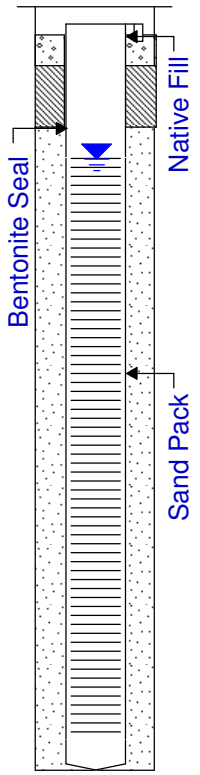
Site Location: Cedar Dell Way, North Dartmouth, MA

Well ID: UMD-8

Field Geologist: DG (MA DEP)

Environmental Strategies & Management, Inc.
184 West Main Street
Norton, MA 02766
508-285-9700

SUBSURFACE PROFILE				SAMPLE
Depth	Symbol	Description	Depth/Elev.	Well Details
0		Ground Surface	0	
		no soil samples collected	0	
12			-13	
13		End of Borehole	13	



Drilled By: AM Drilling Services
Drill Method: Hollow Stem Auger
Drill Date: 8/27/04

Hole Size: 4.25"
Well Diameter: 2"
Sheet: 1 of 1

Appendix B

Modeling Input and Output Files

```
**************************************************************************
********************************
 *****
*****
 ***** SESOIL-84 :  SEASONAL CYCLES OF WATER, SEDIMENT, AND POLLUTANTS
IN SOIL ENVIRONMENTS        *****
 *****
*****
 ***** DEVELOPERS:  M. BONAZOUNTAS,ARTHUR D. LITTLE INC.  ,(617)864-
5770,X5871                  *****
 *****              J. WAGNER     ,DIS/ADLPIPE, INC.      ,(617)492-
1991,X5820                  *****
 *****
*****
 ***** MODIFIED EXTENSIVELY BY:
*****
 ***** D.M. HETRICK
*****
 ***** OAK RIDGE NATIONAL LABORATORY
*****
 ***** (615) 576-7556
*****
 ***** VERSION   :  JANUARY 1995
*****
 *****
*****

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


                        ****** MONTHLY SESOIL MODEL OPERATION ******
                               MONTHLY SITE SPECIFIC SIMULATION


 REGION          :      NEW BEDFORD
 SOIL TYPE       :      Sand
 COMPOUND        :      DEP_Perchlorate
 WASHLOAD DATA   :
 APPLICATION AREA:      UMD-potassium perchlorate


      GENERAL INPUT PARAMETERS
      ========================


      -- SOIL INPUT PARAMETERS --

 SOIL DENSITY (G/CM**3):                                    1.80
 INTRINSIC PERMEABILITY (CM**2):                            .670E-08
 DISCONNECTEDNESS INDEX (-):                                8.50
 POROSITY (-):                                              .320
 ORGANIC CARBON CONTENT (%):                                .200E-01
```

```
 CATION EXCHANGE CAPACITY (MILLI EQ./100G DRY SOIL):       .000
 FREUNDLICH EXPONENT (-):                                 1.00
1

      -- CHEMICAL INPUT PARAMETERS --

 SOLUBILITY (UG/ML):                                      .150E+05
 DIFFUSION COEFFICIENT IN AIR (CM**2/SEC):                .000
 HENRYS LAW CONSTANT (M**3-ATM/MOLE):                     .000
 ADSORPTION COEFFICIENT ON ORGANIC CARBON(KOC):           .000
 ADSORPTION COEFFICIENT ON SOIL (K):                      .000
 MOLECULAR  WEIGHT (G/MOL):                               139.
 VALENCE (-):                                             .000
 NEUTRAL HYDROLYSIS CONSTANT (/DAY):                      .000
 BASE HYDROLYSIS CONSTANT (L/MOL-DAY):                    .000
 ACID HYDROLYSIS CONSTANT (L/MOL-DAY):                    .000
 DEGRADATION RATE IN MOISTURE (/DAY):                     .000
 DEGRADATION RATE ON SOIL (/DAY):                         .000
 LIGAND-POLLUTANT STABILITY CONSTANT (-):                 .000
 NO. MOLES LIGAND/MOLE POLLUTANT (-):                     .000
 LIGAND MOLECULAR WEIGHT (G/MOL):                         .000


      -- APPLICATION INPUT PARAMETERS --

 NUMBER OF SOIL LAYERS:                                     2
 YEARS TO BE SIMULATED:                                    10
 AREA (CM**2):                                          0.210E+08
 APPLICATION AREA LATITUDE (DEG.):                       41.6
 SPILL (1) OR STEADY APPLICATION (0):                       0
 MODIFIED SUMMERS MODEL USED (1) OR NOT (0) FOR GWR. CONC.:  0
 INITIAL CHEMICAL CONCENTRATIONS GIVEN (1) OR NOT GIVEN (0)  0
 DEPTHS (CM):                                               2.5
0.15E+03
 NUMBER OF SUBLAYERS/LAYER                                          1
1
 PH (CM):                                                  0.00
0.00
 INTRINSIC PERMEABILITIES (CM**2):                         0.00
0.00
 KDEL RATIOS (-):                                           1.0
 KDES RATIOS (-):                                           1.0
 OC RATIOS (-):                                             1.0
 CEC RATIOS (-):                                            1.0
 FRN RATIOS(-):                                             1.0
 ADS RATIOS(-):                                             1.0
1
      YEAR -   1    MONTHLY INPUT PARAMETERS
      ========    ========================

      -- CLIMATIC INPUT PARAMETERS --

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

 TEMP. (DEG C)        12.810    7.250    2.250   -3.330   -3.330
2.250    7.250   12.810   18.360   23.920   23.920   18.360
```

```
 CLOUD CVR (FRAC.)     0.610    0.700    0.700    0.610    0.610
0.610    0.610    0.700    0.610    0.610    0.610    0.610
 REL. HUM.(FRAC.)      0.700    0.700    0.700    0.700    0.610
0.610    0.700    0.700    0.780    0.700    0.780    0.780
 ALBEDO (-)            0.097    0.100    0.110    0.120    0.120
0.110    0.100    0.097    0.095    0.094    0.094    0.097
 EVAPOT. (CM/DAY)      0.000    0.000    0.000    0.000    0.000
0.000    0.000    0.000    0.000    0.000    0.000    0.000

 PRECIP. (CM)          3.500    4.440    4.420    4.230    3.950
4.230    3.980    3.520    3.120    2.840    4.270    3.390
 M.TIME RAIN(DAYS)     0.190    0.250    0.240    0.210    0.180
0.230    0.230    0.230    0.200    0.190    0.220    0.190
 M. STORM NO. (-)     13.100   13.250   13.800   11.860   12.880
13.560   13.810   12.840   10.990    8.230    9.610   11.900
 M. SEASON (DAYS)     30.400   30.400   30.400   30.400   30.400
30.400   30.400   30.400   30.400   30.400   30.400   30.400



      -- POLLUTANT INPUT PARAMETERS --

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

 POL. INP-1 (UG/CM**2)  0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 2.52E+00
 TRNSFORMD-1 (UG/CM**2) 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
 SINKS-1 (UG/CM**2)     0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
 LIG.INPUT-1 (UG/CM**2) 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
 VOLATILIZATION MULT.-1 1.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E+00
1.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E+00
 SURFACE RUNOFF MULT.   0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
 POL. IN RAIN (FRAC-SL) 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00


 POL. INP-L (UG/CM**2)  0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
 TRNSFORMD-L (UG/CM**2) 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
 SINKS-L (UG/CM**2)     0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
 LIG.INPUT-L (UG/CM**2) 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
 VOLATILIZATION MULT.-L 1.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E+00
1.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E+00
1
      YEAR -   2    MONTHLY INPUT PARAMETERS
      ========    ======================

      -- CLIMATIC INPUT PARAMETERS ARE SAME AS LAST YEAR
```

-- POLLUTANT INPUT PARAMETERS --

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
POL. INP-1 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TRNSFORMD-1 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SINKS-1 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LIG.INPUT-1 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VOLATILIZATION MULT.-1	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
SURFACE RUNOFF MULT.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
POL. IN RAIN (FRAC-SL)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
POL. INP-L (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TRNSFORMD-L (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SINKS-L (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LIG.INPUT-L (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VOLATILIZATION MULT.-L	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00

1

YEAR - 3 MONTHLY INPUT PARAMETERS

-- CLIMATIC INPUT PARAMETERS ARE SAME AS LAST YEAR

-- POLLUTANT INPUT PARAMETERS ARE SAME AS LAST YEAR

1

YEAR - 4 MONTHLY INPUT PARAMETERS

-- CLIMATIC INPUT PARAMETERS ARE SAME AS LAST YEAR

-- POLLUTANT INPUT PARAMETERS ARE SAME AS LAST YEAR

1

YEAR - 5 MONTHLY INPUT PARAMETERS

-- CLIMATIC INPUT PARAMETERS ARE SAME AS LAST YEAR

-- POLLUTANT INPUT PARAMETERS ARE SAME AS LAST YEAR

1

YEAR - 6 MONTHLY INPUT PARAMETERS

-- CLIMATIC INPUT PARAMETERS ARE SAME AS LAST YEAR

-- POLLUTANT INPUT PARAMETERS ARE SAME AS LAST YEAR
1
YEAR - 7 MONTHLY INPUT PARAMETERS
======== ==========

-- CLIMATIC INPUT PARAMETERS ARE SAME AS LAST YEAR

-- POLLUTANT INPUT PARAMETERS ARE SAME AS LAST YEAR
1
YEAR - 8 MONTHLY INPUT PARAMETERS
======== ==========

-- CLIMATIC INPUT PARAMETERS ARE SAME AS LAST YEAR

-- POLLUTANT INPUT PARAMETERS ARE SAME AS LAST YEAR
1
YEAR - 9 MONTHLY INPUT PARAMETERS
======== ==========

-- CLIMATIC INPUT PARAMETERS ARE SAME AS LAST YEAR

-- POLLUTANT INPUT PARAMETERS ARE SAME AS LAST YEAR
1
YEAR - 10 MONTHLY INPUT PARAMETERS
======== ==========

-- CLIMATIC INPUT PARAMETERS ARE SAME AS LAST YEAR

-- POLLUTANT INPUT PARAMETERS ARE SAME AS LAST YEAR

**** WARNING (MONTH 3) - PROBLEM IN HYDRO CYCLE: BETA GREATER THAN 0.5
RAINFALL MAY NOT FOLLOW POISSON DISTRIBUTION

**** WARNING (MONTH 3) - PROBLEM IN HYDRO CYCLE: W EQUALS OR EXCEEDS
EP
W SET TO EP

**** WARNING (MONTH 7) - PROBLEM IN HYDRO CYCLE: BETA GREATER THAN 0.5
RAINFALL MAY NOT FOLLOW POISSON DISTRIBUTION
1

YEAR - 1 MONTHLY RESULTS (OUTPUT)
======== ==========

-- HYDROLOGIC CYCLE COMPONENTS --

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

 MOIS. IN L1 (%)       12.599    15.895    16.791    17.047    16.087
13.943    12.759    12.151    11.895    11.927    12.631    12.055
 MOIS. BELOW L1 (%)    12.599    15.895    16.791    17.047    16.087
13.943    12.759    12.151    11.895    11.927    12.631    12.055
 PRECIPATION (CM)       3.494     4.452     4.422     4.253     3.964
4.266     4.011     3.521     3.150     2.848     4.273     3.394
 NET INFILT. (CM)       3.494     4.452     4.422     4.253     3.964
4.266     4.011     3.521     3.150     2.848     4.273     3.394
 EVAPOTRANS. (CM)       4.078     1.842     0.797     0.928     2.357
4.505     4.644     4.323     4.026     3.780     4.852     4.267
 MOIS. RETEN (CM)       0.004     0.419     0.114     0.033    -0.122    -
0.272    -0.150    -0.077    -0.032     0.004     0.090    -0.073
 SUR. RUNOFF (CM)       0.000     0.000     0.000     0.000     0.000
0.000     0.000     0.000     0.000     0.000     0.000     0.000
 GRW. RUNOFF (CM)      -0.589     2.192     3.511     3.292     1.729
0.033    -0.483    -0.725    -0.843    -0.937    -0.669    -0.800
 YIELD (CM)            -0.589     2.192     3.511     3.292     1.729
0.033    -0.483    -0.725    -0.843    -0.937    -0.669    -0.800

 PAU/MPA (GZU)          0.998     1.003     1.001     1.005     1.004
1.009     1.008     1.000     1.010     1.003     1.001     1.001
 PA/MPA (GZ)            0.998     1.003     1.001     1.005     1.004
1.009     1.008     1.000     1.010     1.003     1.001     1.001

1                     -- POLLUTANT MASS INPUT TO COLUMN (UG) - INCLUDES
INITIAL POLLUTANT CONCENTRATIONS --
                      ------------------------------------------------
-----------------------------------


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

 PRECIP.     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
 LOAD UPPER  0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 5.292E+07
 LOAD LOWER  0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00

 TOTAL INPUT 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 5.292E+07
0          -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF
COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
           ------------------------------------------------------------
-------------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1
```

```
 IN SOIL MOI 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 3.929E+06

      LOWER SOIL ZONE:

           SUBLAYER  1

 IN SOIL MOI 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 4.899E+07



      -- POLLUTANT CONCENTRATIONS (UG/ML) OR (UG/G) -- NOTE: IF
CONCENTRATIONS ARE ZERO FOR EACH MONTH, THEY ARE NOT PRINTED --
      ------------------------------------------------------------------
----------------------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1

 MOISTURE    0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 6.110E-01
 %SOLUBILITY 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 4.073E-03

      LOWER SOIL ZONE:

           SUBLAYER  1

 MOISTURE    0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 1.291E-01
 %SOLUBILITY 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 8.609E-04


 POL DEP CM  0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 1.520E+01
1                            YEAR -   1 ANNUAL SUMMARY REPORT
                             ================================


        -- TOTAL INPUTS (UG) --


 UPPER SOIL ZONE              5.292E+07
 LOWER SOIL ZONE              0.000E+00


           -- HYDROLOGIC CYCLE COMPONENTS --

 AVERAGE SOIL MOISTURE ZONE 1 (%)              13.815
 AVERAGE SOIL MOISTURE BELOW ZONE 1 (%)        13.815
 TOTAL PRECIPITATION (CM)                      46.048
 TOTAL INFILTRATION (CM)                       46.048
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 TOTAL EVAPOTRANSPIRATION (CM)                  40.400
 TOTAL SURFACE RUNOFF (CM)                       0.000
 TOTAL GRW RUNOFF (CM)                           5.712
 TOTAL MOISTURE RETENTION (CM)                  -0.064
 TOTAL YIELD (CM)                                5.712
0          -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF
COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
           ------------------------------------------------------------
-------------------------------------------
 FOR FINAL MASS IN SOIL MOI., ADS. ON SOIL, SOIL AIR, IMMOBIL CEC,
COMPLEXED, AND PURE PHASE FOR EACH SUBLAYER, SEE ABOVE (MONTH SEP)
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      UPPER SOIL ZONE:

           SUBLAYER  1


      LOWER SOIL ZONE:

           SUBLAYER  1

1                         -- AVERAGE POLLUTANT CONCENTRATIONS --  NOTE:
ONLY NON-ZERO VALUES ARE PRINTED --
                          ------------------------------------------
----------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1

                                    SOIL MOISTURE (UG/ML)  5.092E-02

      LOWER SOIL ZONE:

           SUBLAYER  1

                                    SOIL MOISTURE (UG/ML)  1.076E-02


                                    MAX. POLL. DEPTH (M)   1.520E-01

 **** WARNING (MONTH 3) - PROBLEM IN HYDRO CYCLE: BETA GREATER THAN 0.5
     RAINFALL MAY NOT FOLLOW POISSON DISTRIBUTION

 **** WARNING (MONTH 3) - PROBLEM IN HYDRO CYCLE: W EQUALS OR EXCEEDS
EP
     W SET TO EP

 **** WARNING (MONTH 7) - PROBLEM IN HYDRO CYCLE: BETA GREATER THAN 0.5
     RAINFALL MAY NOT FOLLOW POISSON DISTRIBUTION
1
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YEAR - 2 MONTHLY RESULTS (OUTPUT)
======== ========================

-- HYDROLOGIC CYCLE COMPONENTS --

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MOIS. IN L1 (%)	12.503	15.863	16.791	17.047	16.087	13.943	12.759	12.151	11.895	11.927	12.631	12.055
MOIS. BELOW L1 (%)	12.503	15.863	16.791	17.047	16.087	13.943	12.759	12.151	11.895	11.927	12.631	12.055
PRECIPATION (CM)	3.470	4.407	4.426	4.253	3.964	4.266	4.011	3.521	3.150	2.848	4.273	3.394
NET INFILT. (CM)	3.470	4.407	4.426	4.253	3.964	4.266	4.011	3.521	3.150	2.848	4.273	3.394
EVAPOTRANS. (CM)	4.034	1.842	0.797	0.928	2.357	4.505	4.644	4.323	4.026	3.780	4.852	4.267
MOIS. RETEN (CM)	0.057	0.427	0.118	0.033	-0.122	-0.272	-0.150	-0.077	-0.032	0.004	0.090	-0.073
SUR. RUNOFF (CM)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GRW. RUNOFF (CM)	-0.621	2.138	3.511	3.292	1.729	0.033	-0.483	-0.725	-0.843	-0.937	-0.669	-0.800
YIELD (CM)	-0.621	2.138	3.511	3.292	1.729	0.033	-0.483	-0.725	-0.843	-0.937	-0.669	-0.800
PAU/MPA (GZU)	0.991	0.993	1.001	1.005	1.004	1.009	1.008	1.000	1.010	1.003	1.001	1.001
PA/MPA (GZ)	0.991	0.993	1.001	1.005	1.004	1.009	1.008	1.000	1.010	1.003	1.001	1.001

1 -- POLLUTANT MASS INPUT TO COLUMN (UG) --

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
PRECIP.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
LOAD UPPER	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
LOAD LOWER	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

```
 TOTAL INPUT 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0          -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF
COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
           ------------------------------------------------------------
-------------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1

 IN SOIL MOI 1.060E+02 8.461E-02 8.956E-02 9.093E-02 8.581E-02 7.437E-
02 6.806E-02 6.482E-02 6.345E-02 6.362E-02 6.738E-02 6.430E-02

      LOWER SOIL ZONE:

           SUBLAYER  1

 IN SOIL MOI 5.292E+07 5.292E+07 5.292E+07 5.292E+07 5.292E+07
5.292E+07 5.292E+07 5.292E+07 5.292E+07 5.292E+07 5.292E+07 5.292E+07



      -- POLLUTANT CONCENTRATIONS (UG/ML) OR (UG/G) -- NOTE: IF
CONCENTRATIONS ARE ZERO FOR EACH MONTH, THEY ARE NOT PRINTED --
      ------------------------------------------------------------------
-----------------------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1

 MOISTURE    1.590E-05 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-
08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08
 %SOLUBILITY 1.060E-07 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-
11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11

      LOWER SOIL ZONE:

           SUBLAYER  1

 MOISTURE    1.345E-01 1.060E-01 1.001E-01 9.864E-02 1.045E-01 1.206E-
01 1.318E-01 1.384E-01 1.414E-01 1.410E-01 1.331E-01 1.395E-01
 %SOLUBILITY 8.966E-04 7.067E-04 6.676E-04 6.576E-04 6.968E-04 8.040E-
04 8.786E-04 9.226E-04 9.424E-04 9.399E-04 8.875E-04 9.299E-04


 POL DEP CM  2.872E+01 4.922E+01 7.282E+01 9.490E+01 1.125E+02
1.276E+02 1.430E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02
1                            YEAR -   2 ANNUAL SUMMARY REPORT
                             ================================


        -- TOTAL INPUTS (UG) --
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 UPPER SOIL ZONE              0.000E+00
 LOWER SOIL ZONE              0.000E+00


          -- HYDROLOGIC CYCLE COMPONENTS --

 AVERAGE SOIL MOISTURE ZONE 1 (%)              13.805
 AVERAGE SOIL MOISTURE BELOW ZONE 1 (%)        13.805
 TOTAL PRECIPITATION (CM)                      45.983
 TOTAL INFILTRATION (CM)                       45.983
 TOTAL EVAPOTRANSPIRATION (CM)                 40.356
 TOTAL SURFACE RUNOFF (CM)                      0.000
 TOTAL GRW RUNOFF (CM)                          5.626
 TOTAL MOISTURE RETENTION (CM)                  0.001
 TOTAL YIELD (CM)                               5.626
0          -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF
COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
           ------------------------------------------------------------
-------------------------------------------
 FOR FINAL MASS IN SOIL MOI., ADS. ON SOIL, SOIL AIR, IMMOBIL CEC,
COMPLEXED, AND PURE PHASE FOR EACH SUBLAYER, SEE ABOVE (MONTH SEP)
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-------------------------------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1


      LOWER SOIL ZONE:

           SUBLAYER  1

1                        -- AVERAGE POLLUTANT CONCENTRATIONS --  NOTE:
ONLY NON-ZERO VALUES ARE PRINTED --
                         ------------------------------------------
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      UPPER SOIL ZONE:

           SUBLAYER  1

                                    SOIL MOISTURE (UG/ML)  1.334E-06

      LOWER SOIL ZONE:

           SUBLAYER  1

                                    SOIL MOISTURE (UG/ML)  1.241E-01


                                    MAX. POLL. DEPTH (M)   1.524E+00
1
```

YEAR - 3 MONTHLY RESULTS (OUTPUT)
======== ========================

-- HYDROLOGIC CYCLE COMPONENTS --

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MOIS. IN L1 (%)	12.503	15.863	16.791	17.047	16.087	13.943	12.759	12.151	11.895	11.927	12.631	12.055
MOIS. BELOW L1 (%)	12.503	15.863	16.791	17.047	16.087	13.943	12.759	12.151	11.895	11.927	12.631	12.055
PRECIPATION (CM)	3.470	4.407	4.426	4.253	3.964	4.266	4.011	3.521	3.150	2.848	4.273	3.394
NET INFILT. (CM)	3.470	4.407	4.426	4.253	3.964	4.266	4.011	3.521	3.150	2.848	4.273	3.394
EVAPOTRANS. (CM)	4.034	1.842	0.797	0.928	2.357	4.505	4.644	4.323	4.026	3.780	4.852	4.267
MOIS. RETEN (CM)	0.057	0.427	0.118	0.033	-0.122	-0.272	-0.150	-0.077	-0.032	0.004	0.090	-0.073
SUR. RUNOFF (CM)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GRW. RUNOFF (CM)	-0.621	2.138	3.511	3.292	1.729	0.033	-0.483	-0.725	-0.843	-0.937	-0.669	-0.800
YIELD (CM)	-0.621	2.138	3.511	3.292	1.729	0.033	-0.483	-0.725	-0.843	-0.937	-0.669	-0.800
PAU/MPA (GZU)	0.991	0.993	1.001	1.005	1.004	1.009	1.008	1.000	1.010	1.003	1.001	1.001
PA/MPA (GZ)	0.991	0.993	1.001	1.005	1.004	1.009	1.008	1.000	1.010	1.003	1.001	1.001

1 -- POLLUTANT MASS INPUT TO COLUMN (UG) --

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
PRECIP.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
LOAD UPPER	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

LOAD LOWER 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00

TOTAL INPUT 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0 -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF
COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED

UPPER SOIL ZONE:

SUBLAYER 1

IN SOIL MOI 6.669E-02 8.461E-02 8.956E-02 9.093E-02 8.581E-02 7.437E-
02 6.806E-02 6.482E-02 6.345E-02 6.362E-02 6.738E-02 6.430E-02

LOWER SOIL ZONE:

SUBLAYER 1

IN SOIL MOI 5.292E+07 4.837E+07 4.209E+07 3.701E+07 3.445E+07
3.440E+07 3.440E+07 3.440E+07 3.440E+07 3.440E+07 3.440E+07 3.440E+07
GWR. RUNOFF 0.000E+00 4.545E+06 6.287E+06 5.079E+06 2.558E+06
5.440E+04 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00

-- POLLUTANT CONCENTRATIONS (UG/ML) OR (UG/G) -- NOTE: IF
CONCENTRATIONS ARE ZERO FOR EACH MONTH, THEY ARE NOT PRINTED --
---

UPPER SOIL ZONE:

SUBLAYER 1

MOISTURE 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-
08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08
%SOLUBILITY 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-
11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11

LOWER SOIL ZONE:

SUBLAYER 1

MOISTURE 1.345E-01 9.690E-02 7.964E-02 6.898E-02 6.805E-02 7.838E-
02 8.566E-02 8.994E-02 9.188E-02 9.163E-02 8.653E-02 9.066E-02
%SOLUBILITY 8.966E-04 6.460E-04 5.310E-04 4.599E-04 4.536E-04 5.226E-
04 5.711E-04 5.996E-04 6.125E-04 6.109E-04 5.768E-04 6.044E-04

POL DEP CM 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02
1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02

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-- TOTAL INPUTS (UG) --

UPPER SOIL ZONE	0.000E+00
LOWER SOIL ZONE	0.000E+00

-- HYDROLOGIC CYCLE COMPONENTS --

AVERAGE SOIL MOISTURE ZONE 1 (%)	13.805
AVERAGE SOIL MOISTURE BELOW ZONE 1 (%)	13.805
TOTAL PRECIPITATION (CM)	45.983
TOTAL INFILTRATION (CM)	45.983
TOTAL EVAPOTRANSPIRATION (CM)	40.356
TOTAL SURFACE RUNOFF (CM)	0.000
TOTAL GRW RUNOFF (CM)	5.626
TOTAL MOISTURE RETENTION (CM)	0.001
TOTAL YIELD (CM)	5.626

0 -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED

FOR FINAL MASS IN SOIL MOI., ADS. ON SOIL, SOIL AIR, IMMOBIL CEC, COMPLEXED, AND PURE PHASE FOR EACH SUBLAYER, SEE ABOVE (MONTH SEP)

UPPER SOIL ZONE:

SUBLAYER 1

LOWER SOIL ZONE:

SUBLAYER 1

TOTAL IN GROUNDWATER RUNOFF 1.852E+07

1 -- AVERAGE POLLUTANT CONCENTRATIONS -- NOTE: ONLY NON-ZERO VALUES ARE PRINTED --

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UPPER SOIL ZONE:

SUBLAYER 1

SOIL MOISTURE (UG/ML) 1.000E-08

LOWER SOIL ZONE:

SUBLAYER 1

SOIL MOISTURE (UG/ML) 8.856E-02

MAX. POLL. DEPTH (M)   1.524E+00

1

YEAR - 4 MONTHLY RESULTS (OUTPUT)

-- HYDROLOGIC CYCLE COMPONENTS --

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MOIS. IN L1 (%)	12.503	15.863	16.791	17.047	16.087	13.943	12.759	12.151	11.895	11.927	12.631	12.055
MOIS. BELOW L1 (%)	12.503	15.863	16.791	17.047	16.087	13.943	12.759	12.151	11.895	11.927	12.631	12.055
PRECIPATION (CM)	3.470	4.407	4.426	4.253	3.964	4.266	4.011	3.521	3.150	2.848	4.273	3.394
NET INFILT. (CM)	3.470	4.407	4.426	4.253	3.964	4.266	4.011	3.521	3.150	2.848	4.273	3.394
EVAPOTRANS. (CM)	4.034	1.842	0.797	0.928	2.357	4.505	4.644	4.323	4.026	3.780	4.852	4.267
MOIS. RETEN (CM)	0.057	0.427	0.118	0.033	-0.122	-0.272	-0.150	-0.077	-0.032	0.004	0.090	-0.073
SUR. RUNOFF (CM)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GRW. RUNOFF (CM)	-0.621	2.138	3.511	3.292	1.729	0.033	-0.483	-0.725	-0.843	-0.937	-0.669	-0.800
YIELD (CM)	-0.621	2.138	3.511	3.292	1.729	0.033	-0.483	-0.725	-0.843	-0.937	-0.669	-0.800
PAU/MPA (GZU)	0.991	0.993	1.001	1.005	1.004	1.009	1.008	1.000	1.010	1.003	1.001	1.001
PA/MPA (GZ)	0.991	0.993	1.001	1.005	1.004	1.009	1.008	1.000	1.010	1.003	1.001	1.001

1 -- POLLUTANT MASS INPUT TO COLUMN (UG) --

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

```
 PRECIP.     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
 LOAD UPPER  0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
 LOAD LOWER  0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00

 TOTAL INPUT 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0          -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF
COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
           ------------------------------------------------------------
-----------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1

 IN SOIL MOI 6.669E-02 8.461E-02 8.956E-02 9.093E-02 8.581E-02 7.437E-
02 6.806E-02 6.482E-02 6.345E-02 6.362E-02 6.738E-02 6.430E-02

      LOWER SOIL ZONE:

           SUBLAYER  1

 IN SOIL MOI 3.440E+07 3.144E+07 2.736E+07 2.405E+07 2.239E+07
2.236E+07 2.236E+07 2.236E+07 2.236E+07 2.236E+07 2.236E+07 2.236E+07
 GWR. RUNOFF 0.000E+00 2.954E+06 4.086E+06 3.301E+06 1.663E+06
3.536E+04 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00



      -- POLLUTANT CONCENTRATIONS (UG/ML) OR (UG/G) -- NOTE: IF
CONCENTRATIONS ARE ZERO FOR EACH MONTH, THEY ARE NOT PRINTED --
      ------------------------------------------------------------------
-----------------------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1

 MOISTURE    1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-
08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08
 %SOLUBILITY 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-
11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11

      LOWER SOIL ZONE:

           SUBLAYER  1

 MOISTURE    8.741E-02 6.298E-02 5.177E-02 4.484E-02 4.423E-02 5.095E-
02 5.567E-02 5.846E-02 5.972E-02 5.956E-02 5.624E-02 5.893E-02
 %SOLUBILITY 5.827E-04 4.199E-04 3.451E-04 2.989E-04 2.949E-04 3.396E-
04 3.712E-04 3.897E-04 3.981E-04 3.971E-04 3.749E-04 3.928E-04
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 POL DEP CM  1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02
1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02
1                            YEAR -   4 ANNUAL SUMMARY REPORT
                             ================================


        -- TOTAL INPUTS (UG) --


 UPPER SOIL ZONE              0.000E+00
 LOWER SOIL ZONE              0.000E+00


          -- HYDROLOGIC CYCLE COMPONENTS --

 AVERAGE SOIL MOISTURE ZONE 1 (%)              13.805
 AVERAGE SOIL MOISTURE BELOW ZONE 1 (%)        13.805
 TOTAL PRECIPITATION (CM)                      45.983
 TOTAL INFILTRATION (CM)                       45.983
 TOTAL EVAPOTRANSPIRATION (CM)                 40.356
 TOTAL SURFACE RUNOFF (CM)                      0.000
 TOTAL GRW RUNOFF (CM)                          5.626
 TOTAL MOISTURE RETENTION (CM)                  0.001
 TOTAL YIELD (CM)                               5.626
0          -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF
COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
           ------------------------------------------------------------
-------------------------------------------
 FOR FINAL MASS IN SOIL MOI., ADS. ON SOIL, SOIL AIR, IMMOBIL CEC,
COMPLEXED, AND PURE PHASE FOR EACH SUBLAYER, SEE ABOVE (MONTH SEP)
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-------------------------------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1


      LOWER SOIL ZONE:

           SUBLAYER  1

                TOTAL IN GROUNDWATER RUNOFF       1.204E+07
1                         -- AVERAGE POLLUTANT CONCENTRATIONS --  NOTE:
ONLY NON-ZERO VALUES ARE PRINTED --
                          ------------------------------------------
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      UPPER SOIL ZONE:

           SUBLAYER  1

                                    SOIL MOISTURE (UG/ML)  1.000E-08
```

LOWER SOIL ZONE:

SUBLAYER 1

SOIL MOISTURE (UG/ML) 5.756E-02

MAX. POLL. DEPTH (M) 1.524E+00

1

YEAR - 5 MONTHLY RESULTS (OUTPUT)

-- HYDROLOGIC CYCLE COMPONENTS --

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MOIS. IN L1 (%)	12.503	15.863	16.791	17.047	16.087	13.943	12.759	12.151	11.895	11.927	12.631	12.055
MOIS. BELOW L1 (%)	12.503	15.863	16.791	17.047	16.087	13.943	12.759	12.151	11.895	11.927	12.631	12.055
PRECIPATION (CM)	3.470	4.407	4.426	4.253	3.964	4.266	4.011	3.521	3.150	2.848	4.273	3.394
NET INFILT. (CM)	3.470	4.407	4.426	4.253	3.964	4.266	4.011	3.521	3.150	2.848	4.273	3.394
EVAPOTRANS. (CM)	4.034	1.842	0.797	0.928	2.357	4.505	4.644	4.323	4.026	3.780	4.852	4.267
MOIS. RETEN (CM)	0.057	0.427	0.118	0.033	-0.122	-0.272	-0.150	-0.077	-0.032	0.004	0.090	-0.073
SUR. RUNOFF (CM)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GRW. RUNOFF (CM)	-0.621	2.138	3.511	3.292	1.729	0.033	-0.483	-0.725	-0.843	-0.937	-0.669	-0.800
YIELD (CM)	-0.621	2.138	3.511	3.292	1.729	0.033	-0.483	-0.725	-0.843	-0.937	-0.669	-0.800
PAU/MPA (GZU)	0.991	0.993	1.001	1.005	1.004	1.009	1.008	1.000	1.010	1.003	1.001	1.001
PA/MPA (GZ)	0.991	0.993	1.001	1.005	1.004	1.009	1.008	1.000	1.010	1.003	1.001	1.001

1 -- POLLUTANT MASS INPUT TO COLUMN (UG) --

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

 PRECIP.     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
 LOAD UPPER  0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
 LOAD LOWER  0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00

 TOTAL INPUT 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0          -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF
COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
           ------------------------------------------------------------
-----------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1

 IN SOIL MOI 6.669E-02 8.461E-02 8.956E-02 9.093E-02 8.581E-02 7.437E-
02 6.806E-02 6.482E-02 6.345E-02 6.362E-02 6.738E-02 6.430E-02

      LOWER SOIL ZONE:

           SUBLAYER  1

 IN SOIL MOI 2.236E+07 2.044E+07 1.778E+07 1.563E+07 1.455E+07
1.453E+07 1.453E+07 1.453E+07 1.453E+07 1.453E+07 1.453E+07 1.453E+07
 GWR. RUNOFF 0.000E+00 1.920E+06 2.656E+06 2.145E+06 1.081E+06
2.298E+04 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00



      -- POLLUTANT CONCENTRATIONS (UG/ML) OR (UG/G) -- NOTE: IF
CONCENTRATIONS ARE ZERO FOR EACH MONTH, THEY ARE NOT PRINTED --
      ------------------------------------------------------------------
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      UPPER SOIL ZONE:

           SUBLAYER  1

 MOISTURE    1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-
08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08
 %SOLUBILITY 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-
11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11

      LOWER SOIL ZONE:
```

SUBLAYER 1

MOISTURE 5.681E-02 4.093E-02 3.365E-02 2.914E-02 2.875E-02 3.311E-02 3.619E-02 3.800E-02 3.881E-02 3.871E-02 3.655E-02 3.830E-02
%SOLUBILITY 3.788E-04 2.729E-04 2.243E-04 1.943E-04 1.916E-04 2.208E-04 2.412E-04 2.533E-04 2.588E-04 2.581E-04 2.437E-04 2.553E-04

POL DEP CM 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02

1 YEAR - 5 ANNUAL SUMMARY REPORT
==========

-- TOTAL INPUTS (UG) --

UPPER SOIL ZONE 0.000E+00
LOWER SOIL ZONE 0.000E+00

-- HYDROLOGIC CYCLE COMPONENTS --

AVERAGE SOIL MOISTURE ZONE 1 (%) 13.805
AVERAGE SOIL MOISTURE BELOW ZONE 1 (%) 13.805
TOTAL PRECIPITATION (CM) 45.983
TOTAL INFILTRATION (CM) 45.983
TOTAL EVAPOTRANSPIRATION (CM) 40.356
TOTAL SURFACE RUNOFF (CM) 0.000
TOTAL GRW RUNOFF (CM) 5.626
TOTAL MOISTURE RETENTION (CM) 0.001
TOTAL YIELD (CM) 5.626

0 -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED

FOR FINAL MASS IN SOIL MOI., ADS. ON SOIL, SOIL AIR, IMMOBIL CEC, COMPLEXED, AND PURE PHASE FOR EACH SUBLAYER, SEE ABOVE (MONTH SEP)

UPPER SOIL ZONE:

SUBLAYER 1

LOWER SOIL ZONE:

SUBLAYER 1

TOTAL IN GROUNDWATER RUNOFF 7.825E+06

1 -- AVERAGE POLLUTANT CONCENTRATIONS -- NOTE: ONLY NON-ZERO VALUES ARE PRINTED --

---

UPPER SOIL ZONE:

SUBLAYER 1

SOIL MOISTURE (UG/ML) 1.000E-08

LOWER SOIL ZONE:

SUBLAYER 1

SOIL MOISTURE (UG/ML) 3.741E-02

MAX. POLL. DEPTH (M) 1.524E+00
1

YEAR - 6 MONTHLY RESULTS (OUTPUT)
======== ========================

-- HYDROLOGIC CYCLE COMPONENTS --

	OCT	NOV	DEC	JAN	FEB	MAR
APR	MAY	JUN	JUL	AUG	SEP	
MOIS. IN L1 (%)	12.503	15.863	16.791	17.047	16.087	
13.943	12.759	12.151	11.895	11.927	12.631	12.055
MOIS. BELOW L1 (%)	12.503	15.863	16.791	17.047	16.087	
13.943	12.759	12.151	11.895	11.927	12.631	12.055
PRECIPATION (CM)	3.470	4.407	4.426	4.253	3.964	
4.266	4.011	3.521	3.150	2.848	4.273	3.394
NET INFILT. (CM)	3.470	4.407	4.426	4.253	3.964	
4.266	4.011	3.521	3.150	2.848	4.273	3.394
EVAPOTRANS. (CM)	4.034	1.842	0.797	0.928	2.357	
4.505	4.644	4.323	4.026	3.780	4.852	4.267
MOIS. RETEN (CM)	0.057	0.427	0.118	0.033	-0.122	-
0.272	-0.150	-0.077	-0.032	0.004	0.090	-0.073
SUR. RUNOFF (CM)	0.000	0.000	0.000	0.000	0.000	
0.000	0.000	0.000	0.000	0.000	0.000	0.000
GRW. RUNOFF (CM)	-0.621	2.138	3.511	3.292	1.729	
0.033	-0.483	-0.725	-0.843	-0.937	-0.669	-0.800
YIELD (CM)	-0.621	2.138	3.511	3.292	1.729	
0.033	-0.483	-0.725	-0.843	-0.937	-0.669	-0.800
PAU/MPA (GZU)	0.991	0.993	1.001	1.005	1.004	
1.009	1.008	1.000	1.010	1.003	1.001	1.001

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 PA/MPA (GZ)           0.991    0.993    1.001    1.005    1.004
1.009    1.008    1.000    1.010    1.003    1.001    1.001

1                                          -- POLLUTANT MASS INPUT TO
COLUMN (UG) --
                                           ---------------------------
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                OCT       NOV       DEC       JAN       FEB       MAR
APR       MAY       JUN       JUL       AUG       SEP

 PRECIP.     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
 LOAD UPPER  0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
 LOAD LOWER  0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00

 TOTAL INPUT 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0          -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF
COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
           ------------------------------------------------------------
-------------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1

 IN SOIL MOI 6.669E-02 8.461E-02 8.956E-02 9.093E-02 8.581E-02 7.437E-
02 6.806E-02 6.482E-02 6.345E-02 6.362E-02 6.738E-02 6.430E-02

      LOWER SOIL ZONE:

           SUBLAYER  1

 IN SOIL MOI 1.453E+07 1.328E+07 1.156E+07 1.016E+07 9.459E+06
9.444E+06 9.444E+06 9.444E+06 9.444E+06 9.444E+06 9.444E+06 9.444E+06
 GWR. RUNOFF 0.000E+00 1.248E+06 1.726E+06 1.394E+06 7.024E+05
1.494E+04 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00



      -- POLLUTANT CONCENTRATIONS (UG/ML) OR (UG/G) -- NOTE: IF
CONCENTRATIONS ARE ZERO FOR EACH MONTH, THEY ARE NOT PRINTED --
      ------------------------------------------------------------------
-----------------------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1

 MOISTURE    1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-
08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08
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 %SOLUBILITY 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-
11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11

      LOWER SOIL ZONE:

           SUBLAYER  1

 MOISTURE    3.693E-02 2.661E-02 2.187E-02 1.894E-02 1.868E-02 2.152E-
02 2.352E-02 2.470E-02 2.523E-02 2.516E-02 2.376E-02 2.489E-02
 %SOLUBILITY 2.462E-04 1.774E-04 1.458E-04 1.263E-04 1.246E-04 1.435E-
04 1.568E-04 1.646E-04 1.682E-04 1.677E-04 1.584E-04 1.660E-04


 POL DEP CM  1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02
1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02
1                            YEAR -   6 ANNUAL SUMMARY REPORT
                             ================================


        -- TOTAL INPUTS (UG) --


 UPPER SOIL ZONE              0.000E+00
 LOWER SOIL ZONE              0.000E+00


           -- HYDROLOGIC CYCLE COMPONENTS --

 AVERAGE SOIL MOISTURE ZONE 1 (%)              13.805
 AVERAGE SOIL MOISTURE BELOW ZONE 1 (%)        13.805
 TOTAL PRECIPITATION (CM)                      45.983
 TOTAL INFILTRATION (CM)                       45.983
 TOTAL EVAPOTRANSPIRATION (CM)                 40.356
 TOTAL SURFACE RUNOFF (CM)                      0.000
 TOTAL GRW RUNOFF (CM)                          5.626
 TOTAL MOISTURE RETENTION (CM)                  0.001
 TOTAL YIELD (CM)                               5.626
0          -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF
COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
           ------------------------------------------------------------
-------------------------------------------
 FOR FINAL MASS IN SOIL MOI., ADS. ON SOIL, SOIL AIR, IMMOBIL CEC,
COMPLEXED, AND PURE PHASE FOR EACH SUBLAYER, SEE ABOVE (MONTH SEP)
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      UPPER SOIL ZONE:

           SUBLAYER  1


      LOWER SOIL ZONE:

           SUBLAYER  1

                TOTAL IN GROUNDWATER RUNOFF       5.086E+06
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1 -- AVERAGE POLLUTANT CONCENTRATIONS -- NOTE: ONLY NON-ZERO VALUES ARE PRINTED --

UPPER SOIL ZONE:

SUBLAYER 1

SOIL MOISTURE (UG/ML) 1.000E-08

LOWER SOIL ZONE:

SUBLAYER 1

SOIL MOISTURE (UG/ML) 2.432E-02

MAX. POLL. DEPTH (M) 1.524E+00

1

YEAR - 7 MONTHLY RESULTS (OUTPUT)

-- HYDROLOGIC CYCLE COMPONENTS --

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MOIS. IN L1 (%)	12.503	15.863	16.791	17.047	16.087	13.943	12.759	12.151	11.895	11.927	12.631	12.055
MOIS. BELOW L1 (%)	12.503	15.863	16.791	17.047	16.087	13.943	12.759	12.151	11.895	11.927	12.631	12.055
PRECIPATION (CM)	3.470	4.407	4.426	4.253	3.964	4.266	4.011	3.521	3.150	2.848	4.273	3.394
NET INFILT. (CM)	3.470	4.407	4.426	4.253	3.964	4.266	4.011	3.521	3.150	2.848	4.273	3.394
EVAPOTRANS. (CM)	4.034	1.842	0.797	0.928	2.357	4.505	4.644	4.323	4.026	3.780	4.852	4.267
MOIS. RETEN (CM)	0.057	0.427	0.118	0.033	-0.122	-0.272	-0.150	-0.077	-0.032	0.004	0.090	-0.073
SUR. RUNOFF (CM)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GRW. RUNOFF (CM)	-0.621	2.138	3.511	3.292	1.729	0.033	-0.483	-0.725	-0.843	-0.937	-0.669	-0.800

```
 YIELD (CM)           -0.621    2.138    3.511    3.292    1.729
0.033   -0.483   -0.725   -0.843   -0.937   -0.669   -0.800

 PAU/MPA (GZU)         0.991    0.993    1.001    1.005    1.004
1.009    1.008    1.000    1.010    1.003    1.001    1.001
 PA/MPA (GZ)           0.991    0.993    1.001    1.005    1.004
1.009    1.008    1.000    1.010    1.003    1.001    1.001

1                                          -- POLLUTANT MASS INPUT TO
COLUMN (UG) --
                                           ---------------------------
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                OCT       NOV       DEC       JAN       FEB       MAR
APR       MAY       JUN       JUL       AUG       SEP

 PRECIP.     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
 LOAD UPPER  0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
 LOAD LOWER  0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00

 TOTAL INPUT 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0          -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF
COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
           ------------------------------------------------------------
-------------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1

 IN SOIL MOI 6.669E-02 8.461E-02 8.956E-02 9.093E-02 8.581E-02 7.437E-
02 6.806E-02 6.482E-02 6.345E-02 6.362E-02 6.738E-02 6.430E-02

      LOWER SOIL ZONE:

           SUBLAYER  1

 IN SOIL MOI 9.444E+06 8.633E+06 7.511E+06 6.605E+06 6.148E+06
6.138E+06 6.138E+06 6.138E+06 6.138E+06 6.138E+06 6.138E+06 6.138E+06
 GWR. RUNOFF 0.000E+00 8.111E+05 1.122E+06 9.063E+05 4.565E+05
9.708E+03 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00



      -- POLLUTANT CONCENTRATIONS (UG/ML) OR (UG/G) -- NOTE: IF
CONCENTRATIONS ARE ZERO FOR EACH MONTH, THEY ARE NOT PRINTED --
      ------------------------------------------------------------------
-----------------------------------------------------


      UPPER SOIL ZONE:
```

SUBLAYER 1

MOISTURE 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08
%SOLUBILITY 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11

LOWER SOIL ZONE:

SUBLAYER 1

MOISTURE 2.400E-02 1.729E-02 1.421E-02 1.231E-02 1.214E-02 1.399E-02 1.529E-02 1.605E-02 1.640E-02 1.635E-02 1.544E-02 1.618E-02
%SOLUBILITY 1.600E-04 1.153E-04 9.476E-05 8.207E-05 8.096E-05 9.326E-05 1.019E-04 1.070E-04 1.093E-04 1.090E-04 1.029E-04 1.079E-04

POL DEP CM 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02

1 YEAR - 7 ANNUAL SUMMARY REPORT
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-- TOTAL INPUTS (UG) --

UPPER SOIL ZONE 0.000E+00
LOWER SOIL ZONE 0.000E+00

-- HYDROLOGIC CYCLE COMPONENTS --

AVERAGE SOIL MOISTURE ZONE 1 (%) 13.805
AVERAGE SOIL MOISTURE BELOW ZONE 1 (%) 13.805
TOTAL PRECIPITATION (CM) 45.983
TOTAL INFILTRATION (CM) 45.983
TOTAL EVAPOTRANSPIRATION (CM) 40.356
TOTAL SURFACE RUNOFF (CM) 0.000
TOTAL GRW RUNOFF (CM) 5.626
TOTAL MOISTURE RETENTION (CM) 0.001
TOTAL YIELD (CM) 5.626

0 -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED

FOR FINAL MASS IN SOIL MOI., ADS. ON SOIL, SOIL AIR, IMMOBIL CEC, COMPLEXED, AND PURE PHASE FOR EACH SUBLAYER, SEE ABOVE (MONTH SEP)

UPPER SOIL ZONE:

SUBLAYER 1

LOWER SOIL ZONE:

SUBLAYER 1

TOTAL IN GROUNDWATER RUNOFF 3.306E+06
1 -- AVERAGE POLLUTANT CONCENTRATIONS -- NOTE: ONLY NON-ZERO VALUES ARE PRINTED --
---

UPPER SOIL ZONE:

SUBLAYER 1

SOIL MOISTURE (UG/ML) 1.000E-08

LOWER SOIL ZONE:

SUBLAYER 1

SOIL MOISTURE (UG/ML) 1.580E-02

MAX. POLL. DEPTH (M) 1.524E+00
1

YEAR - 8 MONTHLY RESULTS (OUTPUT)
======== ========================

-- HYDROLOGIC CYCLE COMPONENTS --

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MOIS. IN L1 (%)	12.503	15.863	16.791	17.047	16.087	13.943	12.759	12.151	11.895	11.927	12.631	12.055
MOIS. BELOW L1 (%)	12.503	15.863	16.791	17.047	16.087	13.943	12.759	12.151	11.895	11.927	12.631	12.055
PRECIPATION (CM)	3.470	4.407	4.426	4.253	3.964	4.266	4.011	3.521	3.150	2.848	4.273	3.394
NET INFILT. (CM)	3.470	4.407	4.426	4.253	3.964	4.266	4.011	3.521	3.150	2.848	4.273	3.394
EVAPOTRANS. (CM)	4.034	1.842	0.797	0.928	2.357	4.505	4.644	4.323	4.026	3.780	4.852	4.267

```
 MOIS. RETEN (CM)      0.057    0.427    0.118    0.033   -0.122   -
0.272   -0.150   -0.077   -0.032    0.004    0.090   -0.073
 SUR. RUNOFF (CM)      0.000    0.000    0.000    0.000    0.000
0.000    0.000    0.000    0.000    0.000    0.000    0.000
 GRW. RUNOFF (CM)     -0.621    2.138    3.511    3.292    1.729
0.033   -0.483   -0.725   -0.843   -0.937   -0.669   -0.800
 YIELD (CM)           -0.621    2.138    3.511    3.292    1.729
0.033   -0.483   -0.725   -0.843   -0.937   -0.669   -0.800

 PAU/MPA (GZU)         0.991    0.993    1.001    1.005    1.004
1.009    1.008    1.000    1.010    1.003    1.001    1.001
 PA/MPA (GZ)           0.991    0.993    1.001    1.005    1.004
1.009    1.008    1.000    1.010    1.003    1.001    1.001

1                                          -- POLLUTANT MASS INPUT TO
COLUMN (UG) --
                                           ---------------------------
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                OCT       NOV       DEC       JAN       FEB       MAR
APR       MAY       JUN       JUL       AUG       SEP

 PRECIP.     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
 LOAD UPPER  0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
 LOAD LOWER  0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00

 TOTAL INPUT 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0          -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF
COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
           ------------------------------------------------------------
-------------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1

 IN SOIL MOI 6.669E-02 8.461E-02 8.956E-02 9.093E-02 8.581E-02 7.437E-
02 6.806E-02 6.482E-02 6.345E-02 6.362E-02 6.738E-02 6.430E-02

      LOWER SOIL ZONE:

           SUBLAYER  1

 IN SOIL MOI 6.138E+06 5.611E+06 4.882E+06 4.293E+06 3.996E+06
3.990E+06 3.990E+06 3.990E+06 3.990E+06 3.990E+06 3.990E+06 3.990E+06
 GWR. RUNOFF 0.000E+00 5.272E+05 7.292E+05 5.891E+05 2.967E+05
6.310E+03 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
```

```
      -- POLLUTANT CONCENTRATIONS (UG/ML) OR (UG/G) -- NOTE: IF
CONCENTRATIONS ARE ZERO FOR EACH MONTH, THEY ARE NOT PRINTED --
      ------------------------------------------------------------------
-----------------------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1

 MOISTURE    1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-
08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08
 %SOLUBILITY 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-
11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11

      LOWER SOIL ZONE:

           SUBLAYER  1

 MOISTURE    1.560E-02 1.124E-02 9.238E-03 8.001E-03 7.893E-03 9.092E-
03 9.936E-03 1.043E-02 1.066E-02 1.063E-02 1.004E-02 1.052E-02
 %SOLUBILITY 1.040E-04 7.493E-05 6.159E-05 5.334E-05 5.262E-05 6.061E-
05 6.624E-05 6.955E-05 7.105E-05 7.086E-05 6.691E-05 7.011E-05


 POL DEP CM  1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02
1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02
1                            YEAR -   8 ANNUAL SUMMARY REPORT
                             ================================


        -- TOTAL INPUTS (UG) --


 UPPER SOIL ZONE              0.000E+00
 LOWER SOIL ZONE              0.000E+00


           -- HYDROLOGIC CYCLE COMPONENTS --

 AVERAGE SOIL MOISTURE ZONE 1 (%)               13.805
 AVERAGE SOIL MOISTURE BELOW ZONE 1 (%)         13.805
 TOTAL PRECIPITATION (CM)                       45.983
 TOTAL INFILTRATION (CM)                        45.983
 TOTAL EVAPOTRANSPIRATION (CM)                  40.356
 TOTAL SURFACE RUNOFF (CM)                       0.000
 TOTAL GRW RUNOFF (CM)                           5.626
 TOTAL MOISTURE RETENTION (CM)                   0.001
 TOTAL YIELD (CM)                                5.626
0          -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF
COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
           ------------------------------------------------------------
-------------------------------------------
 FOR FINAL MASS IN SOIL MOI., ADS. ON SOIL, SOIL AIR, IMMOBIL CEC,
COMPLEXED, AND PURE PHASE FOR EACH SUBLAYER, SEE ABOVE (MONTH SEP)
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```

UPPER SOIL ZONE:

SUBLAYER 1

LOWER SOIL ZONE:

SUBLAYER 1

TOTAL IN GROUNDWATER RUNOFF 2.148E+06
1 -- AVERAGE POLLUTANT CONCENTRATIONS -- NOTE: ONLY NON-ZERO VALUES ARE PRINTED --
---

UPPER SOIL ZONE:

SUBLAYER 1

SOIL MOISTURE (UG/ML) 1.000E-08

LOWER SOIL ZONE:

SUBLAYER 1

SOIL MOISTURE (UG/ML) 1.027E-02

MAX. POLL. DEPTH (M) 1.524E+00
1

YEAR - 9 MONTHLY RESULTS (OUTPUT)
======== ========================

-- HYDROLOGIC CYCLE COMPONENTS --

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MOIS. IN L1 (%)	12.503	15.863	16.791	17.047	16.087	13.943	12.759	12.151	11.895	11.927	12.631	12.055
MOIS. BELOW L1 (%)	12.503	15.863	16.791	17.047	16.087	13.943	12.759	12.151	11.895	11.927	12.631	12.055

```
 PRECIPATION (CM)      3.470    4.407    4.426    4.253    3.964
4.266    4.011    3.521    3.150    2.848    4.273    3.394
 NET INFILT. (CM)      3.470    4.407    4.426    4.253    3.964
4.266    4.011    3.521    3.150    2.848    4.273    3.394
 EVAPOTRANS. (CM)      4.034    1.842    0.797    0.928    2.357
4.505    4.644    4.323    4.026    3.780    4.852    4.267
 MOIS. RETEN (CM)      0.057    0.427    0.118    0.033   -0.122   -
0.272   -0.150   -0.077   -0.032    0.004    0.090   -0.073
 SUR. RUNOFF (CM)      0.000    0.000    0.000    0.000    0.000
0.000    0.000    0.000    0.000    0.000    0.000    0.000
 GRW. RUNOFF (CM)     -0.621    2.138    3.511    3.292    1.729
0.033   -0.483   -0.725   -0.843   -0.937   -0.669   -0.800
 YIELD (CM)           -0.621    2.138    3.511    3.292    1.729
0.033   -0.483   -0.725   -0.843   -0.937   -0.669   -0.800

 PAU/MPA (GZU)         0.991    0.993    1.001    1.005    1.004
1.009    1.008    1.000    1.010    1.003    1.001    1.001
 PA/MPA (GZ)           0.991    0.993    1.001    1.005    1.004
1.009    1.008    1.000    1.010    1.003    1.001    1.001

1                                          -- POLLUTANT MASS INPUT TO
COLUMN (UG) --
                                           ---------------------------
--------------


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

 PRECIP.     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
 LOAD UPPER  0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
 LOAD LOWER  0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00

 TOTAL INPUT 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0          -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF
COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
           ------------------------------------------------------------
-------------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1

 IN SOIL MOI 6.669E-02 8.461E-02 8.956E-02 9.093E-02 8.581E-02 7.437E-
02 6.806E-02 6.482E-02 6.345E-02 6.362E-02 6.738E-02 6.430E-02

      LOWER SOIL ZONE:

           SUBLAYER  1

 IN SOIL MOI 3.990E+06 3.647E+06 3.173E+06 2.790E+06 2.597E+06
2.593E+06 2.593E+06 2.593E+06 2.593E+06 2.593E+06 2.593E+06 2.593E+06
```

GWR. RUNOFF 0.000E+00 3.426E+05 4.740E+05 3.829E+05 1.929E+05
4.101E+03 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00

-- POLLUTANT CONCENTRATIONS (UG/ML) OR (UG/G) -- NOTE: IF
CONCENTRATIONS ARE ZERO FOR EACH MONTH, THEY ARE NOT PRINTED --
---

UPPER SOIL ZONE:

SUBLAYER 1

MOISTURE 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-
08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08
%SOLUBILITY 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-
11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11

LOWER SOIL ZONE:

SUBLAYER 1

MOISTURE 1.014E-02 7.305E-03 6.005E-03 5.201E-03 5.130E-03 5.910E-
03 6.458E-03 6.781E-03 6.927E-03 6.908E-03 6.523E-03 6.835E-03
%SOLUBILITY 6.759E-05 4.870E-05 4.003E-05 3.467E-05 3.420E-05 3.940E-
05 4.305E-05 4.521E-05 4.618E-05 4.606E-05 4.349E-05 4.557E-05

POL DEP CM 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02
1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02
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==========

-- TOTAL INPUTS (UG) --

UPPER SOIL ZONE 0.000E+00
LOWER SOIL ZONE 0.000E+00

-- HYDROLOGIC CYCLE COMPONENTS --

AVERAGE SOIL MOISTURE ZONE 1 (%) 13.805
AVERAGE SOIL MOISTURE BELOW ZONE 1 (%) 13.805
TOTAL PRECIPITATION (CM) 45.983
TOTAL INFILTRATION (CM) 45.983
TOTAL EVAPOTRANSPIRATION (CM) 40.356
TOTAL SURFACE RUNOFF (CM) 0.000
TOTAL GRW RUNOFF (CM) 5.626
TOTAL MOISTURE RETENTION (CM) 0.001
TOTAL YIELD (CM) 5.626
0 -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF
COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED

```
          ------------------------------------------------------------
-------------------------------------------
 FOR FINAL MASS IN SOIL MOI., ADS. ON SOIL, SOIL AIR, IMMOBIL CEC,
COMPLEXED, AND PURE PHASE FOR EACH SUBLAYER, SEE ABOVE (MONTH SEP)
 ------------------------------------------------------------------
-----------------------------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1


      LOWER SOIL ZONE:

           SUBLAYER  1

                TOTAL IN GROUNDWATER RUNOFF       1.396E+06
1                        -- AVERAGE POLLUTANT CONCENTRATIONS --  NOTE:
ONLY NON-ZERO VALUES ARE PRINTED --
                         ------------------------------------------
-----------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1

                                    SOIL MOISTURE (UG/ML)  1.000E-08

      LOWER SOIL ZONE:

           SUBLAYER  1

                                    SOIL MOISTURE (UG/ML)  6.677E-03


                                    MAX. POLL. DEPTH (M)   1.524E+00
1




      YEAR -  10    MONTHLY RESULTS (OUTPUT)
      ========    ========================




      -- HYDROLOGIC CYCLE COMPONENTS --
```

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

 MOIS. IN L1 (%)       12.503   15.863   16.791   17.047   16.087
13.943   12.759   12.151   11.895   11.927   12.631   12.055
 MOIS. BELOW L1 (%)    12.503   15.863   16.791   17.047   16.087
13.943   12.759   12.151   11.895   11.927   12.631   12.055
 PRECIPATION (CM)       3.470    4.407    4.426    4.253    3.964
4.266    4.011    3.521    3.150    2.848    4.273    3.394
 NET INFILT. (CM)       3.470    4.407    4.426    4.253    3.964
4.266    4.011    3.521    3.150    2.848    4.273    3.394
 EVAPOTRANS. (CM)       4.034    1.842    0.797    0.928    2.357
4.505    4.644    4.323    4.026    3.780    4.852    4.267
 MOIS. RETEN (CM)       0.057    0.427    0.118    0.033   -0.122   -
0.272   -0.150   -0.077   -0.032    0.004    0.090   -0.073
 SUR. RUNOFF (CM)       0.000    0.000    0.000    0.000    0.000
0.000    0.000    0.000    0.000    0.000    0.000    0.000
 GRW. RUNOFF (CM)      -0.621    2.138    3.511    3.292    1.729
0.033   -0.483   -0.725   -0.843   -0.937   -0.669   -0.800
 YIELD (CM)            -0.621    2.138    3.511    3.292    1.729
0.033   -0.483   -0.725   -0.843   -0.937   -0.669   -0.800

 PAU/MPA (GZU)          0.991    0.993    1.001    1.005    1.004
1.009    1.008    1.000    1.010    1.003    1.001    1.001
 PA/MPA (GZ)            0.991    0.993    1.001    1.005    1.004
1.009    1.008    1.000    1.010    1.003    1.001    1.001

1                                          -- POLLUTANT MASS INPUT TO
COLUMN (UG) --
                                           ---------------------------
--------------


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

 PRECIP.     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
 LOAD UPPER  0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
 LOAD LOWER  0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00

 TOTAL INPUT 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0          -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF
COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
           ------------------------------------------------------------
-------------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1

 IN SOIL MOI 6.669E-02 8.461E-02 8.956E-02 9.093E-02 8.581E-02 7.437E-
02 6.806E-02 6.482E-02 6.345E-02 6.362E-02 6.738E-02 6.430E-02
```

LOWER SOIL ZONE:

SUBLAYER 1

IN SOIL MOI 2.593E+06 2.370E+06 2.062E+06 1.813E+06 1.688E+06 1.685E+06 1.685E+06 1.685E+06 1.685E+06 1.685E+06 1.685E+06 1.685E+06
GWR. RUNOFF 0.000E+00 2.227E+05 3.081E+05 2.489E+05 1.254E+05 2.666E+03 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00

-- POLLUTANT CONCENTRATIONS (UG/ML) OR (UG/G) -- NOTE: IF CONCENTRATIONS ARE ZERO FOR EACH MONTH, THEY ARE NOT PRINTED --

---

UPPER SOIL ZONE:

SUBLAYER 1

MOISTURE 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08 1.000E-08
%SOLUBILITY 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11 6.667E-11

LOWER SOIL ZONE:

SUBLAYER 1

MOISTURE 6.590E-03 4.748E-03 3.903E-03 3.380E-03 3.334E-03 3.841E-03 4.197E-03 4.408E-03 4.502E-03 4.490E-03 4.240E-03 4.443E-03
%SOLUBILITY 4.393E-05 3.165E-05 2.602E-05 2.254E-05 2.223E-05 2.561E-05 2.798E-05 2.938E-05 3.002E-05 2.994E-05 2.827E-05 2.962E-05

POL DEP CM 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02 1.524E+02

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-- TOTAL INPUTS (UG) --

UPPER SOIL ZONE	0.000E+00
LOWER SOIL ZONE	0.000E+00

-- HYDROLOGIC CYCLE COMPONENTS --

AVERAGE SOIL MOISTURE ZONE 1 (%)	13.805
AVERAGE SOIL MOISTURE BELOW ZONE 1 (%)	13.805
TOTAL PRECIPITATION (CM)	45.983
TOTAL INFILTRATION (CM)	45.983
TOTAL EVAPOTRANSPIRATION (CM)	40.356

```
 TOTAL SURFACE RUNOFF (CM)                        0.000
 TOTAL GRW RUNOFF (CM)                            5.626
 TOTAL MOISTURE RETENTION (CM)                    0.001
 TOTAL YIELD (CM)                                 5.626
0          -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF
COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
           ------------------------------------------------------------
-------------------------------------------
 FOR FINAL MASS IN SOIL MOI., ADS. ON SOIL, SOIL AIR, IMMOBIL CEC,
COMPLEXED, AND PURE PHASE FOR EACH SUBLAYER, SEE ABOVE (MONTH SEP)
 ------------------------------------------------------------------------
-------------------------------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1


      LOWER SOIL ZONE:

           SUBLAYER  1

                TOTAL IN GROUNDWATER RUNOFF       9.077E+05
1                        -- AVERAGE POLLUTANT CONCENTRATIONS --  NOTE:
ONLY NON-ZERO VALUES ARE PRINTED --
                         ------------------------------------------
-----------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1

                                     SOIL MOISTURE (UG/ML)  1.000E-08

      LOWER SOIL ZONE:

           SUBLAYER  1

                                     SOIL MOISTURE (UG/ML)  4.340E-03


                                     MAX. POLL. DEPTH (M)   1.524E+00



 ************************************EXECUTION
COMPLETED************************************
```

Appendix C

Dispersivity Values for Model

Justification for selection of Dispersivity coefficients

Dispersion in groundwater occurs as a consequence of two different processes: mechanical dispersion and diffusion as shown in equation 4. (Pickens and Grisak, 1981):

$$D_x = \alpha_x v + D^* \qquad (1)$$

Where D_X is the coefficient of hydrodynamic dispersion, α_x is the longitudinal dispersivity in the x-direction and D^* is the molecular diffusion.

Mechanical dispersion is caused by local variations in velocity which in turn is caused by non-idealities or heterogeneity of a medium. Some of the geological features contributing to heterogeneity of a medium are pore size distribution, non-uniform stratification, directional and non-uniform permeability etc. Hydraulic conductivity is the most important variable contributing to heterogeneity of a medium.

In a more recent geo-statistical approach, longitudinal macro-dispersion, A^*_L is given by (Domenico, Swartz, 1998):

$$A_L^* = A_L + \alpha_L + \frac{D_d^*}{v} \qquad (2)$$

where

α_L = local scale (Sudicky, 1986), pore scale (Domenico and Schwartz, 1998), microscopic and column scale dispersion (Smith and Schwartz,1980). Local scale dispersion is generally assumed to be insignificant (Gelhar and Axness, 1983).

D_d^* = diffusion coefficient, is generally assumed to be negligible (Domenico and Schwartz, 1998), (Pickens and Grisak, 1981).

A_L = asymptotic longitudinal dispersivity (Gelhar and Axness, 1983) given by:

$$A_L = \frac{\sigma_Y^2 \lambda}{\gamma^2} \qquad (3)$$

where:

γ =1 (Dagan, 1982)
σ_Y^2 = variance of the log-transformed hydraulic conductivity (Y = ln K)
λ = correlation length in the mean direction of flow.

A^*_T, the transverse macro-dispersivity is given by:

$$A_T^* = A_T + \alpha_T + \frac{D_d^*}{v} \quad (4)$$

In equation 3, $A_T = 0$ and therefore, theoretically, field-scale heterogeniety does not affect transverse dispersion.

From equation 3, the asymptotic longitudinal dispersivity, A_L is affected by the heterogeneity or variability of a medium. Spatial mean and variance of hydraulic conductivity and correlation lengths have been used to describe the heterogeneity of a medium. The correlation length is a measure of spatial persistence of zones of similar properties.

Dispersivity and scale of measurement

The greater the distance over which dispersivity is measured, the greater the observed value which is called the *scale effect* (Anderson, 1979). In laboratory column experiments, dispersion is reported to be controlled by fluid flow velocity and grain size distribution. Local scale dispersion is in the centimeter range and is generally two or more orders of magnitude smaller than dispersivity at a macro scale (Smith and Schwartz, 1980). For example, longitudinal dispersivities for a *medium sand* soil were measured using an in-situ single-well injection-withdrawl tracer test and a laboratory column test (Pickens and Grisak, 1981). Longitudinal dispersivities were found to be an order of magnitude higher when measured in-situ (0.7 cm) than the column scale study (0.035 cm). Based on the scale of measurements reported by researchers, there is evidence that dispersivity coefficients are scale dependent (Pickens and Grisak, 1981, Gelhar et.al. 1985).

Theoretically, however, from equation 3, longitudinal dispersivity initially increases linearly with distance and gradually approaches a constant asymptotic value (Gelhar and Axness, 1983, Dagan, 1986,1988). Therefore, groundwater must move a substantial distance before it is able to fully interact with the heterogeneity to the extent necessary to produce a macro-scale mixing. That would explain increase in dispersivity away from a source before approaching an asympotic (or fixed) value. For example, the asymptotic value had not been reached even after 90m (300ft) of contaminant travel at the Borden site (Freyberg, 1986).

Gelhar et al (1992) reviewed 106 field observations of dispersivities from 59 sites and classified the data points into three groups of varying reliability levels: high, intermediate, and low. They concluded that, in general, field scale dispersion appears to be scale-dependent although the relation may not be linear.

Xu and Eckstein (1995) have proposed a weighted least-squares data fitting method using the data reviewed by Gelhar to provide an improved statistical model of relationship between field scale and dispersivity given as equation 5. Their equation incorporates the general asymptotic nature of dispersion. Their analysis indicates when

the flow distance exceeds 1,000 meters, increase in longitudinal dispersivity is practically negligible.

$$\alpha_x = 3.28 * 0.83\left[\log_{10}\left(\frac{L_p}{3.28}\right)\right]^{2.414} \qquad (5)$$

where:
L_P = Scale of study, ft.
α_x = Longitudinal dispersion coefficient, ft.

Field measured variance of hydraulic conductivity, correlation lengths and longitudinal dispersivities of four well characterized sites are shown in the following Table :

Table

Site Location	Variance of conductivity	Horizontal correlation scale,m	L,T,V* Dispersivity, m	Reference
Cape Cod, MA	0.24	2.6	0.96, 0.018, 0.0015	Garabedian et.al., 1991
Borden, Canada	0.29	2.8	0.43,0.039	Freyberg et.al., 1986
Borden, Canada	0.29	2.8	0.5, 0.05, 0.0022	Gelhar et.al. 1991
Columbus, Mississippi	4.5	12.8	7.5	Gelhar et.al., 1992
Denmark	0.37	1.5	0.45, 0.001,0.0005	Jensen et.al., 1993

* Independently measured longitudinal, transverse, and vertical dispersivity, where reported.

As discussed earlier (also equation 3), longitudinal dispersivity is proportional to heterogeneity, which is indicated by variance of conductivity. Based on the estimated variances of hydraulic conductivity measurements of four sites presented in the abovementioned Table, the Columbus site is the most heterogeneous (highest value of variance) with a field measured longitudinal dispersivity (7.5m) an order of magnitude higher than the rest of the sites. In a reliable study conducted at a sand and gravel aquifer in Cape Cod, at a scale of 250m (820 feet), the longitudinal, transverse and the vertical dispersivities were measured to be 0.96m, 0.018m, 0.0015m, respectively. For the Cape Cod site, longitudinal dispersivity estimated using equation 3 yields a value of 0.63m which is close to the measured value of 0.96m.

For groundwater modeling of contaminant migration in subsurface, it is a common practice to select constant values for the ratio of longitudinal to transverse dispersivities. Gelhar et. al.(1992) in a review of all available field-scale studies noted that transverse dispersivities are at least an order of magnitude smaller than the longitudinal dispersivity values. From the high reliable field data, the ratio of horizontal to transverse dispersivity was observed to be approximately 10.

From results of available field studies, vertical dispersivity was noted to be 1-2 orders of magnitude smaller than the transverse dispersivity. In media with pronounced

horizontal stratification, values of vertical dispersivity may be similar to diffusion (Sudicky, 1986). To date, only 9 field-scale vertical dispersivity data points have been reported in the literature. Of the 9 points, only 2 data points were classified as highly reliable corresponding to the Borden (Freygerg, 1986) and the Cape Cod (Garabedian, 1991) sites. All of the vertical dispersivities reported in the literature are less than 1meter and the two high-reliable values (according to Gelhar et. al.) are only a few millimeters which is the same order of magnitude as the local transverse dispersivity for sandy materials.

In light of the above discussion, longitudinal dispersivity is a function of heterogeneity. Since most sites in MA are not as homogeneous as the CapeCod site in MA, dispersivity values measured at CapeCod can at best be assumed to be a conservative estimate for most sites in MA. Table 2 lists the assumptions for dispersivities.

TABLE 2
Dispersivity Assumptions

Dispersivity	**Value**
Longitudinal	Based on Xu & Eckstein's equation
Transverse	0.1* longitudinal dispersivity (Field scale data, Gelhar et. al. 1992)
Vertical	0.025 * longitudinal dispersivity (EPA, 1986)

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