A.2
3/26/96

MEMORANDUM

MONTGOMERY WATSON

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US EPA RECORDS CENTER REGION 5
464744

cc: ACS Technical Committee

From: Peter Vagt

Subject: Summary of Modeling Set-up for Technical Brief Evaluation of Groundwater Extraction Trench ACS NPL RD/RA

Visual Modflow® was the software interface used to set up the evaluation of the groundwater extraction trench for the ACS NPL Site Perimeter Groundwater Collection System (PGCS). Aquifer characteristics and properties were derived from the investigations previously conducted at the site, including the remedial investigation, a pumping test, and previous groundwater modeling activities.

Copies of the Modflow input files for this modeling exercise are attached to show the values that were input into the model to represent the site conditions. "Feet" were the length unit and "days" were the time unit used in the model. The following is a listing of the primary properties and characteristics used, including references to the model input files.

A single hydraulic conductivity value of 12 ft/day (4×10^{-3} cm/sec) was used for the upper aquifer. The input line is shown on Page 5.

Storativity and porosity values are not used by the model, since the model was run as a steady state model.

The drainage ditch north of the ACS site was represented by "river" cells (Page 6). The surface water elevation (which controls recharge or discharge) ranges from 629.5 feet above mean sea level (amsl) at the north side of the modeled area, to 628.1 feet at the west boundary. Since these elevations are below the static water table levels (generally above 630 feet amsl), the modeled ditch acts as a discharge zone in the model.

Infiltration was applied to the model on the ACS facility, but not applied to the wetland areas surrounding the site, since the wetland areas are discharge areas rather than recharge areas (Page 7). Infiltration values from 4 to 10 inches per year were applied across the ACS facility ($9x10^{-4}$ to $2x10^{-3}$ ft/day). An amount equivalent to 200 inches per year was applied to the Firepond, since the surface water drainage system is currently diverted to the firepond (Page 8).

The Extraction Trench representing the 50 Percent Design Submittal is on Page 13 and the modified extraction trench is shown on Page 14. The model cell width in the extension area is 75 feet per cell. Therefore, the 300-foot extension is represented by adding four cells. The fourth column shows that the "intake elevation" of the trench is set at 628 feet. This is one foot below the static water table elevation along most of the trench alignment on the baseline model.

PJV
C:\MSOFFICE\WINWORD\JOBS\ACS\VMF-SUM.DOC
4077.0080

Input file name →

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Basic Package translator - (c) 1994 Waterloo Hydrogeologic Software
ACS-A.BAS Mon Mar 18 09:08:54 1996
         1          31          31           1           4
 11  0  0 14 15  0  0 18 19  0  0 22  0  0  0  0  0  0  0  0  0  0  0  0
         0           1
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Boundary Conditions Established by setting constant head values at the outer edge of the modeled area

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  6.32E+02
6.25000e+2  6.25000e+2  6.25000e+2  6.25000e+2  6.26426e+2  6.27845e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2
6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2
6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2
  6.32E+02
6.28000e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29000e+2  6.29982e+2  6.29982e+2  6.29982e+2
6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2
6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2
  6.32E+02
6.28000e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29000e+2  6.29982e+2  6.29982e+2
6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2
6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2
  6.32E+02
6.28000e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29000e+2  6.29982e+2  6.29982e+2
6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2
6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2  6.29982e+2
  6.32E+02
6.28000e+2  6.28553e+2  6.29160e+2  6.29468e+2  6.29636e+2  6.29803e+2  6.29939e+2  6.30040e+2  6.30139e+2  6.30248e+2
6.30352e+2  6.30440e+2  6.30527e+2  6.30615e+2  6.30699e+2  6.30824e+2  6.31000e+2  6.31079e+2  6.31159e+2
6.31242e+2  6.31325e+2  6.31404e+2  6.31484e+2  6.31565e+2  6.31648e+2  6.31729e+2  6.31811e+2  6.31933e+2  6.32175e+2
  6.33E+02
1.0000          11.0000
```

ACS-A.RIV ← Input file name

23	50				
23					
1	5	26.28144e+2	1.00000e+3	6.25096e+2	-1
1	5	36.28406e+2	1.00000e+3	6.25270e+2	-1
1	5	46.28538e+2	1.00000e+3	6.25359e+2	-1
1	5	56.28610e+2	1.00000e+3	6.25407e+2	-1
1	5	66.28682e+2	1.00000e+3	6.25455e+2	-1
1	6	76.28877e+2	1.00000e+3	6.25585e+2	-1
1	6	86.28920e+2	1.00000e+3	6.25614e+2	-1
1	6	96.28963e+2	1.00000e+3	6.25642e+2	-1
1	6	106.29010e+2	1.00000e+3	6.25673e+2	-1
1	6	116.29055e+2	1.00000e+3	6.25703e+2	-1
1	6	126.29092e+2	1.00000e+3	6.25728e+2	-1
1	6	136.29130e+2	1.00000e+3	6.25753e+2	-1
1	6	146.29168e+2	1.00000e+3	6.25778e+2	-1
1	6	156.29204e+2	1.00000e+3	6.25802e+2	-1
1	7	166.29305e+2	1.00000e+3	6.25870e+2	-1
1	8	176.29425e+2	1.00000e+3	6.25950e+2	-1
1	8	186.29500e+2	1.00000e+3	6.26000e+2	-1
1	7	196.29500e+2	1.00000e+3	6.26000e+2	-1
1	6	196.29500e+2	1.00000e+3	6.26000e+2	-1
1	5	206.29500e+2	1.00000e+3	6.26000e+2	-1
1	4	216.29500e+2	1.00000e+3	6.26000e+2	-1
1	3	226.29500e+2	1.00000e+3	6.26000e+2	-1
1	2	236.29500e+2	1.00000e+3	6.26000e+2	-1
Layer	Row	Column	Surface Water Elevation (ft)	River Bottom Conductivity (ft^2/day)	River Bottom Elevation (ft)

Drainage Ditch North and West of Site

 Input file name

No infiltrating Precipitation Represented for Wetlands Surrounding the Site


```
        3        50         0
       18
      181.000      (15G11.4)              -1 Recharge Period - 1
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
        0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
        0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
        0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
        0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
        0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
        0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
        0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
        0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
        0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
        0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
        0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
        0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
        0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0
```

Precipitation I Iltration on ACS
Site 4 - 10 inches per year

Finpond (200 in/yr)

0												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0.0000	0.0000	0.0000	0.0000	4.5662e-4	4.5662e-4	4.5662e-4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0.0000	4.5662e-4	4.5662e-4	4.5662e-4	4.5662e-4	4.5662e-4	9.1324e-4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
4.5662e-4	9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	0.0000	0.0000	0.0000	0.0000	0.0
0												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
9.1324e-4	4.5662e-2	9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	0.0000	0.0000	0.0000	0.0000	0.0
0												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.5
9.1324e-4	4.5662e-2	9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	0.0000	0.0000	0.0000	0.0000	0.0
0												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.5662e-4	4.5
9.1324e-4	4.5662e-2	9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	0.0000	0.0000	0.0000	0.0000	0.0
0												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.5662e-4	4.5
9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
2.2831e-3	2.2831e-3	9.1324e-4	9.1324e-4	9.1324e-4	9.1324e-4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0.0000	9.1324e-4	4.5662e-4	4.5662e-4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0

FROM :MONTGOMERY WATSON 708 691 5133 1996,03-26 10:12 #105 P.10/16

```
        1        50-1.00e+030         0 1.00e+000         1         0
        3
       11 1.00e+000(10G11.4)                    -1 Anisotropy factor(s)
        1
       11 1.00e+000(10G11.4)                    -1 cell column delta
1.4697e+2  3.3718e+2  1.9491e+2  7.4546e+1  7.2627e+1  7.3766e+1  4.5440e+1  4.2667e+1  4.3726e+1  5.2011e+1
3.9327e+1  3.7171e+1  3.9657e+1  3.6841e+1  3.6594e+1  7.3101e+1  8.1223e+1  7.2241e+1  7.3960e+1  7.3101e+1
8.1223e+1  7.1716e+1  7.4486e+1  7.3101e+1  7.7162e+1  7.5251e+1  7.5012e+1  7.7162e+1  1.4783e+2  3.0000e+2
  3.00E+02
       11 1.00e+000(10G11.4)                    -1 cell row delta
3.0000e+2  3.0000e+2  1.6081e+2  1.3919e+2  1.5476e+2  1.2390e+2  5.0578e+1  3.9391e+1  3.4480e+1  3.6951e+1
3.6221e+1  4.1589e+1  3.8236e+1  4.3897e+1  3.9253e+1  3.4234e+1  4.0138e+1  3.7672e+1  6.9164e+1  7.9539e+1
6.7435e+1  7.7810e+1  7.9728e+1  7.5027e+1  7.1175e+1  6.8018e+1  8.1395e+1  1.6068e+2  2.1873e+2  1.4438e+2
  1.56E+02
        01.200e+1   (10G11.4)                   -1 Conductivity Layer - 0
        06.200e+2   (10G11.4)                   -1 Aquifer Bottom - 0
        06.400e+2   (10G11.4)                   -1 Aquifer Top - 0
```

12 ft/day = 4×10^{-3} cm/sec

620 ft amsl.

640 ft amsl

FROM : MONTGOMERY WATSON 708 691 5133 1995,03-26 10:11 #105 P.07/16

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
	0											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
	0											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
	0											

1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000

1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	4.5662e-4
1000	0.0000	0.0000
1000	4.5662e-4	4.5662e-4
1000	0.0000	0.0000
662e-4	4.5662e-4	9.1324e-4
1000	0.0000	0.0000
662e-4	4.5662e-4	9.1324e-4
1000	0.0000	0.0000
662e-4	4.5662e-4	9.1324e-4
1000	0.0000	0.0000
1000	4.5662e-4	2.2831e-3
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000

1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000
1000	0.0000	0.0000

FROM :MONTGOMERY WATSON 708 691 5133 1996,03-25 10:13 #106 P.14/16

ACS-B.DRN ← Input File Name

18	50				
18					
1	24	6	628.000	50.000	-1
1	23	6	628.000	50.000	-1
1	22	6	628.000	50.000	-1
1	21	7	628.000	50.000	-1
1	20	7	628.000	50.000	-1
1	19	8	628.000	50.000	-1
1	18	9	628.000	50.000	-1
1	17	10	628.000	50.000	-1
1	16	10	628.000	50.000	-1
1	15	11	628.000	50.000	-1
1	14	12	628.000	50.000	-1
1	13	12	628.000	50.000	-1
1	12	13	628.000	50.000	-1
1	11	13	628.000	50.000	-1
1	10	14	628.000	100.000	-1
1	10	15	628.000	100.000	-1
1	10	16	628.000	100.000	-1
1	10	17	628.000	100.000	-1
Layer	Row	Column			

50% Design Extraction Trench

Elevation of Trench Intake

Conductivity of Trench (ft²/day)

FROM MONTGOMERY WATSON 708 691 5133 1996,03-26 10:14 #105 P.16/16

Proposed Trench - extended 300 feet to East

22	50				
22					
1	24	6	628.000	50.000	-1
1	23	6	628.000	50.000	-1
1	22	6	628.000	50.000	-1
1	21	7	628.000	50.000	-1
1	20	7	628.000	50.000	-1
1	19	8	628.000	50.000	-1
1	18	9	628.000	50.000	-1
1	17	10	628.000	50.000	-1
1	16	10	628.000	50.000	-1
1	15	11	628.000	50.000	-1
1	14	12	628.000	50.000	-1
1	13	12	628.000	50.000	-1
1	12	13	628.000	50.000	-1
1	11	13	628.000	50.000	-1
1	10	14	628.000	100.000	-1
1	10	15	628.000	100.000	-1
1	10	16	628.000	100.000	-1
1	10	17	628.000	100.000	-1
1	10	18	628.000	50.000	-1
1	10	19	628.000	50.000	-1
1	11	20	628.000	50.000	-1
1	11	21	628.000	50.000	-1

Added cells for extended trench

Layer Row Column

Elevation of Trench Intake (ft msl)

Conductivity of Trench (ft^2/day)