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NSWC CRANE
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Brent Thomas J CNIN

From: Gates, Bill (Efdsouth) [GatesWH@EFDSOUTH.NAVFAC.NAVY.mil]
Sent: Wednesday, March 20, 2002 10:52 AM
To: Ramanauskas Peter (E-mail)
Cc: Brent Tom (E-mail); Basinski Ralph (E-mail)
Subject: FW: water levels

Pete,

In reply to your email (attached) James May has provided the following information. Additionally the DBG Tech Memo, Figure 6, shows that 02C22 in the Beech Creek was dry. Let me know if you have any further questions.

Bill

-----Original Message-----
From: May, James H ERDC-GSL-MS [mailto:James.H.May@erdc.usace.army.mil]
Sent: Wednesday, March 20, 2002 10:04 AM
To: Gates, Bill (Efdsouth)
Cc: 'Brent Thomas J CNIN'
Subject: water levels

Tom and Bill
If you have any questions please call. Sorry for the delay in getting you this info.

<<gates02.doc>>

Bill
In regard to wells 03C34, 03C35, and 03C36, these wells are located along the eastern valley wall in areas of the Beech Creek that are not fractured and do not contain solution cavities. There is not a lot of groundwater movement except along the Beech Creek/Elwren contact. For example in the WES ABG report (Murphy 94) 03C35 and 03C36 were dry and 03C34 had a reading of 548.65. A round of samples in September 2000 showed Well 03C34 having a reading of 548.56 and Well 03C35 had a reading of 523.05 with no reading for Well 03C36. Note that well 03C36 (Cross section BB' of the 94 RFI report) is across the groundwater divide and was not used in the model These values were what I used in the model. As for well 02C22 I had no value for it except an interpolated value during the contouring process. This is no different from the common practice of interpolating contours in between known data points. The Murphy 94 RFI cross sections shed light on this picture. The sections perpendicular to the creek are especially helpful in showing that groundwater would be expected to move down the creek valley and toward the creek but not across the topographic divide that separates Little Sulfur Creek from adjacent creek valleys. The fact that the wells are dry part of the time is actually additional proof that water is moving toward the sink caused by the fractures and cavities underlying the central area of the valley. The quantitative dye tracer test also indicate no water is exiting Little Sulfur valley in the area of the wells mentioned above. I don't think that because the above wells are sometimes dry weakens the concensus that has been generated by the groundwater experts who have contributed to this study. In fact when the area is viewed from a regional perspective it actually stengthens the concensus more. The water levels that I provided you are in MSL. If additional information is needed please call.

Brent Thomas J CNIN

From: Ramanauskas.Peter@epamail.epa.gov
Sent: Monday, March 11, 2002 2:05 PM
To: Brent Thomas J CNIN; Gates, Bill (Efdsouth)
Subject: Well Levels

Gentlemen,

Referring to the regional ABG/OJT groundwater wells, could you provide me with the most recent groundwater elevation measurements for wells 03C34, 03C35, 03C36, and 02C22. Is 02C22 considered part of the DBG well network?

Thanx,
Pete

Brent Thomas J CNIN

From: Gates, Bill (Efdsouth) [GatesWH@EFDSOUTH.NAVFAC.NAVY.mil]
Sent: Wednesday, February 27, 2002 11:26 AM
To: Ramanauskas Peter (E-mail)
Cc: Basinski Ralph (E-mail); Brent Tom (E-mail); May, James (E-mail); 'cochranm@ttnus.com'; 'krothen@indiana.edu'
Subject: ABG OJT/LSC ISSUES

Beaver Bend Well Pos Hit Summa... | MW 03C03 Piper Diagrams.pdf | ABG Regional GW.ppt

Pete,

During our ABG Old Jeep Trail/Little Sulphur Creek conference call on February 15, we discussed the need or not for additional sampling to complete the RFI. Additional action to address your concerns was assigned as follows:

Action #1: James May will modify Figure 4 (Approximate Groundwater Flow Directions) to overlay Little Sulphur Creek and identify wells used to determine groundwater flow. The assumption is that if regional flow is documented to remain within the Little Sulphur Creek valley, then the maximum possible extent of contamination would be known and no additional wells are necessary. Additionally it would document that existing wells would intercept any metals contaminated groundwater from the 03SB18, 03SB19, 03SB24 area and a "source" well is not necessary.

This information is presented in the ABG Regional GW attachment prepared by James May. His text reads as follows: "The enclosed figure shows the position of Little Sulfur Creek, well and spring locations, and flow direction vectors. The flow arrows and water level contours show that the regional groundwater flow is toward Little Sulfur Creek and then down the Little Sulfur Creek valley. The figure is consistent with the consensus from geologists with Indiana University, Tetra Tech, and the Army Engineering Research and Development Center that near-surface groundwater moves toward the creek where it discharges as surface water and moves on down the valley.

Dr. James H. May, Hydrogeologist"

Action #2: Tetra Tech will research monitoring data including water chemistry data to determine if the Beaver Bend is connected or not to the upper aquifers. The assumption is that if no connection is found, then no additional wells in the Beaver Bend are necessary.

The following email from Ralph Basinski and the attached table and piper diagrams document Beaver Bend is not connected to the upper aquifers.

I would appreciate your earliest review and comment. Call if you have any questions.

Thanks,
Bill

-----Original Message-----

From: **Basinski, Ralph [mailto:BasinskiR@ttnus.com]**
Sent: Wednesday, February 27, 2002 9:38 AM
To: Gates, Bill (Efdsouth); 'Tom Brent'
Cc: Cochran, Matthew; Johnston, Tom; Henn, Keith; Schubert, Jeff
Subject: Beaver Bend Well 03C03

Bill:

Attached is the printout of the positive hits summary for the Beaver Bend Aquifer Monitoring Well (03C03). This well is sampled quarterly as part of the ongoing ground water monitoring program for the Main Treatment Area at the Ammunition Burning Grounds. Volatile organics and explosives are monitored on a quarterly basis. A total of six rounds of data are currently available. There have been no positive detections for either volatile organics or for explosives.

The geochemistry of both the Beech Creek and Beaver Bend Aquifers are monitored on a quarterly basis to determine whether Beech Creek waters may be infiltrating into the Beaver Bend Aquifers. Changes in water chemistry of the Beaver Bend would be one indication of possible infiltration of Beech Creek waters. The Piper diagrams present a visual depiction of the water chemistry.

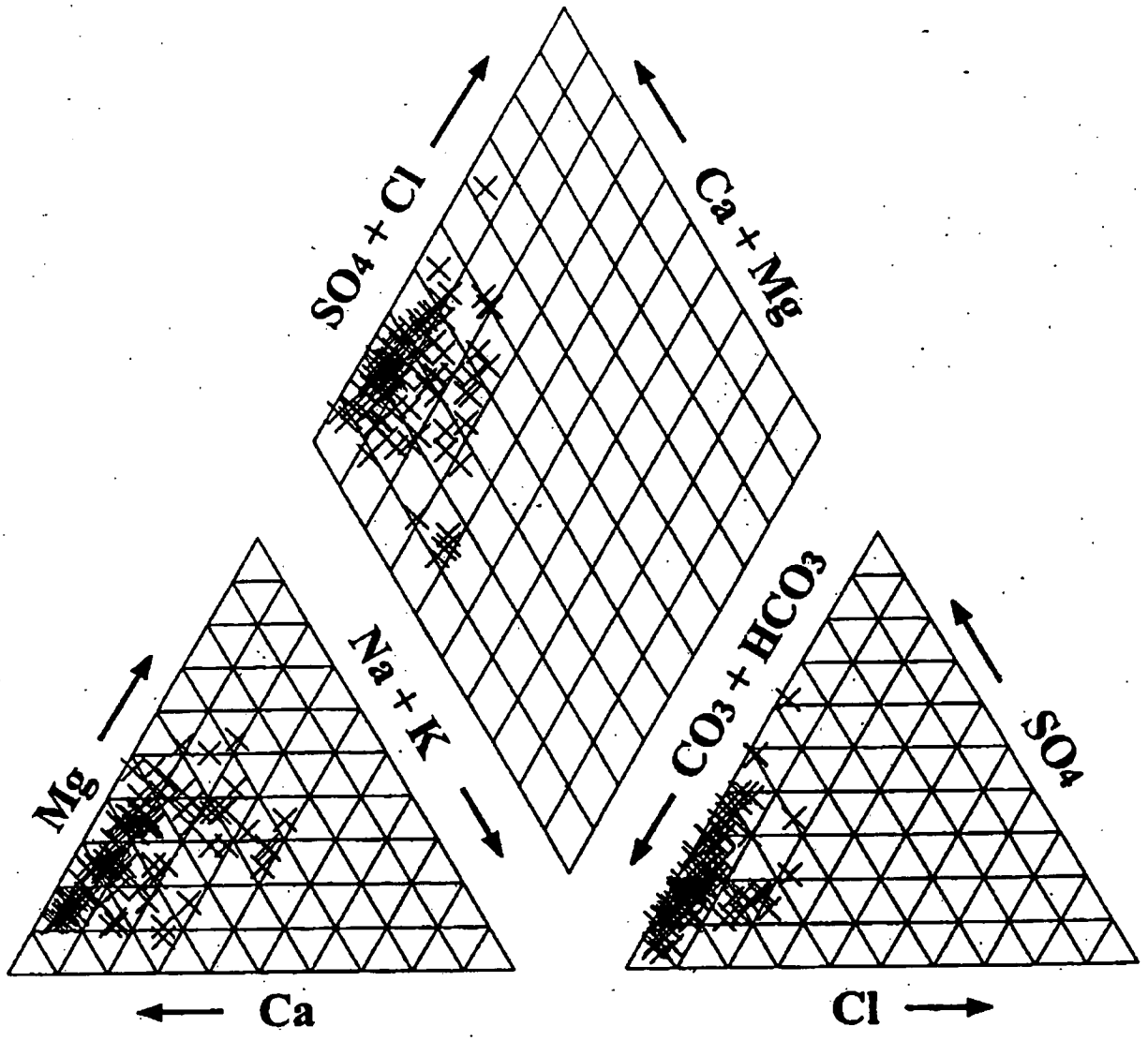
Also attached are Piper Diagrams which are used to illustrate the different chemistry of the Beech Creek and Beaver Bend Aquifers. Figure 7-5 shows the Piper diagram of water chemistry analysis taken from "uncontaminated" wells in the Beech Creek Aquifer. Figure 7-6 shows the Piper diagram of water chemistry analysis taken from wells in the Beaver Bend Aquifer. Both figures were obtained from the approved Ground Water Monitoring Plan (GWMP) for the Ammunition burning Grounds, Old Rifle Range, and Demolition Range. Figure X shows the Piper diagram of water chemistry analysis taken from Monitoring Well 03C03 during the first six rounds of monitoring conducted in accordance with the approved GWMP. This data shows that the water chemistry of the Beaver Bend Aquifer has not changed.

Beaver Bend Aquifer Monitoring Well 03C03 is not contaminated with either volatile organics or explosives. Historical data showing contamination of chlorinated solvent is most likely attributable to laboratory contamination. The Piper diagrams demonstrate that the geochemistry of the Beaver Bend Aquifer distinctly differs from the geochemistry of the Beech Creek Aquifer.

<<MW 03C03 Piper Diagrams>>

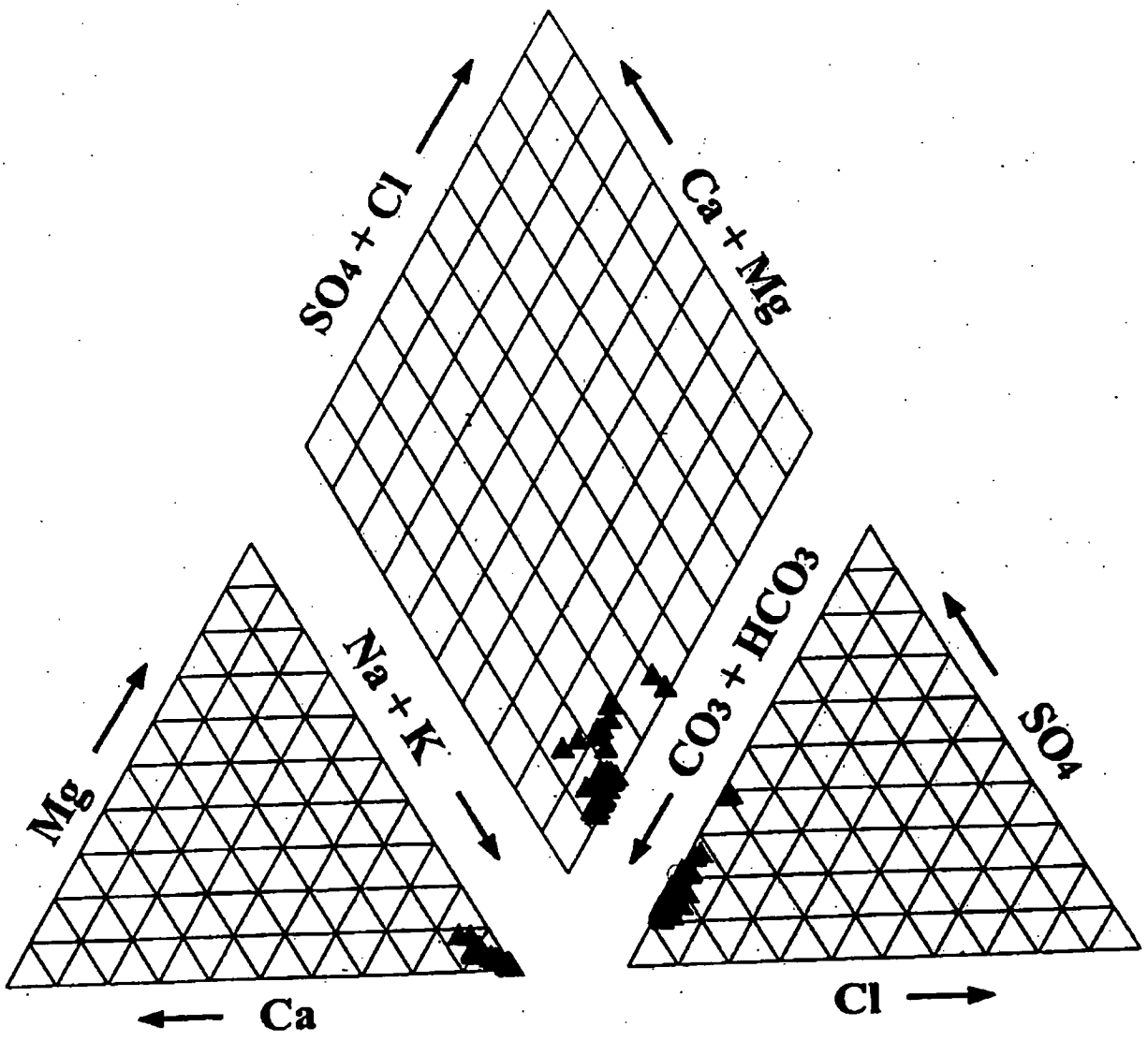
<<Beaver Bend Well Pos Hit Summary 6 Rounds.xls>>

order	001	003	005	007	009		
location	03C03	03C03	03C03	03C03	03C03	03C03	03C03
nsample	ABG03C03GW01	AC031A99	AC032A99	AC033A99	AC033A99-D		
sample	ABG03C03GW01	AC031A99	AC032A99	AC033A99	FD09119901	AC034A99	AC031A00
matrix	GW	GW	GW	GW	GW	GW	GW
sample_dat	11/06/98	02/27/99	05/18/99	09/11/99	09/11/99	12/20/1999	4/1/2000
sort	c_001	c_003	c_005	c_007	c_009		
Field Parameters (mg/L)							
CARBONATE ALKALINITY	100 MG/L	0 MG/L	0 MG/L	0 MG/L	0 MG/L		
DISSOLVED OXYGEN - - HACH (MG/L)	NA	0.31 MG/L	0.74 MG/L	0.15 MG/L	0.15 MG/L	0.05	0.2
DISSOLVED OXYGEN - - METER (MG/L)	0.29 MG/L	0.65 MG/L	1.11 MG/L	3.15 MG/L	3.15 MG/L	0.16	0.21
SULFIDE	NA	0.04 MG/L	0 MG/L	0.01 MG/L	0 MG/L	0.02	0.01
Inorganics (ug/L)							
ANTIMONY	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	
ARSENIC	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
BARIUM	40.3 UG/L	38.3 UG/L	39.0 UG/L	42.3 UG/L	43.7 UG/L	38	42.7
CADMIUM	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.4	
COPPER	2.2 U UG/L	2.8 UG/L	2.2 U UG/L	2.2 U UG/L	4.9 UG/L	2.2 U	2.2 U
IRON	169 J UG/L	111 U UG/L	111 U UG/L	111 U UG/L	111 U UG/L	111. U	111 U
MANGANESE	16.7 U	16.7 U	16.7 U	16.7 U	16.7 U	16.7 U	16.7 U
SELENIUM	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
TIN	11.1 U	11.1 U	11.1 U	11.1 U	11.1 U	11.1 U	
ZINC	11.1 U UG/L	44.2 J UG/L	16.0 UG/L	11.1 U UG/L	11.1 U UG/L		11.1 U
Inorganics, Filtered (ug/L)							
ANTIMONY, FILTERED	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U		1.1 U
ARSENIC,FILTERED	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
BARIUM, FILTERED	42.1 UG/L	47.8 UG/L	35.4 UG/L	49.7 UG/L	45	42.7	42.9
CADMIUM,FILTERED	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U		
CALCIUM, FILTERED	1200 UG/L	1140 UG/L	1110 U UG/L	1430 UG/L	1470	1160	1140
COPPER, FILTERED	2.2 U UG/L	2.2 U UG/L	2.2 U UG/L	2.2 U UG/L	2.2 U UG/L	2.2 U	2.7
MAGNESIUM,FILTERED	1100 U	1100 U	1100 U	1100 U	1110 U	1110 U	1110 U
MANGANESE,FILTERED	16.7 U	16.7 U	16.7 U	16.7 U	16.7 U	16.7 U	16.7 U
POTASSIUM, FILTERED	1110 U UG/L	1110 U UG/L	1110 U UG/L	1190 UG/L	1300	1110	1110 U
SELENIUM,FILTERED	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1	1.1 U
SODIUM, FILTERED	240000 UG/L	218000 UG/L	207000 UG/L	221000 UG/L	235000	212000	214000 N
TIN, FILTERED	11.1 U UG/L	11.1 U UG/L	11.1 U UG/L	11.1 U UG/L	11.1 U	11.1 U	
ZINC, FILTERED	11.1 U UG/L	11.1 U UG/L	11.1 U UG/L	11.1 U UG/L	11.1 U UG/L	11.1 U	103
Miscellaneous Parameters (mg/L)							
ALKALINITY	370 J MG/L	356 MG/L	373 MG/L	338 MG/L	347 MG/L		
BICARBONATE ALKALINITY	270 J MG/L	356 MG/L	373 MG/L	338 MG/L	347 MG/L	399	376
CARBON DIOXIDE	NA	64 MG/L	75 MG/L	33.0 MG/L	34.1 MG/L	37	17.8
CARBONATE ALKALINITY	100 MG/L	0	0	0	0		
CHLORIDE	2.0 MG/L	2 MG/L	5 U MG/L	1 MG/L	1 MG/L	1	1.4
CYANIDE	0.01 U MG/L	0.01 U MG/L	0.010 U MG/L	0.005 MG/L	0.005 U MG/L		
FERROUS IRON	NA	0.05 MG/L	0 MG/L	0 MG/L	0 MG/L	0.02	0.02
HYDROXIDE ALKALINITY	NA	0 MG/L	0 MG/L	0 MG/L	0 MG/L		
NITRATE	0.20 U MG/L	0.207 MG/L	0.01 MG/L	0.05 MG/L	0.05 MG/L	0	ND
NITRITE	0.10 U MG/L	0.003 MG/L	0.001 MG/L	0 MG/L	0.005 MG/L	0	0.002
OXIDATION REDUCTION POTENTIAL	-45.2 MV	-5.8 MV	54.1 MV	2 MV	NA	213.9	
PH	9.62 S.U.	9.22 S.U.	9.24 S.U.	9.21 S.U.	NA	9.26	9.21
SPECIFIC CONDUCTANCE	1.050 MS/CM	0.887 MS/CM	0.901 MS/CM	0.903 MS/CM	NA	0.902	0.895
SULFATE	400 MG/L	76 MG/L	88 MG/L	83 MG/L	86 MG/L	81	84
SULFIDE	NA	1 U MG/L	1 U MG/L	1 UJ MG/L	1 UJ MG/L		
TEMPERATURE	13.70 C	13.7 C	15.7 C	15.5 C	NA	13.07	14.34
TOTAL ORGANIC CARBON	1.0 UJ MG/L	1.6 MG/L	1 U MG/L	7.7 J MG/L	8.9 J MG/L	1.0 U	1.0 U
TOTAL ORGANIC HALIDES	0.02 U MG/L	0.02 U MG/L	0.02 U MG/L	0.04 MG/L	0.02 U MG/L	0.02 U	0.02 U
TURBIDITY	5 NTU	1 NTU	3 NTU	1 NTU	NA	1.2	0
TOTAL PHOSPHORUS	0.03 U	0.1 U	0.1 U	0.1 U	0.10 U	0.10 U	0.10 U
DISSOLVED PHOSPHORUS AS P	NA	NA	NA	NA	NA		0.10 U
WATER LEVEL	NA	87.77 FT	87.81 FT	88.0 FT	NA	88.01	
Volatile Organics (ug/L)							
ETHANE	0.140 J	0.195	0.012	0.005 U	0.005 U	<5	8
ETHENE	0.005 U	0.042	0.005 U	0.005 U	0.005 U	<5	<5
METHANE	13.897 J	13.376	5.308	0.37	0.31	4.893	21.27
1,1-DICHLOROEHTENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
1,2-DICHLOROETHANE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CARBON TETRACHLORIDE	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
CHLOROFORM	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
CIS-1,2-DICHLOROETHENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
METHYLENE CHLORIDE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	
TRANS-1,2-DICHLOROETHENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TRICHLOROETHENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Energetics (ug/L)							
1,3,5-TRINITROBENZENE	0.78 U	1.0 U	0.20 U	0.70 U	0.48 U	0.92 U	1.2 U
2,4,6-TRINITROTOLUENE	0.78 U	1.0 U	0.20 U	0.70 U	0.48 U	0.92 U	1.2 U
2-AMINO-4,6-DINITROTOLUENE	0.78 U	1.0 U	0.20 U	0.70 U	0.48 U	0.92 U	1.2 U
4-AMINO-2,6-DINTROTOLUENE	0.78 U	1.0 U	0.20 U	0.70 U	0.48 U	0.92 U	1.2 U
HMX	0.78 U	1.0 U	0.20 U	0.70 U	0.48 U	0.92 U	1.2 U
MNX	0.78 U	1.0 U	0.20 U	0.70 U	0.48 U	0.92 U	1.2 U
RDX	0.78 U	1.0 U	0.20 U	0.70 U	0.48 U	0.87 U	1.1 U
2-NITROTOLUENE	0.78 U	1.0 U	0.20 U	0.70 U	0.48 U		1.2 U
TNX	0.78 U	1.0 U	0.20 U	0.70 U	0.48 U		1.2 U



Taken From Ground Water Monitoring Plan

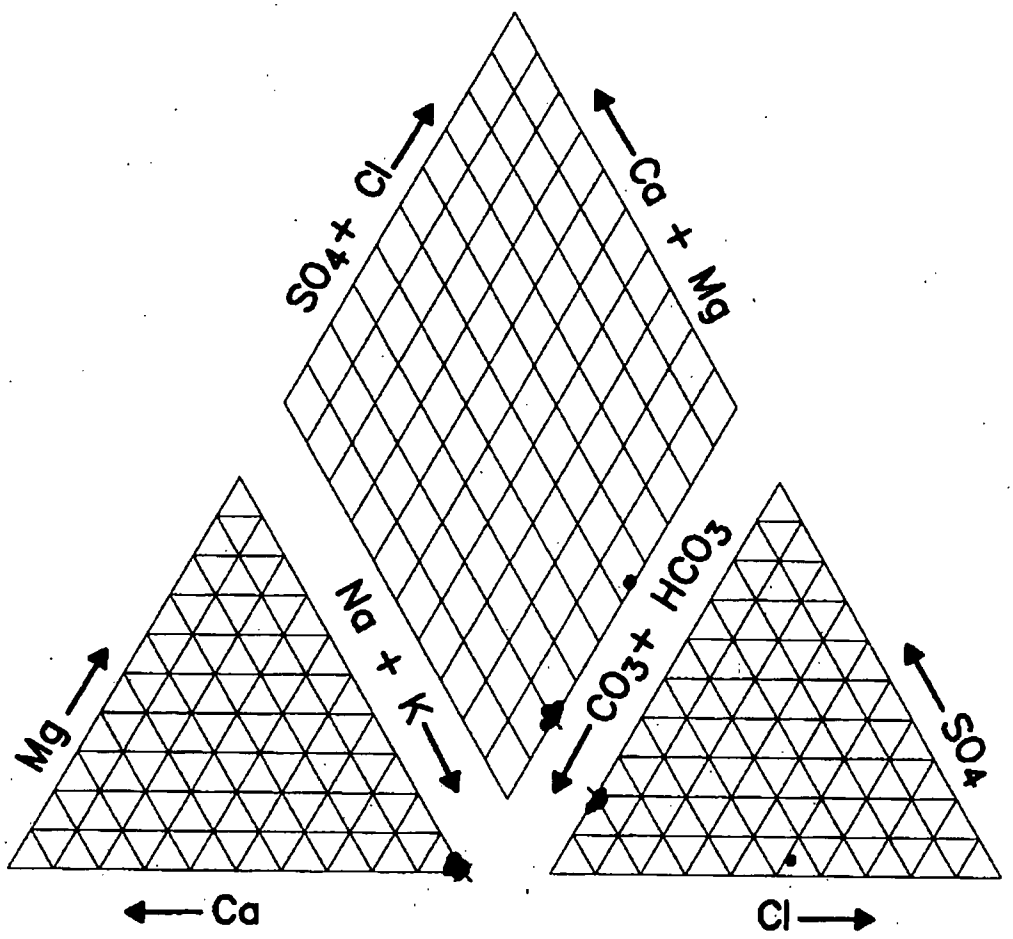
Figure 7-5. Piper diagram of water chemistry analysis' taken from "uncontaminated" wells in the Beech Creek aquifer.



Taken From Ground Water Monitoring Plan

Figure 7-6. Piper diagram of water chemistry analysis' from wells in the Beaver Bend aquifer.

ACAD: 7651KD04.dwg 10/28/99 HJP



Six data points for Monitoring well 03C03 (Beaver Bend well) 11/6/98, 2/27/99, 5/18/99, 9/11/99, 4/1/00, 12/20/99

2/27/02

DRAWN BY HJP ~~10/7/99~~ DATE	DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND	PIPER DIAGRAM OF WATER CHEMISTRY ANALYSIS BEAVER BEND AQUIFER WELL AMMUNITION BURNING GROUNDS [redacted] NSWC CRANE, INDIANA	CONTRACT NO. ~~30597661~~
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE NOT TO SCALE			DRAWING NO. FIGURE [redacted] REV. 0

FORM CADD NO. SDIV_AV.DWG - REV [redacted]

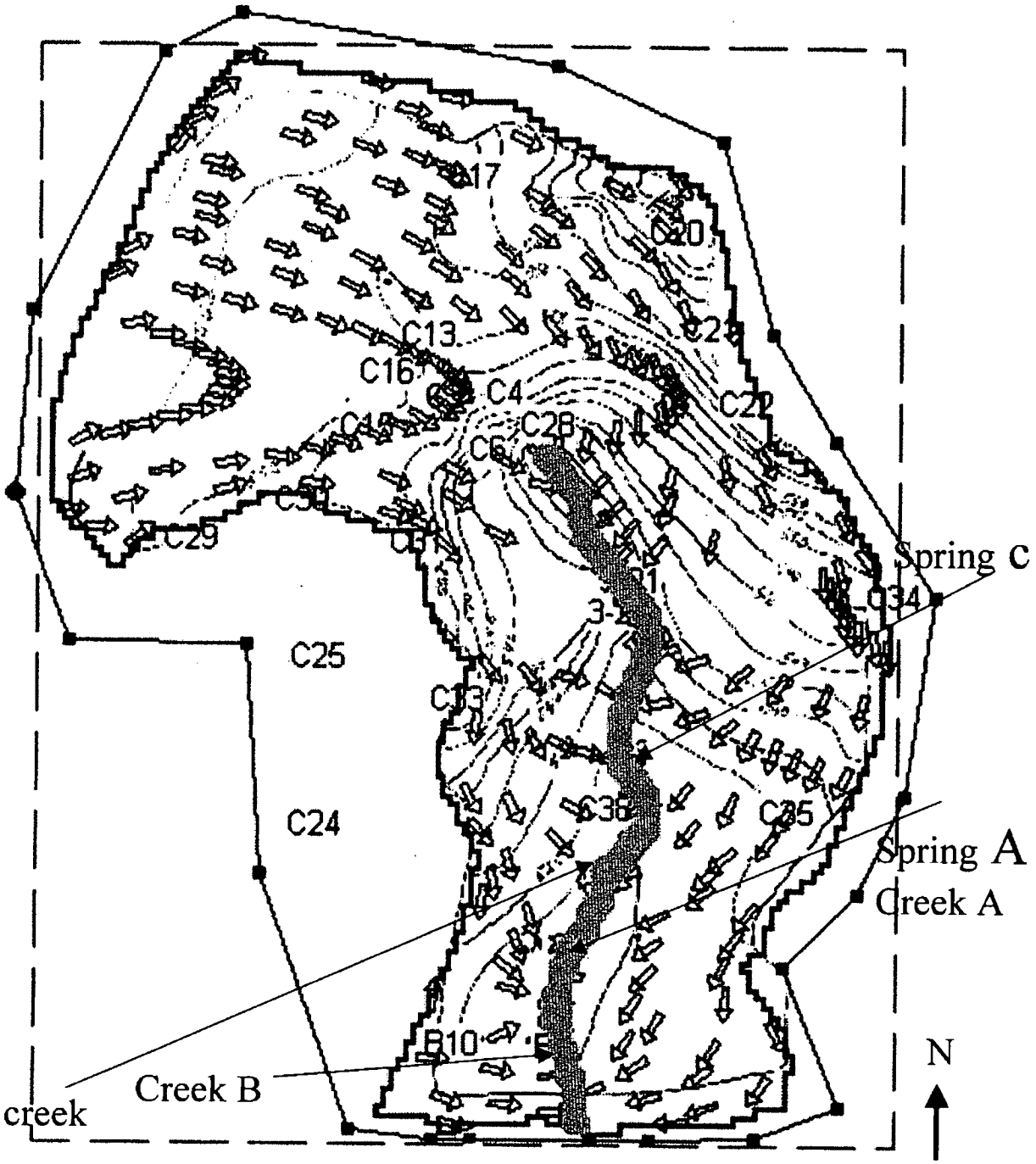


Figure 5. Groundwater Directions with Stream/Wells Displayed

Scale

1000 ft

Brent Thomas J CNIN

From: May, James H ERDC-GSL-MS [James.H.May@erdc.usace.army.mil]
Sent: Thursday, February 14, 2002 12:22 PM
To: 'Gates, Bill (Efdsouth)'
Cc: 'brent_t@crane.navy.mil'
Subject: RE: OJT Tech Memorandum

here are figures note that some vectors are to the east in vicinity of the jeep trail but overall flow is to the south

-----Original Message-----
From: Gates, Bill (Efdsouth) [mailto:GatesWH@EFDSOUTH.NAVFAC.NAVY.mil]
Sent: Thursday, February 14, 2002 8:41 AM
To: 'mayj@wes.army.mil'
Subject: FW: OJT Tech Memorandum

-----Original Message-----
From: Gates, Bill (Efdsouth)
Sent: Thursday, February 14, 2002 11:39 AM
To: May, James (E-mail)
Subject: FW: OJT Tech Memorandum

James - This is the Peter Ramanauskas email that raised questions about soil and groundwater. Note his agreement with surface water and sediment conclusions in the tech memo (no additional sampling needed to complete the RFI report). Talk to you tomorrow at 9:00.

Bill

-----Original Message-----
From: Ramanauskas.Peter@epamail.epa.gov
[mailto:Ramanauskas.Peter@epamail.epa.gov]
Sent: Friday, February 01, 2002 4:12 PM
To: brent_t@crane.navy.mil; Gates, Bill (Efdsouth)
Subject: OJT Tech Memorandum

Gentlemen,

I've received the corrected figure for the Old Jeep Trail organics in groundwater concentrations and have read through the "ABG Meeting Minutes Data Gaps Meeting - October 31, 2001" and the "Technical

Memorandum on Adequacy of Existing Jeep Trail Monitoring Well Network and Environmental Media Samples for Risk Assessment and Corrective Measures Studies."

While I agree with the conclusions that the surface water and sediment sampling results should be sufficient for the RFI report, I do have some comments about the soils and groundwater.

There appear to be two areas where soils have excessively high concentrations of lead. One of these areas is at 03SB48 which has a subsurface lead value at 3,590 ppm (approx 9x R9RES) as well as a copper value of 22,500 ppm (approx 7x R9RES). You note that monitoring well 03-07 is located in this area. This is fine. However, there is also high soil lead in 03SB24 at 10,200 ppm (Surface Soil approx 25x R9RES) and at 03SB18 & 03SB19 (Subsurface) at 1,110 ppm and 616 ppm, respectively. Perhaps proposed monitoring wells 03MWT01, 03MWT02, and/or 03MWT03 should be moved near this area to determine if there are any excessive metals levels in groundwater in this area?

For shallow groundwater, it seems that the organics plume (e.g. TCE) is still present and it appears to spread to the northeast from what seems to be the highest location in GW at monitoring well 03-07. The technical memorandum notes that "Proposed shallow wells 03MWT03 through 03MWT09 were intended to be installed further side and downgradient of the existing monitoring well network, assuming that the 2001 ground water sample results were similar to ground water sampling results from 1994." Where is this assumption noted in the April 2001 QAPP? While the concentration of organics in MW 03-07 appears to have decreased since 1994, the concentrations in wells 03-15, 03-22, and 03-24 have increased. Section 4.4.2. page 4-9 of the QAPP subsection 2. - Shallow Perimeter Wells notes: "Shallow ground water concentrations that are below the RBTL have to be determined (shallow downgradient extent).....Should the extent of contamination to below RBTLs not be reached in this sampling effort, the proposed monitoring wells will be installed." It does not appear to me that the organic plume has been delineated. I believe that additional wells should be driven downgradient of 03-24 to determine the extent of the organic plume.

Regarding the 4 additional deep wells, the technical memorandum notes that "The installation of these wells was also contingent on ground water sampling results from 2001 being similar to 1994." Again, where is this noted in the QAPP? Section 4.4.2. page 4-9 of the QAPP subsection 3. - Deep Vertical Extent Wells notes: "At the Jeep Trail Site, three deep wells (03MWT11, 03MWT12, and 03MWT13) may be located in the ground water plume adjacent to shallow wells that yield ground water contamination in the first round of sampling." Even though the Elwren Shale may serve as an aquiclude, sampling at the ABG has shown that TCE is present in the Beaver Bend aquifer.

Those are my questions/comments. Please let me know if you'd like to discuss.

Thanks!
Peter

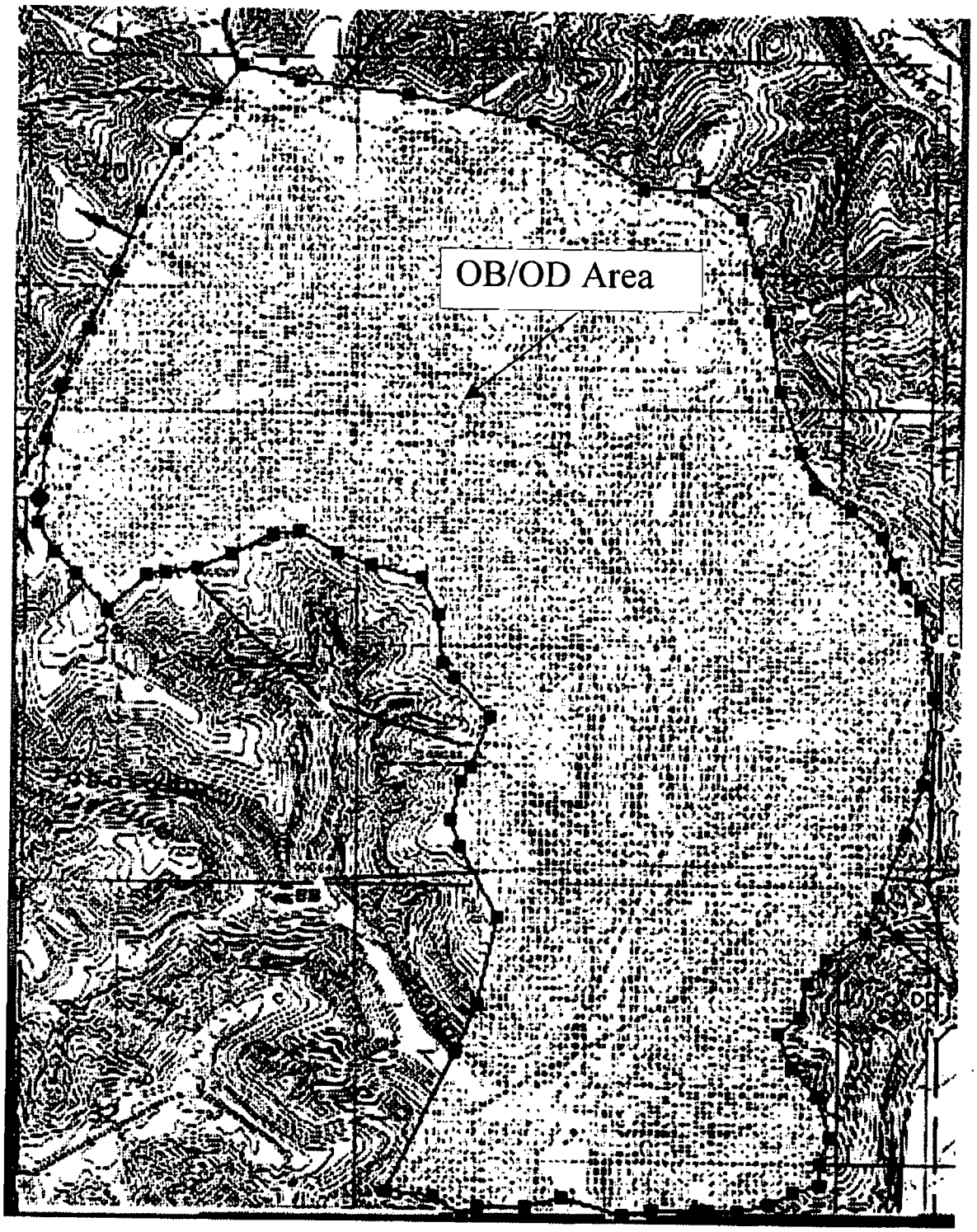


Figure 1. Extent of Model for Crane OB/OD Area

N

Scale

1000 ft

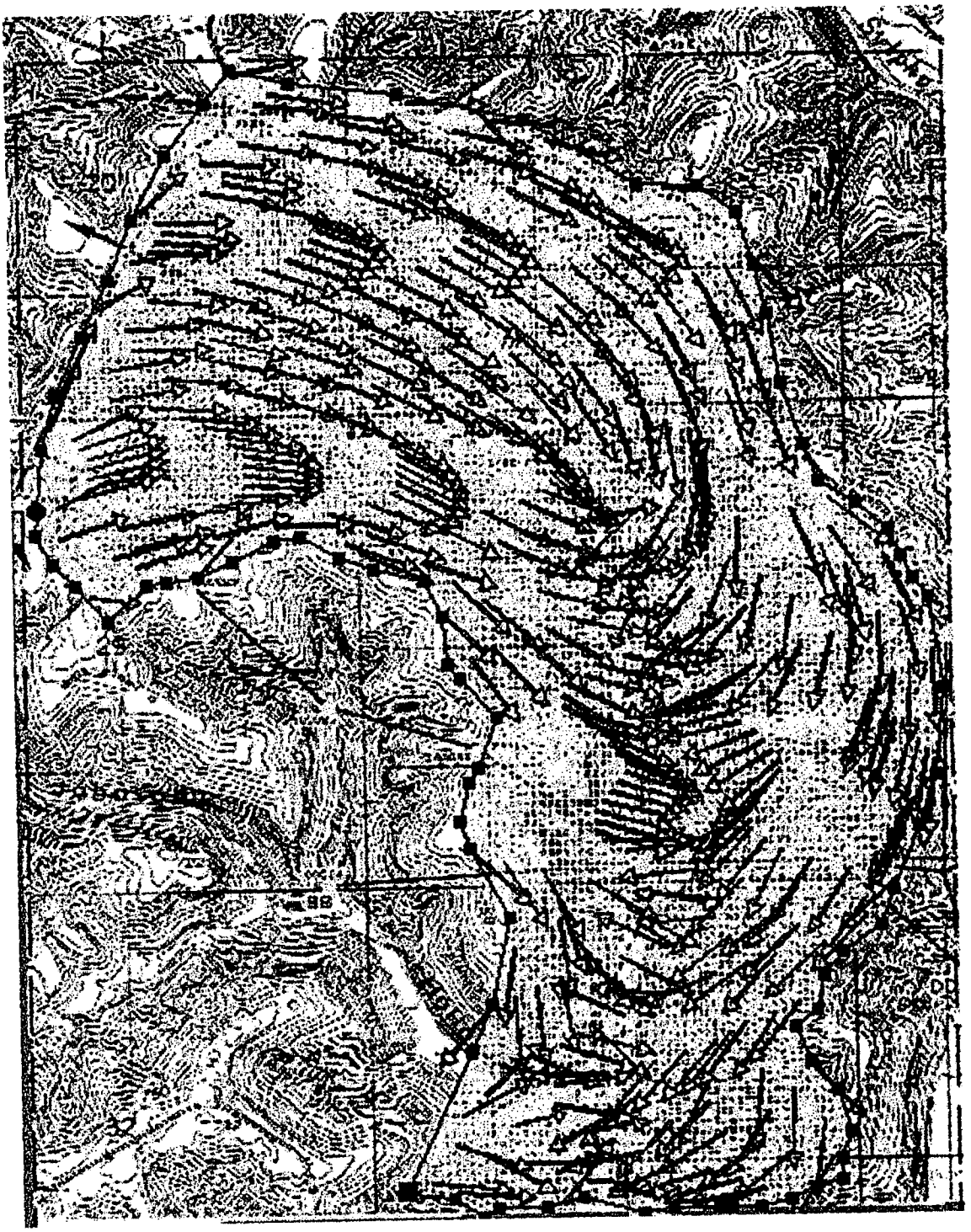


Figure 4. Approximate Groundwater Flow Directions

N

Scale

1000 ft

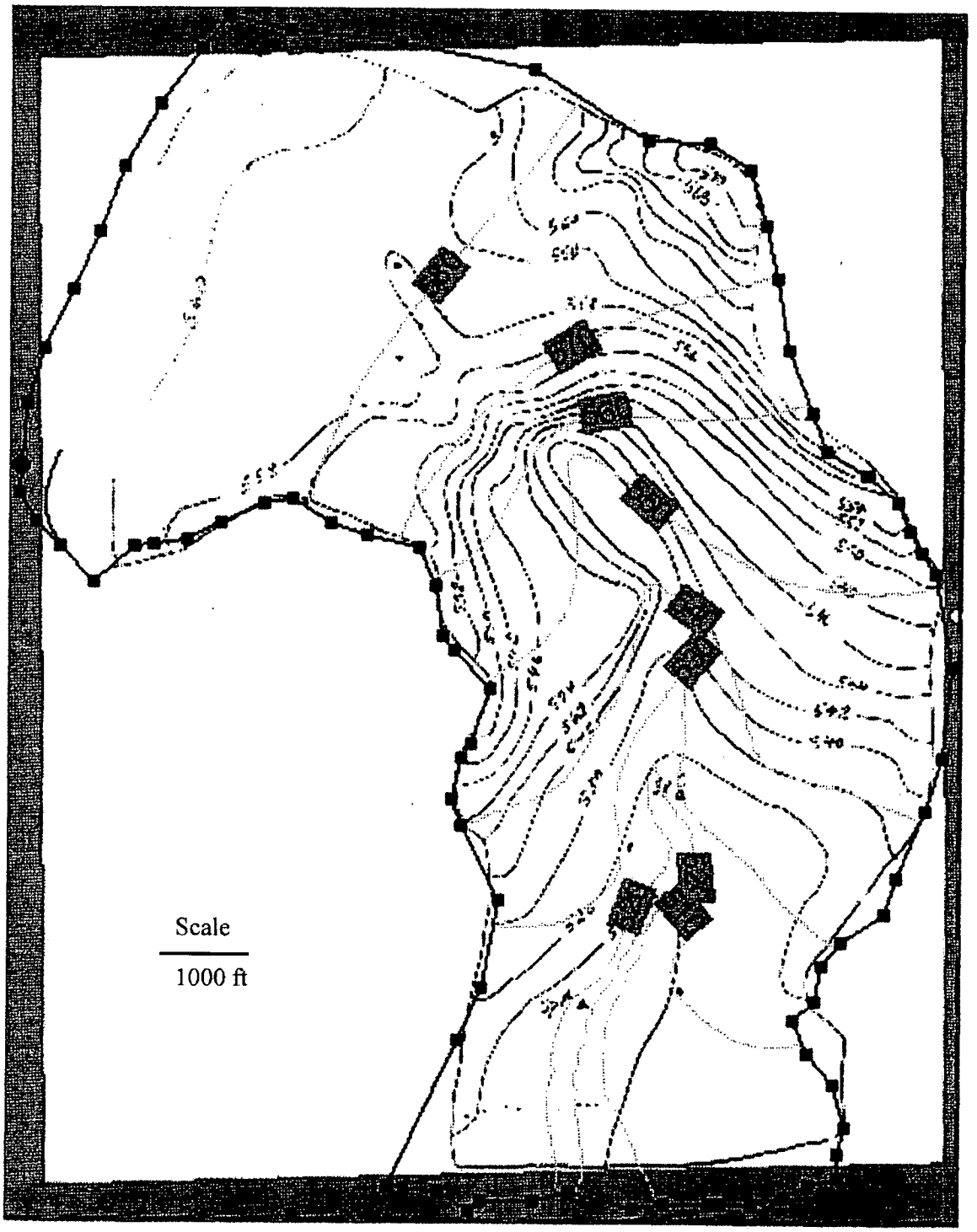


Figure 5. Comparison of Simulated Hydraulic Heads (Green contour lines) and Actual Contours of Hydraulic Heads

N