BLACK & VEATCH

5728 LBJ Freeway, Suite 300, Dallas, Texas 75240, (214) 770-1500, Fax: (214) 770-1549

Sparton Technology
Coors Road Facility

B&V Project 26602.0100
B&V File B
August 22, 1996

Ms. Anna Marie Ortiz
Assistant General Counsel
State of New Mexico Environment Department
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 887502

Re: Calculations of Hydraulic Influence
Groundwater Containment Wells
Coors Road Facility

Dear Ms. Ortiz:

In recent discussions with you, Dennis McQuillan, and Rob Pine, copies of our calculations of predicted groundwater containment well performance were requested. Attached to this letter are copies of the requested calculations. The calculations include:

1. Site-specific calculations of radius of influence using pump test data from the U.S. EPA-approved RFI Report (RFI Attachment 10).

2. Illustration of containment well radius of influence based on RFI pump test data and pumping duration of one day superposed on the January 1996 plume configuration from the CMS Report.

3. Confirmatory calculations of radius of influence using data from the 1995 U.S.G.S. Albuquerque Basin Model.

4. Field demonstrations of radius of influence from Intel Production wells approximately 2.5 miles north of the Sparton Facility.

Sparton Technology
Ms. Anna Marie Ortiz

B&V Project 26602.0100
August 22, 1996

5. Calculations of capture zone using conventional methodology (Fetter 1994, Grubb 1993, and others) using a range of site-specific parameters and containment pumping rates. Note that transmissivity values are from the RFI/CMS Reports and hydraulic gradient is from third quarter 1996 water level data including the recently installed monitoring wells outside the leading edge of the plume.

6. Copy of site-specific 50- and 100-gpm capture zones (T=18,000 gpd/ft) for a potential containment well superposed over the January 1996 plume configuration from CMS report.

7. Calculations of capture zone using USGS-based parameters.

8. Copy of USGS-based capture zones superposed on the January 1996 Plume footprint from the CMS Report.

We trust that the attached information will be helpful in your review.

Sincerely,

BLACK & VEATCH

Pierce L. Chandler, Jr.
Project Manager

bk
enclosures

cc: Mr. James B. Harris
Mr. R. Jan Appel

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Owner St[illegible]TON TECHNOLOGY Computed By PLC (1)
Plant COORS ROAD Unit _____ Date 8/6 1996
Project No. 026602.0100 File No. _____ Verified By _____
Title RADIUS OF INFLUENCE USING RFI PUMP TEST VALUES Date _____ 19__
Page 1 of 3

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1) PUMP TEST WAS CONDUCTED IN EARLY OCTOBER 1984.

2) PUMP TEST WAS CONDUCTED NEAR END OF IRRIGATION SEASON WHICH RUNS FROM MID-APRIL TO MID-NOVEMBER

3) IRRIGATION IS PROVIDED BY CORRALES MAIN CANAL AND RESULTS IN A TWO TO THREE FOOT INCREASE IN POTENTIOMETRIC ELEVATION

4) THE UNLINED CORRALES MAIN CANAL IS LESS THAN 700 FEET SOUTHEAST OF THE PUMPED WELL PW-1 USED IN THE PUMP TEST.

5) PUMP TEST WAS A 180-GPM CONSTANT RATE TEST WITH A 25-HOUR DURATION PRODUCING DRAWDOWN OF 24 FEET IN THE PUMPED WELL

6) NOT SURPRISINGLY, PUMP TEST DATA EXHIBITED AN "EQUILIBRIUM" SIGNATURE (CONDITION OF RECHARGE EQUAL TO PUMPING RATE) AFTER SOME 200 MINUTES OF CONSTANT RATE PUMPING

7) PUMP TEST WAS MONITORED BY THREE OBSERVATION WELLS LOCATED AT RADIAL DISTANCES OF 45, 150, AND 350 FEET FROM THE PUMPED WELL.

8) DISTANCE-DRAWDOWN DATA FROM THE OBSERVATION WELLS DEMONSTRATED A RADIUS OF INFLUENCE OF APPROXIMATELY 600 FEE

REVISED, SUPERSEDED, AND VOID CALCULATIONS MUST BE CLEARLY IDENTIFIED.

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Plant Unit Date 8/6 1996
Project No. File No. Verified By
Title ROI USING RFI Date 19
Page 2 of 3

9) PREDICTABLY, THE RADIUS OF INFLUENCE OF 600 FEET IS ALSO THE APPROXIMATE DISTANCE TO THE CORRALES MAIN CANAL AND IRRIGATED FARM LAND (DEMONSTRATED SOURCE OF RECHARGE)

10) IN THE ABSENCE OF THIS CLOSE SOURCE OF RECHARGE, THE CONE OF DEPRESSION WOULD HAVE CONTINUED TO DEEPEN AND EXPAND DURING THE PUMP TEST

11) ANALYSIS OF THE PUMP TEST DATA RESULTED IN THE FOLLOWING RECOMMENDED DESIGN PARAMETERS:

TRANSMISSIVITY, T = 18,000 gpd/ft *

STORAGE COEFFICIENT, S = 0.0025 *

12) THE RFI AND SUBSEQUENT STUDIES HAVE CONFIRMED THAT HYDROGEOLOGIC CONDITIONS DEFINED BY THE PUMP TEST ARE RELATIVELY CONSTANT OVER THE PLUME AREA.

13) THE LEADING EDGE OF THE PLUME IS SEVERAL THOUSAND FEET FROM THE RECHARGE AREA, SO RADIUS OF INFLUENCE CAN BE CALCULATED FROM THE DESIGN PARAMETERS USING NON-EQUILIBRIUM METHODS

* SEE ATTACHED CONCLUSIONS & CALCULATIONS FROM RFI ATTACHMENT 10

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14) USING THE COOPER-JACOB APPROXIMATIONS OF THE THEIS NON-EQUILIBRIUM EQUATION, THE RADIUS OF INFLUENCE CAN BE CALCULATED FROM THE FOLLOWING:

$$R_o = \sqrt{\frac{0.3\,T t}{S}}$$

WHERE R_o = RADIUS OF INFLUENCE (ft)
T = TRANSMISSIVITY (gpd/ft)
t = PUMPING DURATION (days)
S = STORAGE COEFFICIENT

15) SUBSTITUTING THE PUMP TEST VALUES INTO THE ABOVE EQUATION YIELDS

$$R_o = \sqrt{\frac{0.3\,(18{,}000\ \text{gpd/ft})(t)}{0.0025}}$$

$$R_o = 1469.7\sqrt{t}$$

WHEN t = 1 day	R_o = 1470 ft
= 2 days	= 2078 ft
= 7 days	= 3,888 ft
= 30 days	= 8,050 ft
= 365 days	= 28,078 ft

16) IN CONCLUSION, RADIUS OF INFLUENCE IS AT LEAST 600 FEET ON SITE (DUE TO CORRALES MAIN CANAL). OFF-SITE, RADIUS OF INFLUENCE WILL BE LARGER.

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steady solution. However equilibrium or steady-state conditions provide a higher level of confidence in analytical results.

10. As noted in the analysis section, there is considerable ambiguity as to whether the aquifer is unconfined, partially confined or confined. However, considering the saturated thickness of the aquifer (approximately 75 feet), relatively small drawdowns at the observation wells (1.5 feet to 6 feet), and the apparent equilibrium or steady-state conditions that developed during the pumping tests, there is no significant analytical difference between confined or unconfined conditions. Indeed analysis showed differences in the order of 5% in the calculation of transmissivity. However, the calculated storage coefficient values in the range of 0.002 to 0.003 indicate essentially confined conditions. In any case, the more critical parameter, radius of influence, is well documented and not dependent on aquifer confinement evaluation.

CONCLUSIONS AND RECOMMENDATIONS

Aquifer parameters for the lower flow zones obtained from current analysis of the 1984 pumping test data are adequate for the evaluation of various remedial alternatives to be included in the Corrective Measure Study (CMS). Although these aquifer parameters were developed from on-site pumping tests, geologic correlation off-site indicates general application to the entire plume area.

A radius of influence, R_o, of approximately 600 feet has been demonstrated by both

analytical methods (see Figure 23) and remote observation points during actual pumping. This value should be used in future calculations of capture area, etc. The 600-ft radius of influence reflects steady-state or equilibrium conditions; i.e., it is not a time-dependent value. It should also be noted that this radius of influence will not be affected by pumping rate.

A transmissivity, T, of 18,000 gpd/ft has generally been calculated for the data base as a whole, with lesser values in the order of 12,000 to 14,000 gpd/ft considering only PW-1 data. For conservative design, a transmissivity of 18,000 gpd/ft is recommended.

Both the HLA Report and current analysis indicate a storage coefficient, S, value in the range of 0.002 to 0.003. Some individual analyses indicate a storage coefficient an order of magnitude less. However, considering that radius of influence is well defined, a storage coefficient of 0.0025 is recommended as a conservative measure.

Finally, it should be recognized in any pumping system design that the aquifer is significantly stratified with significant anisotropy. As a result, fully penetrating pumped wells with significant drawdowns could cause downward vertical movement of contaminants from near-water-surface (UFZ) high-constituent-concentration areas.

Analysis by Pierce L. Chandler, Jr., P.E.

HDR Engineering, Inc.

May 1, 1992

SAMPLE CALCULATIONS

I. LOWER FLOW ZONES

A. Steady radial flow without vertical movement

1. Using distance-drawdown data given on Figure 23, the Transmissivity, T, may be calculated from:

$$T = \frac{2.30\ Q}{2\pi\ \Delta s/\Delta \log_{10} r}$$

(Lohman, Eq 34, units of $L^2\ T^{-1}$)

with appropriate conversions for T expressed in gallons per day per foot, the equation becomes

$$T = \frac{528\ Q}{\Delta s/\Delta \log_{10} r}$$

where Q = 180 gallons per minute and

$\Delta s/\Delta \log_{10} r$ = 5.2 feet/cycle

T = 18277 gallons per day per foot

The Storage Coefficient, S, may be determined from the calculated T; the radial distance to zero drawdown, r_o = 600 feet extrapolated from the data in Figure 23; and, the nominal time to equilibrium, t_o, of 200 minutes (0.139 days) using:

$$S = 2.25\ T \left(\frac{t}{r^2}\right)_0 \qquad \text{(Lohman, Eq 59, Dimensionless)}$$

with appropriate conversion factors for T in gallons per day per foot

$$S = \frac{0.3\ T\ t_o}{r_0^{\ 2}} = \frac{0.3\ (18277\ \text{gal/day/ft})\ (0.139\ \text{days})}{(600\ \text{ft})^2}$$

S = 0.0021

note that if $t_e \approx 300$ minutes

$$S \cong 0.003$$

2. Using data from MW-12 and MW-13, and assuming <u>confined</u> conditions, Transmissivity was checked using:

$$T = \frac{2.30\ Q \log_{10}(r_2/r_1)}{2\pi\ (s_1 - s_2)} \quad \text{(Lohman, Eq 32, } L^2T^{-1} \text{ units)}$$

in typical units,

$$T = \frac{528\ Q \log_{10}(r_{MW\text{-}13}/r_{MW\text{-}12})}{s_{MW\text{-}12} - s_{MW\text{-}13}}$$

For $Q = 180$ gpm
$r_{MW\text{-}12} = 45$ feet
$r_{MW\text{-}13} = 150$ feet
$s_{MW\text{-}12} = 5.9$ feet
and $s_{MW\text{-}13} = 3.1$ feet,
the calculation of T is:

$$T = \frac{528\ (180\ \text{gpm})\ \log_{10}(150\ \text{ft}/45\ \text{ft})}{5.9\ \text{ft} - 3.1\ \text{ft}}$$

$$\mathbf{T = 17{,}748\ gal/day/ft}$$

3. Using the MW-12 and MW-13 data, but assuming <u>unconfined</u> conditions; a saturated thickness, b, equal to 75 feet; and the base of the aquifer at an elevation of 4900 feet, T may be calculated using:

$$K = \frac{2.30\ Q \log_{10}(r_2/r_1)}{\pi\ (h^2_2 - h^2_1)} \quad \text{(Lohman, Eq 31, } LT^{-1} \text{ units)}$$

and $T = Kb$

with appropriate conversion factors, the combined equation becomes:

$$T = \frac{1055\ b\ Q\ \log_{10}(r_{MW\text{-}13}/r_{MW\text{-}12})}{(h_{MW\text{-}13})^2 - (h_{MW\text{-}12})^2}$$

For $Q = 180$ gpm
$b = 75$ ft
$r_{MW\text{-}12} = 45$ ft
$r_{MW\text{-}13} = 150$ ft
$h_{MW\text{-}12} = 69.1$ ft (75 ft - 5.9 ft)
$h_{MW\text{-}13} = 71.9$ ft (75 ft - 3.1 ft)

$$T = \frac{1055\ (75\ \text{ft})\ (180\ \text{gpm})\ \log_{10}(150\ \text{ft}/45\ \text{ft})}{(71.9\ \text{ft})^2 - (69.1\ \text{ft})^2}$$

$T = 18863$ gal/day/ft

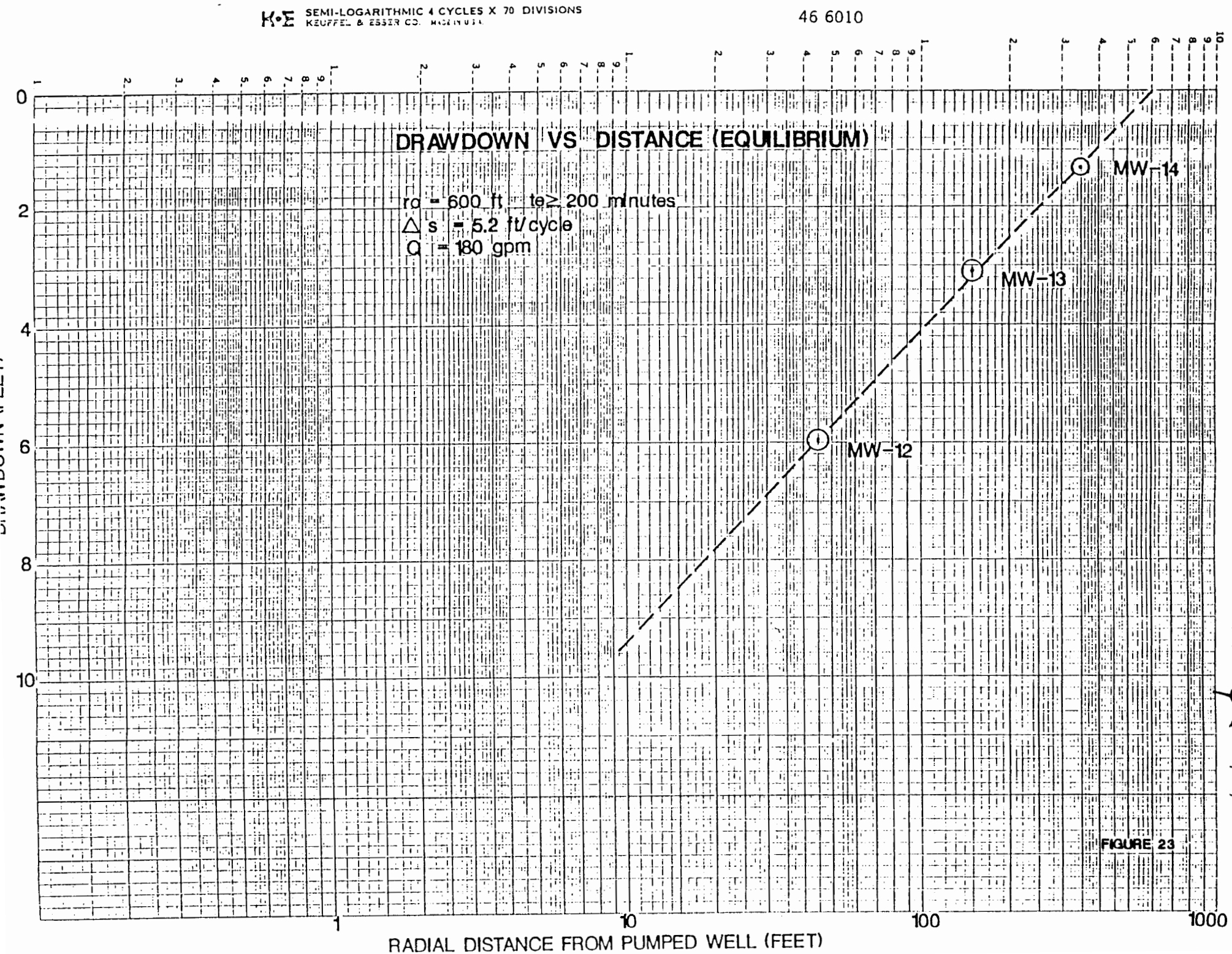
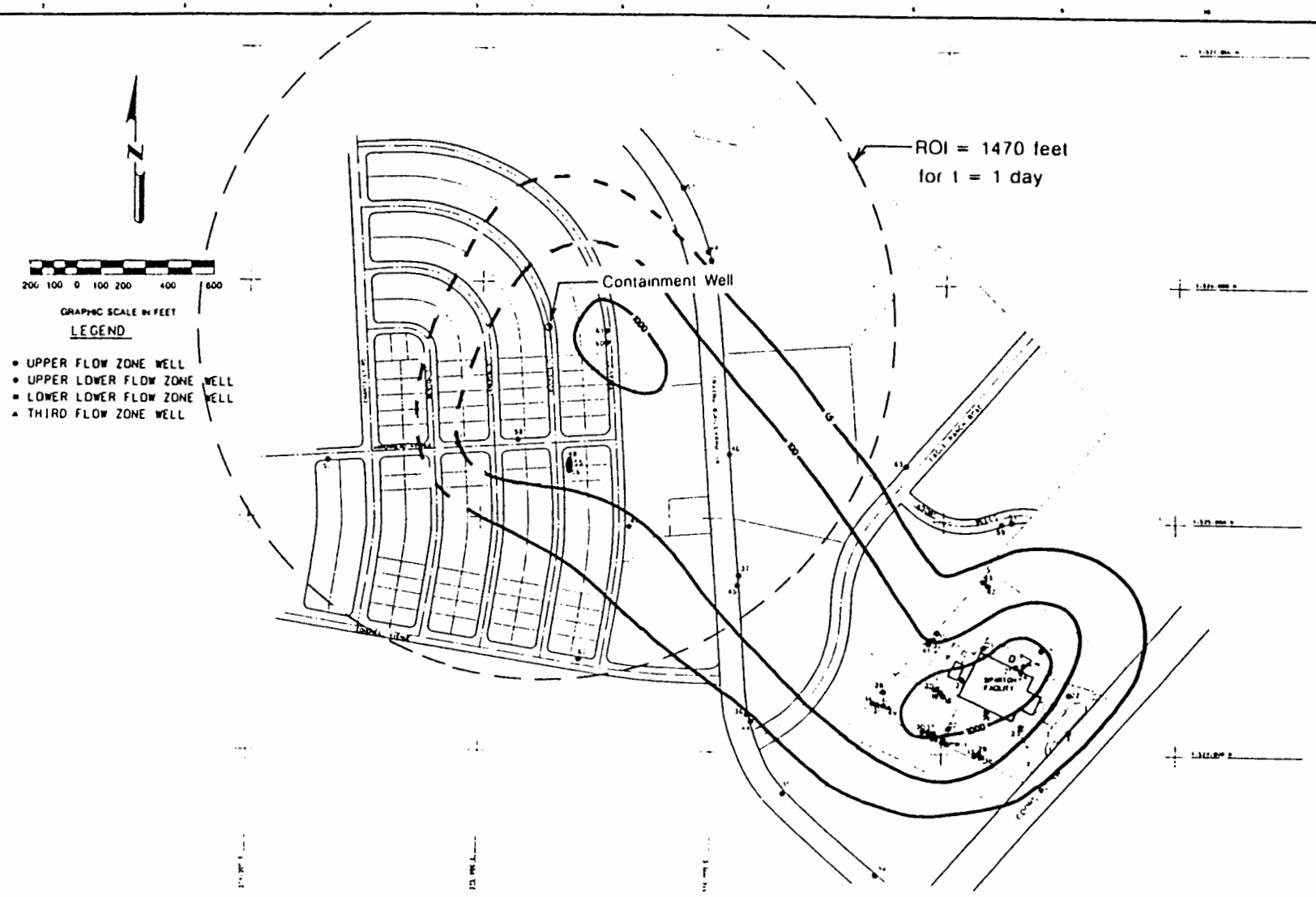

K+E SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO.
46 6010
DRAWDOWN VS DISTANCE (EQUILIBRIUM)
ro = 600 ft te ≥ 200 minutes
Δs = 5.2 ft/cycle
Q = 180 gpm
MW-14
MW-13
MW-12
0
2
4
6
8
10
1
10
100
1000
RADIAL DISTANCE FROM PUMPED WELL (FEET)

FIGURE 23



RADIUS OF INFLUENCE
Site Specific Parameters

FIGURE 12A

Black & Veatch Engineers Architects Dallas Texas	PROJECT NO 026602	UPPER FLOW ZONE TCE CONTOURS - 1996 DATA		CONTRACT NO SHEET NO	

2

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Project No. 026602.0100 File No. _____ Verified By _____

Title RADIUS OF INFLUENCE USING 1995 USGS MODEL VALUES Date _____ 19 ____

Page 1 of 1

1) THE 1995 U.S.G.S. ALBUQUERQUE BASIN MODEL COVERS THE UPPER 1730 FEET OF THE SANTA FE GROUP AQUIFER SYSTEM USING ELEVEN LAYERS.

2) IN THE SPARTON AREA, HORIZONTAL HYDRAULIC CONDUCTIVITY, K, OF 15 FEET/DAY IS USED IN THE FIRST EIGHT MODEL LAYERS (580 TOTAL FEET) WITH ISOLATED POCKETS OF UP TO 25 FEET/DAY (SEE PAGES 26-33, USGS 1995)

3) STORAGE COEFFICIENTS IN THE MODEL WERE ESTIMATED USING A SPECIFIC STORAGE OF 2×10^{-6} PER FOOT BASED ON LOHMAN (USGS 1979)

4) RADIUS OF INFLUENCE CAN BE CALCULATED FROM THE ABOVE VALUES USING THE RELATIONSHIP:

$$R_o = \sqrt{\frac{2.25\,Tt}{S}}$$

AND REMEMBERING $T = Kb$ AND $S = S_s b$

5) SUBSTITUTING THE USGS MODEL VALUES

$$R_o = \sqrt{\frac{2.25\,(15\ \text{Feet/Day})(\cancel{b})(t)}{(2\times10^{-6}/\text{Foot})(\cancel{b})}}$$

$$R_o = 4108\sqrt{t}$$

WHEN	$t = 1$ day	$R_o = 4108$ feet
	$t = 2$ days	$R_o = 5810$ feet
	$t = 7$ days	$R_o = 10{,}869$ feet
	$t = 30$ days	$R_o = 22{,}500$ feet
	$t = 365$ days	$R_o = 78{,}483$ feet

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Plant COORS ROAD Unit _____ Date 8/6 19 96
Project No. 026602.0100 File No. _____ Verified By _____
Title RADIUS OF INFLUENCE Date _____ 19 ____
INTEL WELL DEMONSTRATION Page 1 of 6

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1) THE IMPACT OF THE INTEL PRODUCTION WELLS ON THE AQUIFER IS MONITORED BY A NETWORK OF 3 CLUSTER WELLS (15 TOTAL WELLS) AND 15 DOMESTIC WELLS. SEE FIGURE 1 FOR LOCATION (JOHN SHOMAKER & ASSOC, MARCH 1996)

2) INTEL HAS BEEN PUMPING FROM THE THREE PRODUCTION WELLS ON A SUSTAINED BASIS SINCE EARLY SEPTEMBER 1995. COMBINED PUMPING RATE IS APPROXIMATELY 3 MGD (2080 GPM) – PRIMARILY FROM WELLS 2 AND 3. SEE FIGURE 40 (SHOMAKER, 1996)

3) PRODUCTION WELLS ARE SCREENED FROM 730 TO 2000 FEET BGS (CORRESPONDS TO USGS 1995 BASIN MODEL LAYERS 8 to 11)

4) ALL THREE CLUSTER WELL LOCATIONS SHOW INFLUENCE OF PUMPING. SEE FIGURES 22–24 (SHOMAKER, 1996). NOTE THAT CLUSTER B IS OVER 4000-FOOT DISTANT AND CLUSTER C IS OVER 8000-FOOT DISTANT.

5) INTEL HYDROGEOLOGIC CONDITIONS ARE MODELLED SIMILARLY TO SPARTON (USGS 1995)

6) RADIUS OF INFLUENCE IS MUCH LARGER THAN 8,000 FEET

ENCLOSURES

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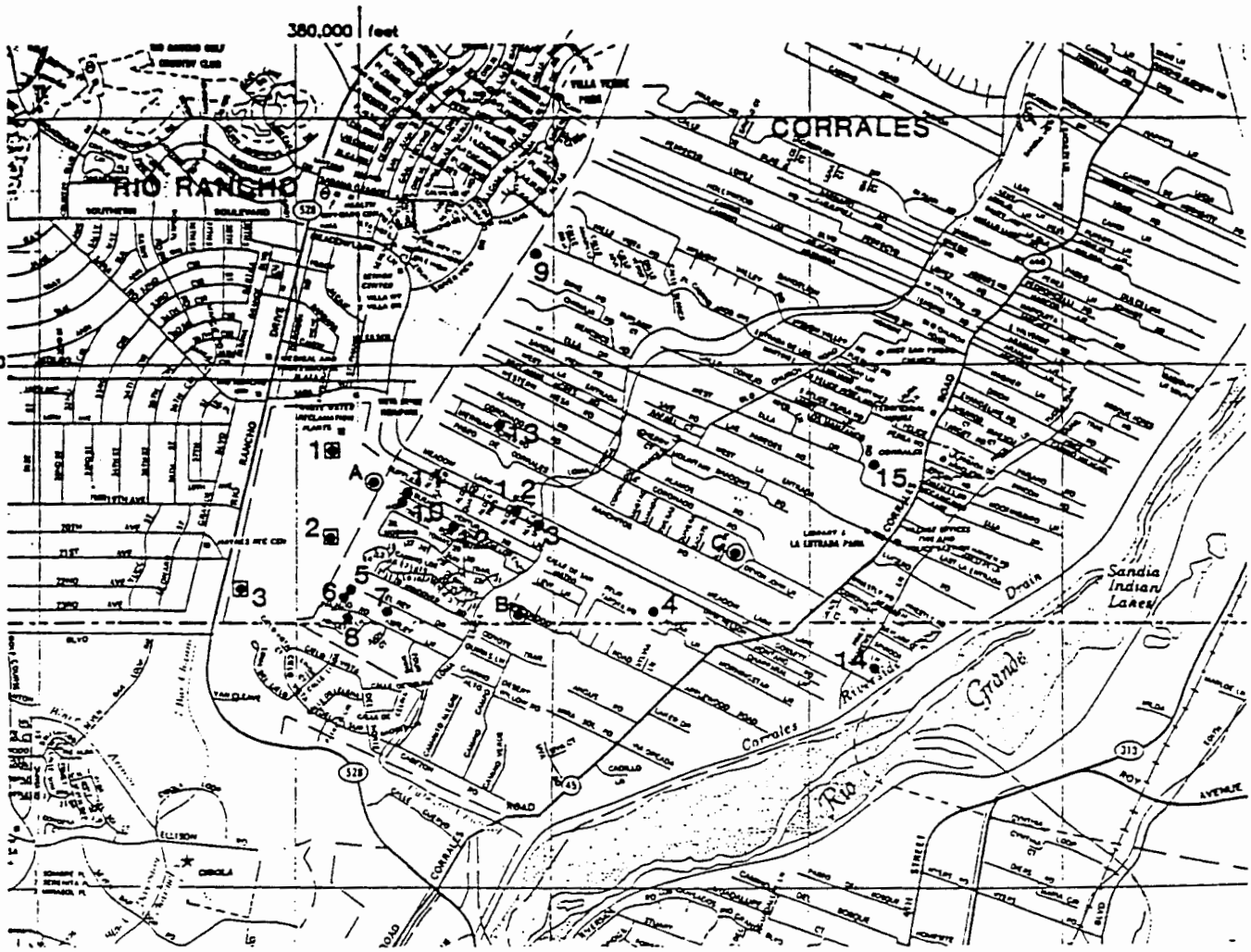


Explanation

- Intel production well location
  1. Intel Production Well No. 1
  2. Intel Production Well No. 2
  3. Intel Production Well No. 3
- domestic monitor well
  1. Betsill
  2. Betsill
  3. Hutchinson
  4. Campbell
  5. Tice
  6. Sheppard
  7. King
  8. Passage
  9. Goering
  10. Walker
  11. Corrales
  12. Rockwell
  13. Swanson
  14. Joseph
  15. Allen
- Intel monitor wells site
  A. Intel monitor wells A1, A2, A3, A4, A5, A6
  B. Intel monitor wells B1, B2, B3
  C. Intel monitor wells C1, C2, C3, C4, C5, C6

Figure 1. Map showing locations of Intel production wells, Intel monitor wells, and domestic monitor wells.

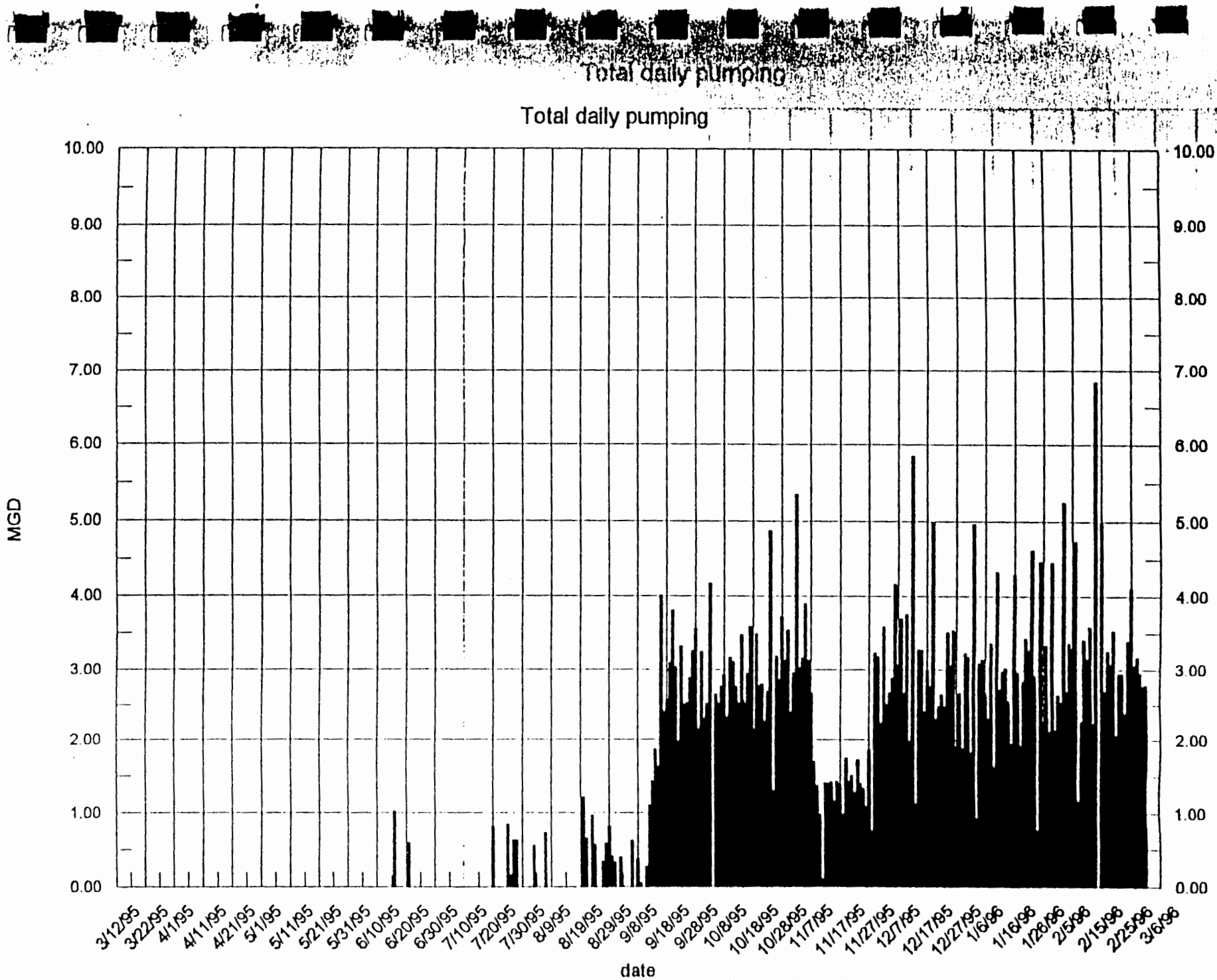


Figure 40. Total water pumped daily from the Intel production wells.

page 4

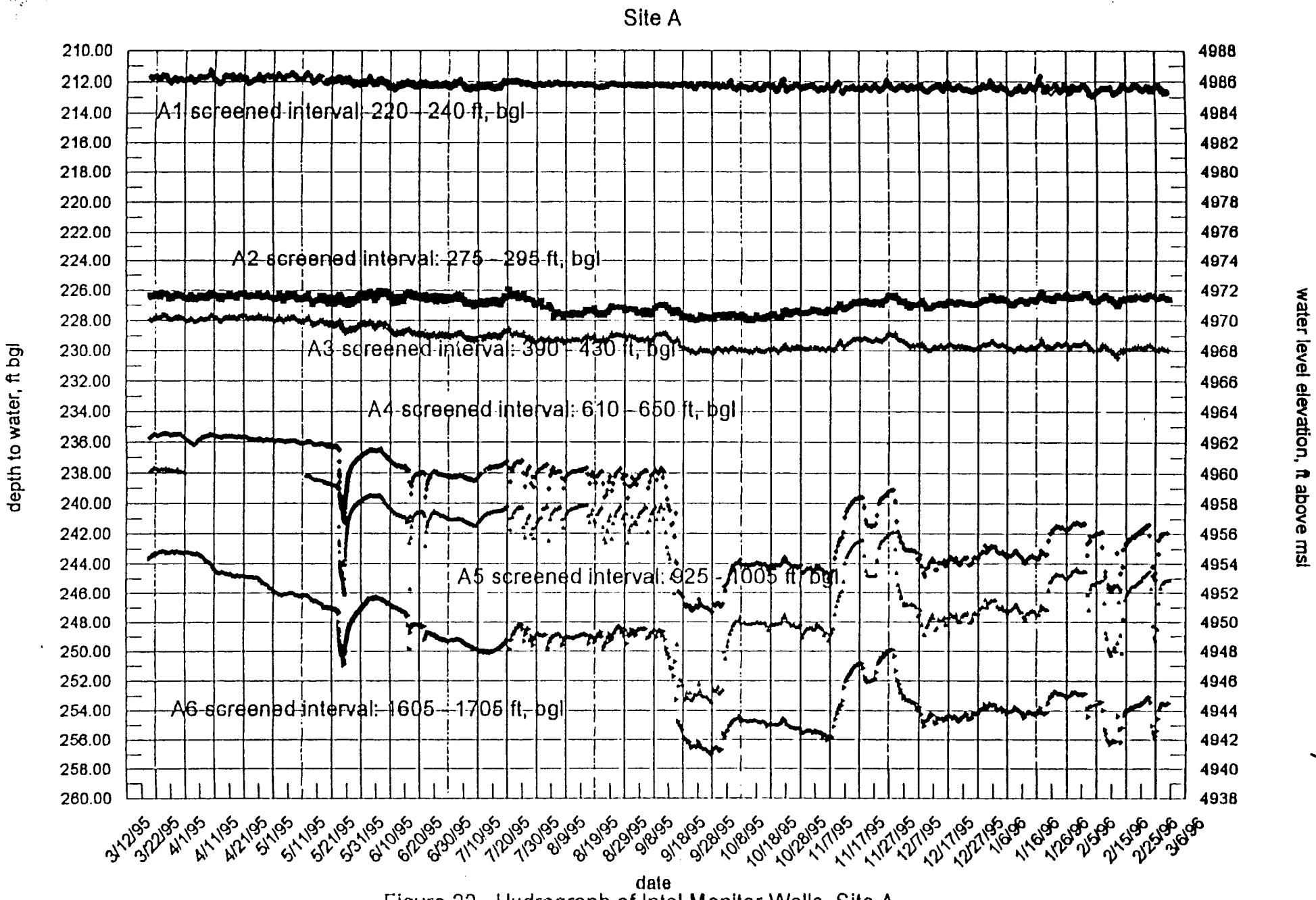


Figure 22. Hydrograph of Intel Monitor Wells, Site A.

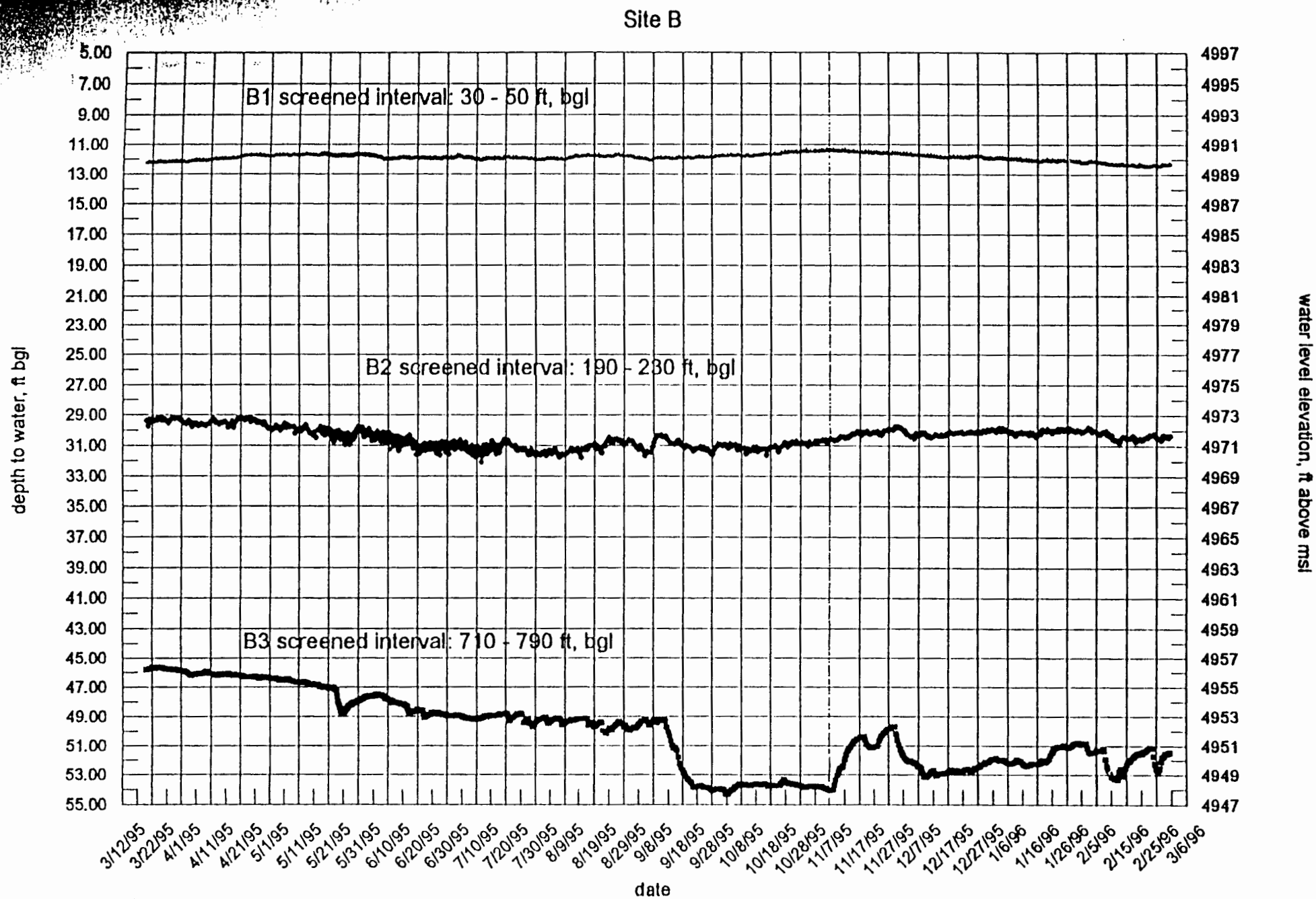


Figure 23. Hydrograph of Intel Monitor Wells, Site B.

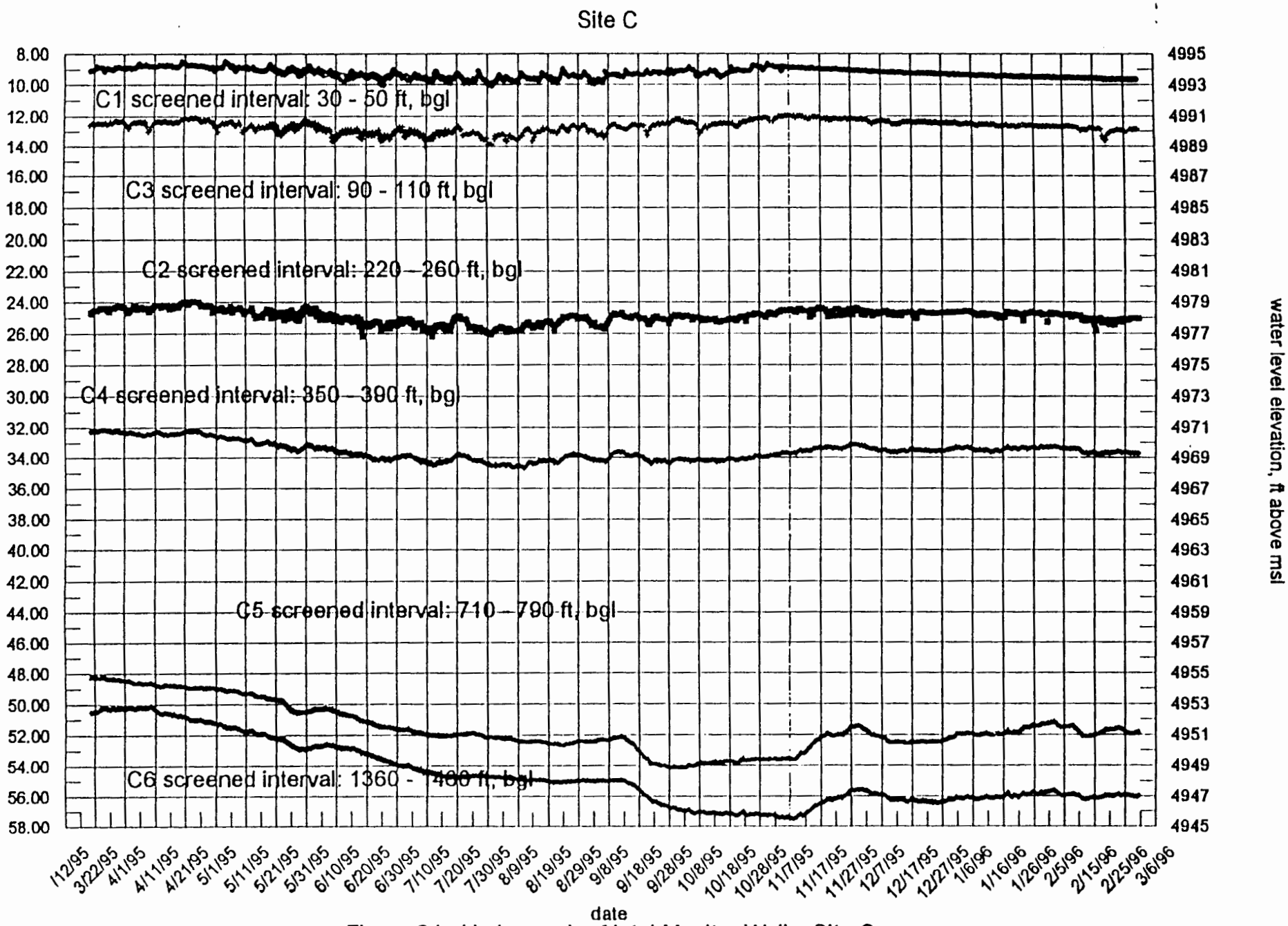


Figure 24. Hydrograph of Intel Monitor Wells, Site C.

Page 36

SPARTON TECHNOLOGY, INC.

Coors Road Facility
Capture Zone Definition

Definition for the Edge of Capture Zone	Stagnation Point	Maximum width of capture Zone
x=(-y)/[tan(2*PI*K*b*i*y/Q)] - in radians	x(0) = -Q/(2*PI*K*b*i)	y(max) = (+/-)Q/(2*K*b*i)

x = distance from pumping well (feet) - parallel to flow
y = distance from pumping well (feet) - perpendicular to flow
PI = 3.141593
K = hydraulic conductivity (feet / minute)
b = initial saturated thickness of aquifer (feet)
i = hydraulic gradient of flow field in absence of pumping (feet / feet)
Q = pumping rate (cubic feet / minute)
T = K*b = Transmissivity (square feet / minute)

Solve for Q = 10,20,50,100,200 gallons per minute
K*b = 12,000 - 18,000 gallons per day per foot (From RFI/CMS Reports)
i = 0.002 feet / feet (third Quarter 1996 water level data)

		K*b (gpd/ft) =		12,000	K*b (gpd/ft) =		15,000	K*b (gpd/ft) =		18,000
		K*b (SF/min) =		1.114	K*b (SF/min) =		1.392	K*b (SF/min) =		1.671
Q		x(0)	y(max)	y@x=0	x(0)	y(max)	y@x=0	x(0)	y(max)	y@x=0
GPM	CF/min		+/-							
10	1.34	(95.49)	300	150	(76.39)	240	120	(63.66)	200	100
20	2.67	(190.99)	600	300	(152.79)	480	240	(127.32)	400	200
50	6.68	(477.46)	1,500	750	(381.97)	1,200	600	(318.31)	1,000	500
100	13.37	(954.93)	3,000	1,500	(763.94)	2,400	1,200	(636.62)	2,000	1,000
200	26.73	(1,909.86)	6,000	3,000	(1,527.89)	4,800	2,400	(1,273.24)	4,000	2,000

Calculate edge of Capture Zone

K*b =	12,000	gpd/ft =	1.114	SF/min						
	GPM	CF/min	GPM	CF/min	GPM	CF/min	GPM	CF/min	GPM	CF/min
Q =	10	1.34	20	2.67	50	6.68	100	13.37	200	26.73
	Y	X	Y	X	Y	X	Y	X	Y	X
	1	(95.49)	1	(190.98)	1	(477.46)	1	(954.93)	1	(1,909.86)
	10	(95.14)	50	(186.60)	200	(449.21)	250	(933.01)	1,000	(1,732.05)
	100	(57.74)	100	(173.21)	400	(360.16)	500	(866.03)	2,000	(1,154.70)
	150	0.00	200	(115.47)	600	(194.95)	1,000	(577.35)	2,500	(669.87)
	200	115.47	300	0.00	750	0.00	1,500	0.00	3,000	0.00
	300	3E+06	400	230.94	800	84.08	2,000	1,154.70	4,000	2,309.40
			500	866.03	1,000	577.35	2,500	4,330.13	5,000	8,660.25
			600	1E+07	1,500	7E+07	3,000	3E+08	6,000	1E+09

K*b =	15,000	gpd/ft =	1.392	SF/min						
	GPM	CF/min	GPM	CF/min	GPM	CF/min	GPM	CF/min	GPM	CF/min
Q =	10	1.34	20	2.67	50	6.68	100	13.37	200	26.73
	Y	X	Y	X	Y	X	Y	X	Y	X
	1	(76.39)	1	(152.79)	1	(381.97)	1	(763.94)	1	(1,527.89)
	10	(75.96)	50	(147.30)	200	(346.41)	250	(736.48)	1,000	(1,303.23)
	100	(26.79)	100	(130.32)	400	(230.94)	500	(651.61)	2,000	(535.90)
	120	0.00	200	(53.59)	600	0.00	1,000	(267.95)	2,400	0.00
	200	346.41	240	0.00	750	310.66	1,200	0.00	3,000	1,242.64
	240	2E+06	400	692.82	800	461.88	1,600	923.76	3,500	3,069.42
			450	2,262.30	1,000	1,732.05	2,000	3,464.10	4,000	6,928.20
			480	7E+06	1,200	5E+08	2,400	2E+08	4,800	7E+08

K*b =	18,000	gpd/ft =	1.671	SF/min						
	GPM	CF/min	GPM	CF/min	GPM	CF/min	GPM	CF/min	GPM	CF/min
Q =	10	1.34	20	2.67	50	6.68	100	13.37	200	26.73
	Y	X	Y	X	Y	X	Y	X	Y	X
	1	(63.66)	1	(127.32)	1	(318.31)	1	(636.62)	1	(1,273.24)
	10	(63.14)	50	(120.71)	200	(275.28)	250	(603.55)	500	(1,207.11)
	50	(50.00)	100	(100.00)	400	(129.97)	500	(500.00)	1,000	(1,000.00)
	100	0.00	200	0.00	500	0.00	1,000	0.00	2,000	0.00
	150	150.00	300	300.00	600	194.95	1,250	517.77	2,500	1,035.53
	200	9E+20	400	2E+21	800	1,101.11	1,500	1,500.00	3,000	3,000.00
					900	3E+03	1,600	2E+03	3,500	8,449.75
					1,000	5E+21	2000	9E+21	4,000	2E+22

* C.W. Fetter, Applied Hydrogeology, pp 501 – 504, 1994.

Attachment 1 : Capture Zone Definition
p 1 of 3

SPARTON TECHNOLOGY, INC.
Offsite Monitoring Well Water Level Elevations
08/02/96

MPE = Measuring Point Elevation in feet above sea level.

SR = Sounder Reading in feet.

WLE = Water Level Elevation in feet above sea level. MPE-SR=WLE.

Well No.	MPE(ft)	SR(ft)	WLE(ft.)	Date	
PZ-1	5142.22	183.75	4958.47	07/23/96	
MW-34	5034.49	58.85	4975.64	07/23/96	
MW-35	5042.50	69.70	4972.80	07/23/96	*3
MW-36					*1
MW-37					*1
MW-44	5058.75	87.43	4971.32	07/23/96	
MW-45	5089.65	120.00	4969.65	07/23/96	
MW-46	5118.98	150.46	4968.52	07/16/96	
MW-47	5155.83	187.59	4968.24	07/15/96	
MW-48	5168.31	200.79	4967.52	07/15/96	
MW-50	5211.21	249.81	4961.40	07/23/96	
MW-52	5156.79	191.70	4965.09	07/15/96	*2
MW-53	5164.24	197.48	4966.76	07/15/96	
MW-54	5097.64	130.47	4967.17	07/23/96	
MW-55	5168.61	201.79	4966.82	07/15/96	
MW-56	5168.61	201.13	4967.48	07/15/96	
MW-57	5103.54	136.78	4966.76	07/16/96	
MW-58	5168.89	201.71	4967.18	07/15/96	
MW-59	5059.18	88.55	4970.63	07/23/96	
MW-60	5134.87	167.71	4967.16	07/15/96	*2
MW-61	5135.23	168.05	4967.18	07/15/96	*2
MW-62					*1
MW-63	5065.74	90.05	4975.69	07/24/96	*3
MW-64	5097.84	130.56	4967.28	07/15/96	
MW-65	5156.45	191.60	4964.85	07/18/96	
MW-66	5103.03	137.21	4965.82	07/18/96	
MW-67	5169.21	209.11	4960.10	07/18/96	
MW-68	5165.53	201.11	4964.42	07/26/96	
MW-69	5165.46	201.15	4964.31	07/26/96	
MW-65	5156.45	191.48	4964.97	08/02/96	
MW-66	5103.03	137.28	4965.75	08/02/96	
MW-67	5169.21	209.08	4960.13	08/02/96	
MW-68	5165.53	201.11	4964.42	08/02/96	
MW-69	5165.46	201.12	4964.34	08/02/96	

*1 Airlines were installed in MW-36, 37 and 62 on 9-15-95 see AR report for WLE.

*2 New surveyed MPE for MW-52 5156.79 survey date = 6-10-96.

*3 WLE below top of pump, pull pump, SR taken next day.

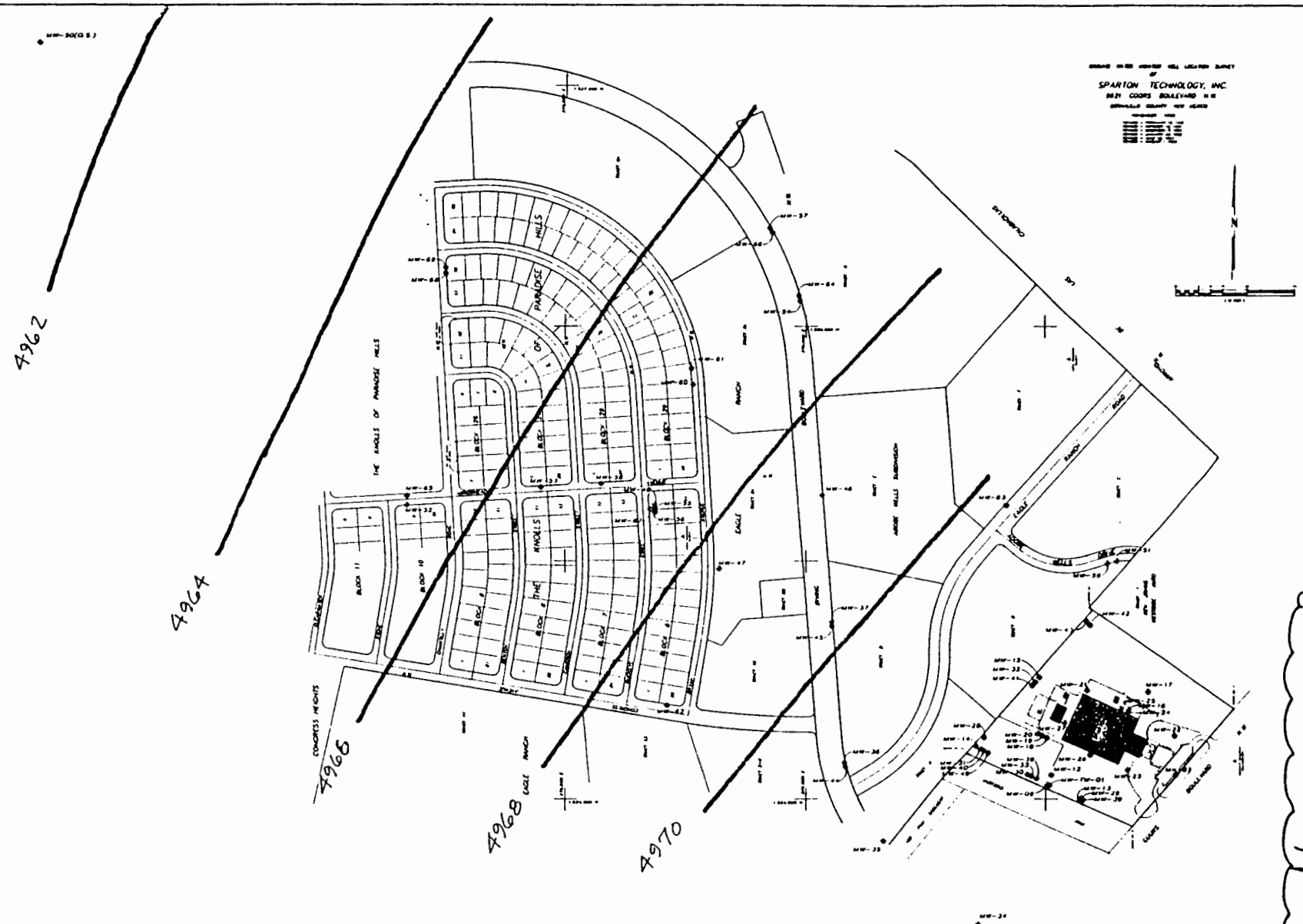
Attachment 1
p 2 of 3

SPARTON TECHNOLOGY, INC.
Onsite Monitoring Well Water Level Elevations
08/01/96

AE = Airline Elevation in feet above sea level.
AR = Airline Reading in inches of water
WLE = Water Level Elevation in feet above sea level. AE+AR/12=WLE.

Well No.	AE (ft)	AR (in)	WLE (ft.)	Date
MW-7	4973.07	67	4978.65	07/23/96
MW-9	4969.41	60	4974.41	07/17/96
MW-12	4968.17	71	4974.09	07/23/96
MW-13	4972.09	46	4975.92	07/23/96
MW-14	4970.39	27	4972.64	07/17/96
MW-15	4974.27	dry	dry	07/17/96
MW-16	4977.28	26	4979.45	07/17/96
MW-17	4978.36	13	4979.44	07/23/96
MW-19	4968.66	54	4973.16	07/17/96
MW-20	4968.07	56	4972.74	07/17/96
MW-21	4978.01	14	4979.18	07/17/96
MW-22	4975.64	41	4979.06	07/17/96
MW-29	4970.24	56	4974.91	07/23/96
MW-30	4968.89	56	4973.56	07/23/96
MW-31	4967.81	57	4972.56	07/23/96
MW-32	4968.54	46	4972.37	07/16/96
MW-33	4972.36	17	4973.78	07/23/96
MW-38	4969.14	68	4974.81	07/23/96
MW-39	4968.97	57	4973.72	07/23/96
MW-40	4968.43	51	4972.68	07/23/96
MW-41	4968.46	47	4972.38	07/23/96
MW-42	4970.34	19	4971.92	07/16/96
MW-43	4970.48	17	4971.90	07/16/96
MW-49	4967.66	55	4972.24	07/16/96
MW-36 OS	4969.19	27	4971.44	07/16/96
MW-37 OS	4967.57	27	4969.82	07/16/96
MW-51 OS	4977.04	44	4980.71	07/16/96
MW-62 OS	4966.94	27	4969.19	07/16/96
Recovery Wells				*1
PW-1	4964.71	7	4965.29	07/23/96
MW-18	4968.07	15	4969.32	07/23/96
MW-23	4973.42	30	4975.92	07/23/96
MW-24	4974.89	10	4975.72	07/23/96
MW-25	4976.06	19	4977.64	07/23/96
MW-26	4965.88	13	4966.96	07/23/96
MW-27	4972.23	13	4973.31	07/23/96
MW-28	4971.62	12	4972.62	07/23/96

*1. AE on Recovery Wells needs recalibration
OS = Offsite



Attachment 1, p 3 of 3

DESIGNED / DETAILED / CHECKED / APPROVED / DATE	Black & Veatch	PROJECT NO.	POTENTIOMETRIC LEVELS JULY 1996 DATA SPARTON TECHNOLOGY COORS ROAD FACILITY
			SHEET OF

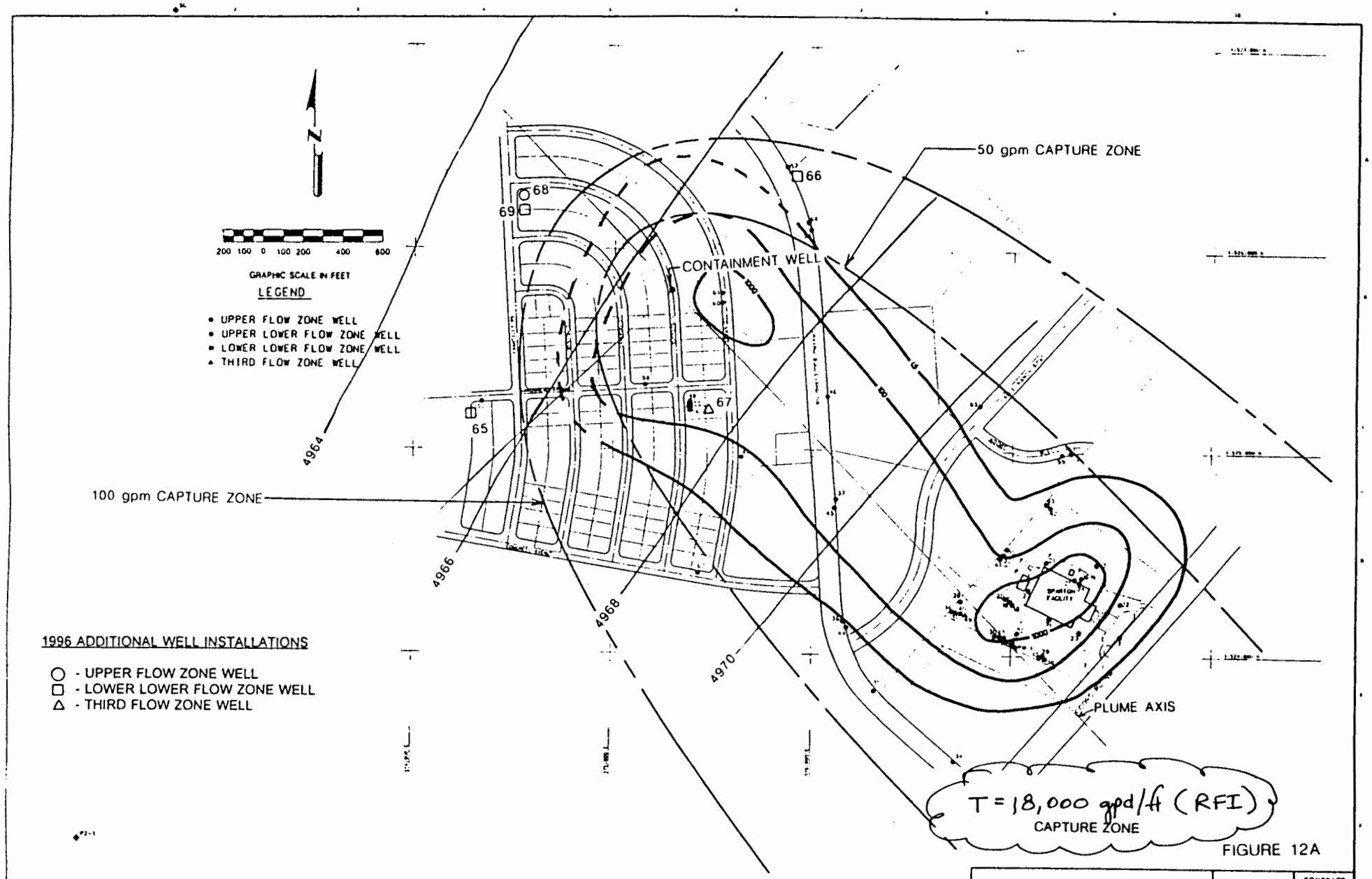


FIGURE 12A

Black & Veatch
Engineers Architects
Dallas, Texas

PROJECT NO 026602

UPPER FLOW ZONE
TCE CONTOURS - 1996 DATA

CONTRACT NO

SHEET NO

6

SPARTON TECHNOLOGY, INC.

Coors Road Facility

Capture Zone Definition - USGS Conditions

Definition for the Edge of Capture Zone	Stagnation Point	Maximum width of capture Zone
x=(-y)/[tan(2*PI*K*b*i*y/Q)] - in radians	x(0) = -Q/(2*PI*K*b*i)	y(max) = (+/-)Q/(2*K*b*i)

x = distance from pumping well (feet) - parallel to flow
y = distance from pumping well (feet) - perpendicular to flow
PI = 3.141593
K = hydraulic conductivity (feet / minute)
b = initial saturated thickness of aquifer (feet)
i = hydraulic gradient of flow field in absence of pumping (feet / feet)
Q = pumping rate (cubic feet / minute)
T = K*b = Transmissivity (square feet / minute)

K =	15	**feet per day - per USGS**
b =	75	**feet - per approved RFI**
T = K*b =	8,416	gallons per day per foot

Solve for Q = 10,20,50,100,200 gallons per minute

i = 0.002 feet / feet (third Quarter 1996 water level data)

		K*b (gpd/ft) =		8,416
		K*b (SF/min) =		0.781
Q		x(0)	y(max)	y@x=0
GPM	CF/min		+/-	
10	1.34	(136.16)	428	214
20	2.67	(272.31)	856	428
50	6.68	(680.79)	2,139	1,070
100	13.37	(1,361.57)	4,278	2,139
200	26.73	(2,723.14)	8,555	4,278

Calculate edge of Capture Zone

K*b =	8,416	gpd/ft =	0.781	SF/min						
	GPM	CF/min	GPM	CF/min	GPM	CF/min	GPM	CF/min	GPM	CF/min
Q =	10	1.34	20	2.67	50	6.68	100	13.37	200	26.73
	Y	X	Y	X	Y	X	Y	X	Y	X
	1	(136.15)	1	(272.31)	1	(680.79)	1	(1,361.57)	1	(2,723.14)
	100	(110.75)	100	(259.96)	400	(600.58)	600	(1,272.28)	1,000	(2,599.62)
	150	(76.03)	200	(221.49)	800	(334.17)	1,200	(989.32)	2,500	(1,911.34)
	200	(20.45)	300	(152.06)	1,000	(102.26)	2,000	(204.52)	3,500	(1,027.38)
	214	0.20	400	(40.90)	1,070	0.20	2,139	0.39	4,000	(409.04)
	250	7E+01	428	(0.39)	1,250	339.65	2,500	679.31	4,278	(0.00)
	300	2E+02	500	135.86	1,500	1,099.52	3,000	2,199.04	4,500	368.50
	350	5E+02	600	4E+02	2,100	4E+04	4,000	2E+04	6,000	4E+03

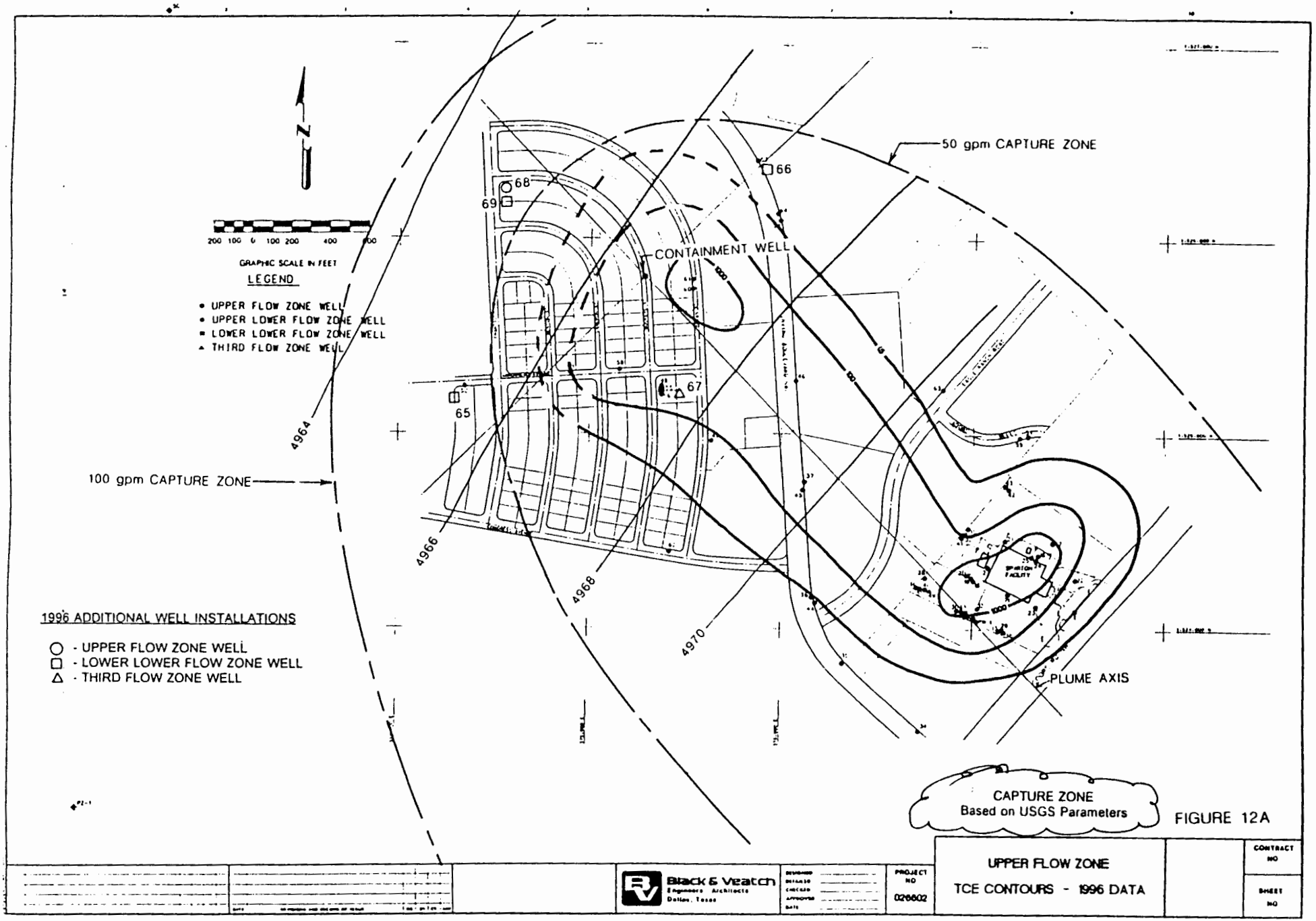


FIGURE 12A

Black & Veatch
Engineers Architects
Dallas, Texas

PROJECT NO 026602

UPPER FLOW ZONE
TCE CONTOURS - 1996 DATA

CONTRACT NO

SHEET NO

08