CBRLicenseRenPEm Resource

From: CrowButte-LicenseRenewal Resource
Sent: Friday, February 27, 2009 12:40 PM
To: CBRLicenseRenPEm Resource
Subject: 1996 MIT Failure
Attachments: 1996 MIT Failure.pdf

Hearing Identifier: CrowButteUR_LicenseRenewal_Public
Email Number: 41

Mail Envelope Properties (3AF7DEF82ADA8944AD8247B7ED7FD65182B368425B)

Subject: 1996 MIT Failure
Sent Date: 2/27/2009 12:40:05 PM
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From: CrowButte-LicenseRenewal Resource

Created By: CrowButte-LicenseRenewal.Resource@nrc.gov

Recipients:
"CBRLicenseRenPEm Resource" <CBRLicenseRenPEm.Resource@nrc.gov>
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CROW BUTTE RESOURCES, INC.

86 Crow Butte Road
P.O. Box 169
Crawford, Nebraska 69339-0169

(308) 665-2215
(308) 665-2341 - FAX

April 25, 1996

Mr. Joseph Holonich, Chief
High Level Waste & Uranium Recovery Projects Branch
Division of Waste Management
NMSS (T-7-J9)
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20850

RE: Docket No. 40-8943
License No. SUA-1534

Dear Mr. Holonich:

Crow Butte Resources, Inc. (CBR) is required to conduct mechanical integrity testing (MIT) on all cased wells once every five years during the life of those wells. As part of that requirement, well I196-5 (Mine Unit 2) was tested on March 29, 1996 and was found to fail the MIT. Subsequent testing isolated the leak at the casing coupling 40 feet below ground level.

Mine Unit 2 has been on restoration status since January 2, 1996 and well I196-5 has not been used since that time. A review of our records showed the following for well I196-5:

injection from March, 1992 through September, 1994;
shut in from October, 1994 through October, 1995;
injection from November 7, 1995 through January 2, 1996;
shut in from January 2, 1996 until the MIT of March 29, 1996.

Although the circumstance of such a leak is not specifically addressed in our license, the discussion of excursions in License Conditions 45 and 46 was used as a guide in subsequent CBR actions. Testing of the affected zone would require recompleting well I196-5 to the proper interval or drilling of a new well. Drilling of new, shallow test wells with "air" was considered the best means of minimizing wellbore damage in the horizon of interest, important with the very small pressure drawdown available for water production at 40 feet.

9605030305 960425
PDR ADOCK 04008943
C PDR

NMSS

Well 196a was drilled with "air" to 50 feet on April 16, 1996. It was left open hole (OH) and sampled with a one liter, plastic sampling device (Sampling Specialties, Inc., SGI) on April 17, 1996. The water level before sampling was at 35.5 feet below Ground Level (GL). The sample had a conductivity of 5540 micro-mhos / cm and a U_3O_8 of 27.6 ppm. A confirming sample was taken on April 18, 1996 in keeping with Condition 45 of our License. The CBR lab analysis showed 4100 conductivity and 17.8 ppm U_3O_8. Mr. John McKinnon, of the USNRC 24 Hour Operations Center, was notified by telephone of this confirmation on April 18, 1996.

Well 196a was cased with 4 1/2" Yelomine and slotted pipe to 50 feet on April 18, 1996. The casing is uncemented, with bentonite pellets placed above the shale basket at five feet to prevent surface water runoff into the well. Additional shallow wells were drilled and sampled to delineate the affected area. Table 1 provides various completion information on the shallow wells drilled to date. The attached figure shows the location of these wells in relation to well 1196-5.

Table 1
Completion Data on Shallow Test Wells in Vicinity of 1196-5

Well	Date Air Drilled	Date Cased	Description
196a	16-Apr-96	18-Apr-96	Air drilled 7 7/8" to 50 feet; cased with 4 1/2" Yelomine: 5' blank, shale basket, 20' blank, 20' slotted 4 1/2" Yelomine; bentonite pellets added in annulus.
196b	18-Apr-96	18-Apr-96	Air drilled 7 7/8" to 25 feet; cased with 4 1/2" Yelomine: 5' blank, shale basket, 15' slotted 4 1/2" Yelomine; bentonite pellets in annulus at surface.
196c	18-Apr-96	---	Air drilled 7 7/8" to 50 feet; left Open Hole (OH)
196d	18-Apr-96	---	Air drilled 7 7/8" to 50 feet; left Open Hole (OH)
196e	19-Apr-96	---	Air drilled 7 7/8" to 50 feet; left Open Hole (OH)
196f	19-Apr-96	19-Apr-96	Air drilled 7 7/8" to 25 feet; cased with 4 1/2" Yelomine: 5' blank, shale basket, 15' slotted 4 1/2" Yelomine; bentonite pellets in annulus at surface.
196g	22-Apr-96	---	Air drilled 7 7/8" to 50 feet; left Open Hole (OH)
196h	22-Apr-96	---	Air drilled 7 7/8" to 50 feet; left Open Hole (OH)
196i	24-Apr-96	---	Air drilled 7 7/8" to 45 feet; left Open Hole (OH)
196j	24-Apr-96	---	Air drilled 7 7/8" to 20 feet; left Open Hole (OH)
196k	24-Apr-96	---	Air drilled 7 7/8" to 30 feet; left Open Hole (OH)

Table 2 (attached) is the analyses to date of the sampled waters from the shallow wells surrounding well I196-5. Except for the samples acquired by submersible pump from well 196a on April 22 and 25, 1996, all were obtained by means of the plastic, one liter SGI samplers. Table 2 shows that the excursion does not extend to wells 196b, 196c, 196d, 196f, and 196k, but does to wells 196a, 196e, 196g and 196h. The open hole completions of wells 196i and 196j were found to be bridged during initial water sampling on April 25, 1996. Both wells will be cleaned by drilling rig, and well 196j will be cased.

Well 196a was sampled by submersible pump at a flowrate of 1.25 gpm on April 22, 1996, and at a 1-1.5 gpm for about four hours on April 25, 1996. Installation of a dedicated electric power line and recovery line for this well is planned. Recovery of the excursion can then begin.

One hundred seventy-three wells have been retested by MIT since January, 1995. All but two of those wells, IJ-36 and I196-5, demonstrated mechanical integrity. The casing in well IJ-36 was damaged during a workover with a drilling rig just prior to retesting with MIT. That well was plugged and abandoned.

Corrective action to mitigate this excursion include:

1. Continue the delineation of the problem area around well I196-5 by drilling shallow wells as needed.

2. Begin recovery of the contaminated fluid from shallow well 196a.

3. Monitor the effectiveness of the recovery efforts by sampling wells around 196a.

4. Sample well 196a weekly for the usual monitor well parameters of sodium, chloride, sulfate, alkalinity, and conductivity. Weekly, sample and analyze for conductivity the shallow wells which are known to be contaminated around well 196a.

If you need any additional information regarding this area, please contact me.

Sincerely,

Craig S. Bartels

Craig S. Bartels
Wellfield Manager

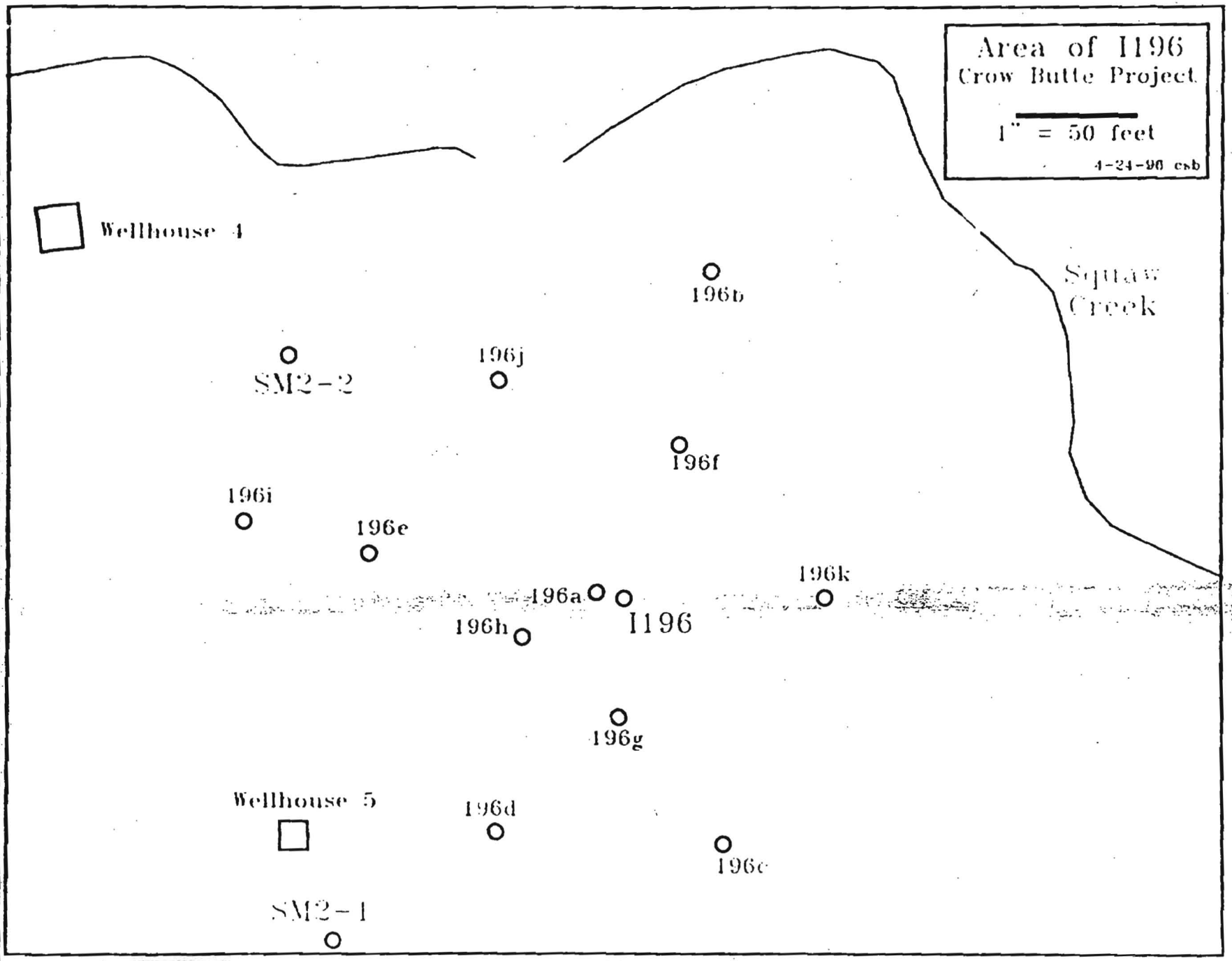
Attachments
cc: Ross Scarano - Region IV
Stephen Collings

Table 2

Water Analysis to Date (25-Apr-96) of Shallow Test Wells and Shallow Monitor Wells in Vicinity of Well I196-5

Crow Butte Resources, Inc.
Crow Butte Project

Sample Location	Sample Date	U3O8	Na	Cl	SO4	Conductivity	Alkalinity
Squaw Creek	18-Apr-96	<0.1	15	0.8	2	350	175
SM2-1	Baseline Average	0.012	135	33.5	51.8	582	209.6
SM2-1	08-Apr-96	---	120	20	48	560	200
SM2-2	Baseline Average	0.0051	112.7	24.9	42	653	202.2
SM2-2	08-Apr-96	---	102	11	42	480	180
SM2-3	Baseline Average	0.0114	126	18.6	51.9	665	235.7
SM2-3	08-Apr-96	---	122	52	10	550	210
196a	17-Apr-96	27.6	1216	576	1196	5540	950
196a	18-Apr-96	17.8	831	422	924	4100	650
196a	22-Apr-96	6.3	358	198	372	2090	390
196a	25-Apr-96	3	243	113	221	1431	335
196b	18-Apr-96	0.1	21	1.5	13	430	215
196b	19-Apr-96	<0.1	23	1.5	18	438	215
196c	19-Apr-96	0.1	16	3.8	21	465	210
196c	25-Apr-96	<0.1	13	5	22	474	210
196d	19-Apr-96	0.1	15	1.5	13	379	175
196d	23-Apr-96	<0.1	12	3	14	381	170
196e	22-Apr-96	1.3	82	110	178	1217	290
196e	24-Apr-96	1.2	90	114	180	1243	305
196e	25-Apr-96	1.3	86	115	188	1266	300
196f	22-Apr-96	0.1	20	4.6	14	480	230
196f	23-Apr-96	<0.1	17	4	13	485	230
196g	23-Apr-96	5.4	267	225	381	2190	450
196g	25-Apr-96	5.3	275	215	387	2160	440
196h	23-Apr-96	0.8	48	252	251	1886	370
196h	25-Apr-96	0.8	47	253	245	1864	380
196k	25-Apr-96	<0.1	14	8	19	541	255


Area of I196
Crow Butte Project
1" = 50 feet
4-24-96 csb
Wellhouse 4
Squaw Creek
196b
SM2-2
196j
196f
196i
196e
196k
196a
I196
196h
196g
Wellhouse 5
196d
196c
SM2-1

Crow Butte Resources, Inc.

86 Crow Butte Road
P.O. Box 169
Crawford, Nebraska 69339-0169

(308) 665-2215
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May 29, 1996

Mr. Joseph Holonich, Chief
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20850

RE: Docket No. 40-8943
License No. SUA-1534

Dear Mr. Holonich:

A casing leak was found in well I196-5 during the routine 5-year Mechanical Integrity Test (MIT) of that well on March 29, 1996. Subsequent testing isolated the leak at the casing coupling 40 feet below ground level. A test well (196a) was drilled near well I196-5 and the water sampled from the screened interval (35 - 50 feet depth). This sample proved to be contaminated, as did a confirming water sample taken from the same well. Your Department was notified of these results by telephone on April 18, 1996 and by letter on April 25, 1996. This letter is to apprise you of the results to date of the areal delineation, the water sampling analyses, and the remediation efforts for this excursion.

As described in our letter of April 25, 1996, well I196-5 was started on injection in March, 1992 as part of Wellhouse 5, Mine Unit 2. The well was shut in from October, 1994 through October, 1995, and again after January 2, 1996, when Mine Unit 2 transferred to restoration status.

Since the fluid level of the near-surface waters in the vicinity of well I196-5 is about 35 feet and very little pressure drawdown is available for water production, delineation wells were drilled with "air" to minimize any wellbore damage at 40 feet depth. The test wells were completed with 4 1/2" Yelomine casing and 12 to 20 feet of 4 1/2" Yelomine slotted pipe. A "shale trap" was placed at a depth of five feet from surface. The casing is uncemented, with bentonite pellets placed above the shale basket to prevent surface water runoff into the annulus of the well.

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PDR ADOCK 04008943
C PDR

NL05

Fifteen shallow test wells have been drilled to date to delineate the contaminated area. The various completion data, locations and elevations are shown for these wells on Table 1 (attached). Nine of the fifteen wells were shown to be uncontaminated and effectively delineated the excursion (see Figure 1, attached). The contaminated area is outlined on Figure 1 as midpoint between wells with and without contamination, and is about 25,000 square feet in area.

Table 2 (attached) lists the analytical results of the multiple water samples taken from the shallow delineation wells. Also shown are various water analyses from Squaw Creek and the three deeper Shallow Monitor Wells from Mine Unit 2. Most water samples for the shallow test wells were gathered with a one liter, plastic sampling device (Sampling Specialties, Inc., SGI), which was manually lowered and retrieved from downhole. This sampling method is noted on Table 2 as "bailer".

To begin recovery of the excursion, water production was begun from well 196a, the shallow well closest to well I196-5, on April 25, 1996. A submersible pump, a 3" Grundfos 'JetSub', was placed into the well at two feet off bottom. Table 3 (attached) provides a history of flowrates, volumes and conductivities of the produced waters. Initially, well 196a was pumped intermittently to ensure adequate cooling of the submersible pump motor and to determine if conductivity of the recovered waters changed with increasing drawdown and time of production. Since conductivity of the recovered solutions increased with continued pumping and because the flowrate from well 196a was reasonably high (2-3 gpm), well 196a was placed on continuous pumping, until well 196n was completed at the center of the delineated excursion (see Figure 1).

Since available fluid level drawdown is small, well 196n was located centrally to allow even recovery of the contaminated fluid across the area. As with well 196a, the flowrate from well 196n increased with time as wellbore damage from the drilling process was cleared. However, the conductivity of the produced fluid remained low with time, even with continuous pumping. As a result, the pump was placed back into well 196a and water production from that well resumed (see Table 3).

Figures 2 and 3 (attached) present pumping and static isopleths, respectively, of the piezometric surface as measured in the shallow delineation wells. The contours shown in Figure 2 are after four days of pumping from the central well, 196n, while Figure 3 shows the static piezometric surface after four days of water level recovery. Figure 3 indicates that the general water movement is from the southeast to the northwest. The oblong contours of Figure 2 suggest that the area is somewhat anisotropic, with the preferred direction of flow along a line situated southeast-northwest. This also suggests that the outline of contamination is actually closer to I196-5 and farther west from 196k than is shown on Figure 1 (i.e., the contaminated area is smaller than the outline of Figure 1).

Remediation of this excursion will include the following:

(1) Pump from wells 196a, 196j and 196n (shallow test wells showing the greatest contamination) until significant cleanup has been attained. This will be done well by well, so as not to develop areas of zero fluid movement.

(2) Bi-weekly, or more often as necessary, sample all wells known to be contaminated. From the pumping well, analyze for the normal monitor well parameters of sodium, chloride, sulfate, alkalinity and conductivity, as well as uranium (as U_3O_8). For the non-pumping, contaminated wells, analyze for conductivity only.

(3) Bi-weekly, or more often as necessary, sample the uncontaminated wells 196i, 196m and 196L, which are down gradient (pressure) as shown by Figure 3, to ensure containment of the excursion. Analyze for conductivity only.

(4) After the initial cleanup of wells 196a, 196n and 196j, pump other wells as needed to finalize the cleanup. Drill, complete, and pump other wells as required.

(5) The goal of this remediation will be to return the waters in the affected area to baseline conditions, or to a quality consistent with original use or uses as determined by the Nebraska Department of Environmental Quality (NDEQ) and the NRC.

(6) Results of the remediation process will be summarized and reported to the NRC on a semi-annual basis as part of the Effluent and Environmental Monitoring Report (Part 40.65). This report includes the quarterly NDEQ Mining Monitoring Reports (MMR), which will include summaries of the remediation.

If you need any additional information regarding this data and our plans for mitigation of this excursion, please contact me.

Sincerely,

Craig S Bartels

Craig S. Bartels
Wellfield Manager

Attachments

cc: Ross Scarano - Region IV
Stephen Collings
Rhonda Grantham

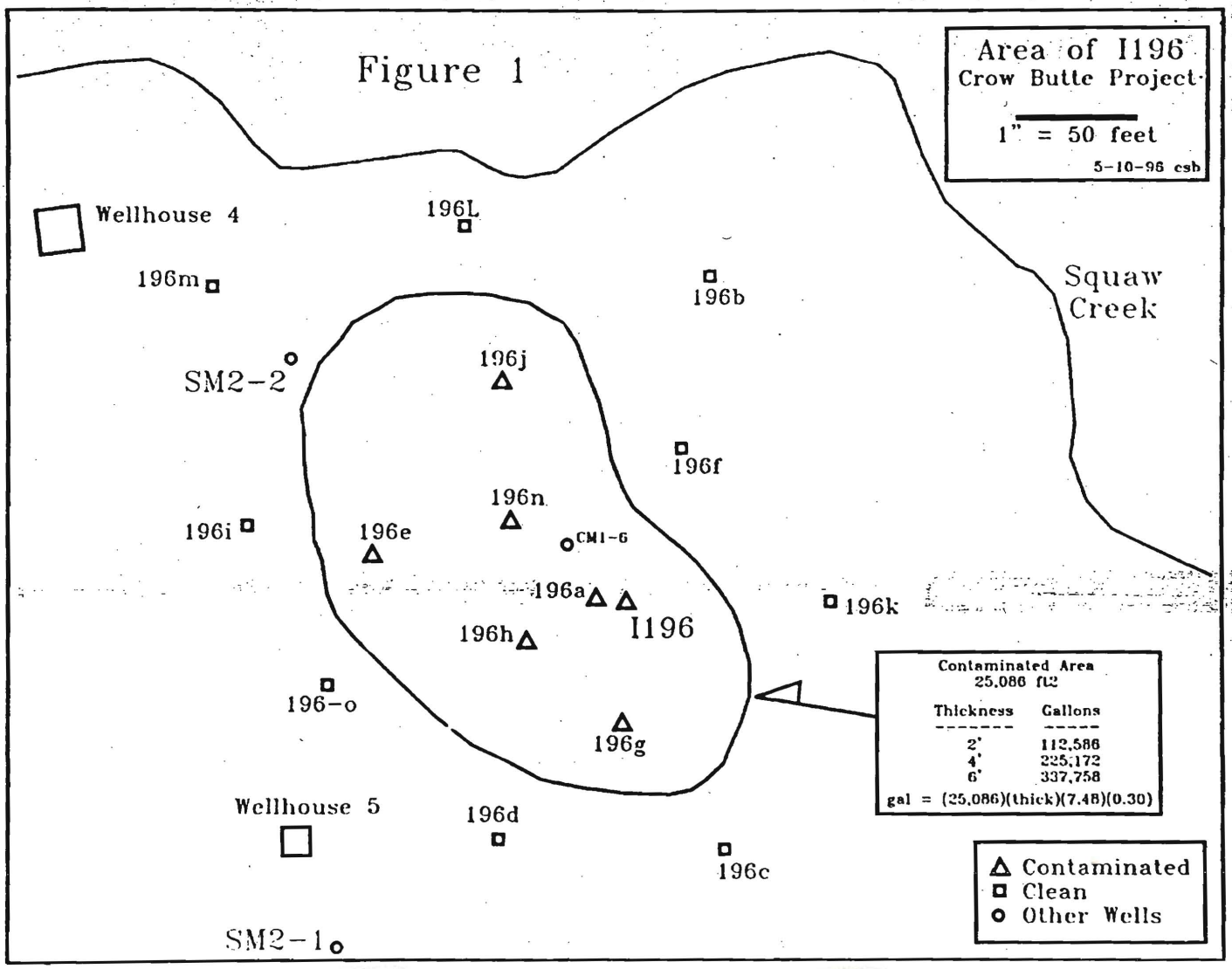
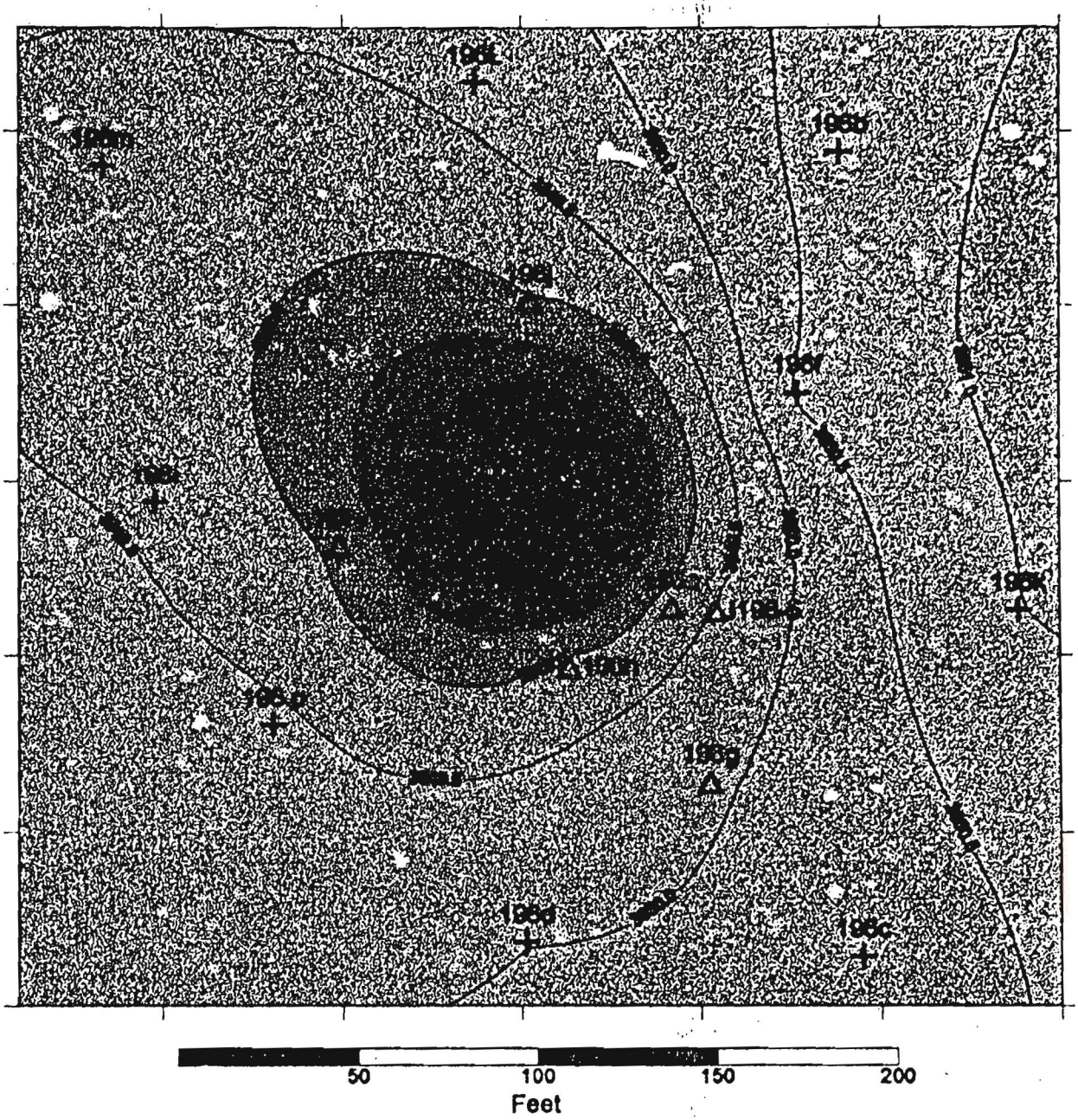


Figure 1
Area of I196
Crow Butte Project
1" = 50 feet
5-10-96 csb
Wellhouse 4
196L
196m
196b
Squaw Creek
SM2-2
196j
196f
196n
196i
196e
CM1-6
196a
196k
196h
I196
196-o
196g
Contaminated Area
25,086 ft2
Thickness Gallons
2' 112,586
4' 225,172
6' 337,758
gal = (25,086)(thick)(7.48)(0.30)
Wellhouse 5
196d
196c
Contaminated
Clean
Other Wells
SM2-1

Figure 2

Crow Butte Project
Shallow Excursion in Area of I196-5

Piezometric Surface (MSL) as of May 16, 1996
After Four Days of Continuous Pumping
of Shallow Well 196n



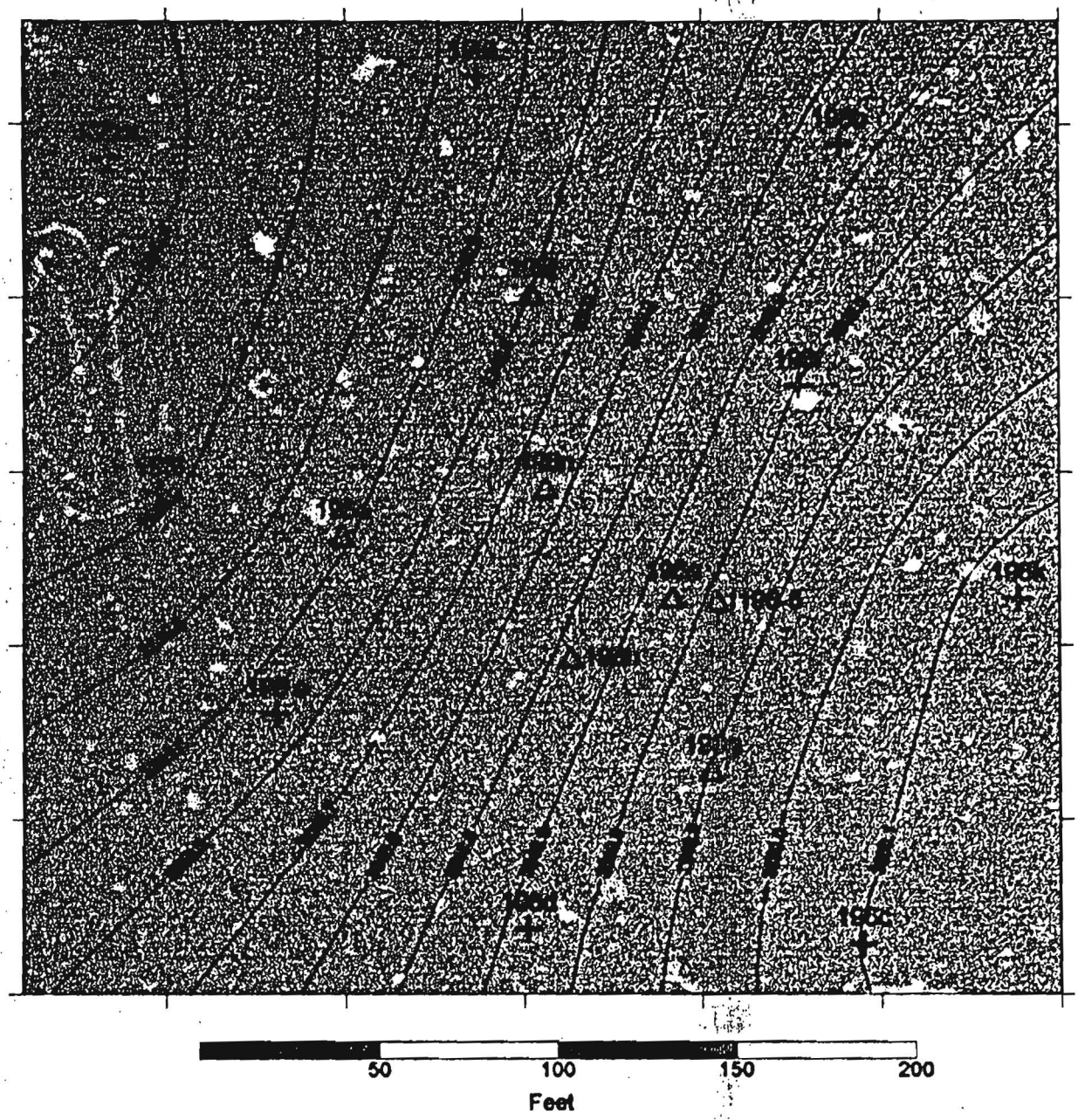
△ Contaminated Shallow Delineation Wells
✚ UNcontaminated Shallow Delineation Wells

Contours by Kriging
using WINSURF (TM)
18-May-96 csb

Figure 3

Crow Butte Project
Shallow Excursion in Area of I196-5

Static Piezometric Surface (MSL) as of May 21, 1996
Four Days After End Pumping
from Shallow Well 196n



△ Contaminated Shallow Delineation Wells
✚ UNcontaminated Shallow Delineation Wells

Contours by Kriging
using WINSURF (TM)
21-May-96 csb

Table

Completion Data for Shall
and Other Selected Wells

Crow Butte Reso
Crow Butte

Well	Date Air Drilled	Date Cased	G.L. Elevation [1]	TOC Elev [w/o Stub for Cap] [1], [2]	TOC Elev [incl. Stub for Cap] [1], [2]	Stub Length [2] (feet)	TOC [with stub] to G.L. [1], [2]	Surveyed Locations X Loc	Surveyed Locations Y Loc	D
SM2-1 (PM-11)	—	—	3,866.2	—	—	—	—	1,099,284.4	495,675.5	
SM2-2	—	—	3,860.6	—	—	—	—	1,099,265.3	495,911.1	
SM2-3	—	—	3,871.5	—	—	—	—	1,098,849.0	496,344.2	
I196-5 (PM-5)	—	—	3864.9	—	—	—	—	1099404.3	495812.8	
196a	16-Apr-96	18-Apr-96	3,865.53	3,866.79	3,867.55	0.76	2.02	1,099,391.9	495,813.8	
196b	18-Apr-96	18-Apr-96	3,860.65	3,861.90	3,862.65	0.75	2.00	1,099,436.8	495,844.2	
196c	18-Apr-96	29-Apr-96	3,867.22	3,868.18	3,868.93	0.75	1.71	1,099,444.9	495,714.3	
196d	18-Apr-96	29-Apr-96	3,867.19	3,868.16	3,868.91	0.75	1.72	1,099,351.1	495,718.5	
196e	19-Apr-96	01-May-96	3,865.00	3,865.97	3,866.72	0.75	1.72	1,099,299.0	495,831.5	
196f	19-Apr-96	19-Apr-96	3,861.29	3,861.76	3,862.50	0.74	1.21	1,099,427.1	495,875.0	
196g	22-Apr-96	29-Apr-96	3,866.00	3,866.84	3,867.58	0.74	1.58	1,099,402.7	495,763.9	
196h	22-Apr-96	06-May-96	3,866.07	3,866.40	3,867.17	0.77	1.10	1,099,363.1	495,796.8	
196i	24-Apr-96	26-Apr-96	3,864.33	3,865.25	3,866.01	0.76	1.68	1,099,247.8	495,044.0	
196j	24-Apr-96	25-Apr-96	3,860.44	3,861.39	3,862.14	0.75	1.70	1,099,352.4	495,901.1	
196k	24-Apr-96	29-Apr-96	3,870.65	3,871.61	3,872.36	0.75	1.71	1,099,488.4	495,813.3	
196L	29-Apr-96	29-Apr-96	3,858.46	3,859.01	3,859.76	0.75	1.30	1,099,337.0	495,964.2	
196m	01-May-96	01-May-96	3,859.34	3,860.21	3,860.96	0.75	1.62	1,099,233.4	495,939.9	
196n	07-May-96	07-May-96	3,864.92	3,865.89	3,866.64	0.75	1.72	1,099,356.3	495,845.4	
196 o	06-May-96	06-May-96	3,864.36	3,865.27	3,866.01	0.74	1.65	1,099,280.6	495,780.3	

[1] G.L. = Ground level elevation; TOC = Top of Casing; all measurements in FEET; blk = blank; Yelo. = Yelo

[2] For all cased wells: ~0.75' casing "stub" added above top casing collar for well cap on Friday, 03-May-96.

Table 2

Water Analyses to Date (24-May-96) of Shallow Delineation Wells and Shallow Monitor Wells in Vicinity of Well I196-5

Crow Butte Resources, Inc.
Crow Butte Project

Sample Location	Sample Date	Time If Multiple Daily Samples	Sampling Method	U3O8 (ppm)	Na (ppm)	Cl (ppm)	SO4 (ppm)	Conductivity (umhos / cm)	Alkalinity (ppm)
Squaw Creek	18-Apr-96	—	bailer	<0.1	15	0.8	2	350	175
SM2-1	Baseline Average	—	—	0.012	135	33.5	51.8	582	209.6
SM2-1	08-Apr-96	—	pump jack	—	120	20	48	560	200
SM2-1	06-May-96	—	pump jack	—	121	20	47	560	200
SM2-2	Baseline Average	—	—	0.0051	112.7	24.9	42	653	202.2
SM2-2	08-Apr-96	—	pump jack	—	102	11	42	480	180
SM2-2	06-May-96	—	pump jack	—	101	11	45	480	170
SM2-3	Baseline Average	—	—	0.0114	126	18.6	51.9	665	235.7
SM2-3	08-Apr-96	—	pump jack	—	122	52	10	550	210
SM2-3	06-May-96	—	pump jack	—	122	10	51	550	210
196a	17-Apr-96	—	bailer	27.6	1216	576	1196	5,540	950
196a	18-Apr-96	—	bailer	17.8	831	422	924	4,100	650
196a	22-Apr-96	—	pump	6.3	358	198	372	2,090	390
196a	25-Apr-96	10:38	pump	3	243	113	221	1,431	335
196a	25-Apr-96	15:10	pump	7.3	453	207	445	2,420	485
196a	03-May-96	—	pump	5.8	384	173	352	2,040	437
196a	09-May-96	—	pump	8.6	—	252	485	2,650	520
196a	16-May-96	—	bailer	10.6	596	284	611	3000	590
196a	23-May-96	—	pump	4.5	287	132	282	1,692	390
196b	18-Apr-96	—	bailer	0.1	21	1.5	13	430	215
196b	19-Apr-96	—	bailer	<0.1	23	1.5	18	438	215
196b	02-May-96	—	bailer	<0.1	20	2.3	16	451	220
196c	19-Apr-96	—	bailer	0.1	16	3.8	21	465	210
196c	25-Apr-96	—	bailer	<0.1	13	5	22	474	210
196c	02-May-96	—	bailer	0.1	50	4.6	44	523	205
196c	06-May-96	—	bailer	<0.1	48	5	46	524	210
196d	19-Apr-96	—	bailer	0.1	15	1.5	13	379	175
196d	23-Apr-96	—	bailer	<0.1	12	3	14	381	170
196d	02-May-96	—	bailer	0.1	15	3.1	22	416	175
196d	06-May-96	—	bailer	<0.1	16	3	24	421	105

Table 2

Water Analyses to Date (24-May-96) of Shallow Delineation Wells and Shallow Monitor Wells in Vicinity of Well I196-5

Crow Butte Resources, Inc.
Crow Butte Project

Sample Location	Sample Date	Time If Multiple Daily Samples	Sampling Method	U3O8 (ppm)	Na (ppm)	Cl (ppm)	SO4 (ppm)	Conductivity (umhos / cm)	Alkalinity (ppm)
196e	22-Apr-96	—	bailer	1.3	82	110	178	1,217	290
196e	24-Apr-96	—	bailer	1.2	90	114	180	1,243	305
196e	25-Apr-96	—	bailer	1.3	86	115	188	1,266	300
196e	02-May-96	—	bailer	0.4	41	69	107	898	230
196e	09-May-96	—	bailer	—	—	—	—	901	—
196e	16-May-96	—	bailer	—	—	—	—	918	—
196e	23-May-96	—	bailer	—	—	—	—	909	—
196f	22-Apr-96	—	bailer	0.1	20	4.6	14	480	230
196f	23-Apr-96	—	bailer	<0.1	17	4	13	485	230
196f	02-May-96	—	bailer	0.1	15	3.1	10	487	240
196g	23-Apr-96	—	bailer	5.4	267	225	381	2,190	450
196g	25-Apr-96	—	bailer	5.3	275	215	387	2,160	440
196g	02-May-96	—	bailer	4.6	261	186	349	1,963	390
196g	09-May-96	—	bailer	—	—	—	--	1,966	—
196g	16-May-96	—	bailer	—	—	—	—	2,030	—
196g	23-May-96	—	bailer	—	—	—	—	1,973	—
196h	23-Apr-96	—	bailer	0.8	48	252	251	1,886	370
196h	25-Apr-96	—	bailer	0.8	47	253	245	1,864	380
196h	02-May-96	—	bailer	0.5	30	247	229	1,794	345
196h	07-May-96	—	bailer	0.5	40	246	238	1,746	335
196h	09-May-96	—	bailer	—	—	—	—	1,741	—
196h	16-May-96	—	bailer	—	—	—	—	1,656	—
196h	23-May-96	—	bailer	—	—	—	—	1,658	—
196i	29-Apr-96	—	bailer	<0.1	19	9	24	441	180
196i	02-May-96	—	bailer	0.1	19	8.4	24	445	170
196j	26-Apr-96	—	bailer	5.8	412	338	608	2,940	475
196j	29-Apr-96	—	bailer	6.9	440	340	663	3,030	480
196j	02-May-96	—	bailer	6.8	431	344	580	3,070	480
196j	09-May-96	—	bailer	—	—	—	—	3,070	—
196j	09-May-96	—	bailer	—	—	—	—	3,090	—
196j	23-May-96	—	bailer	—	—	—	—	3,060	—
196k	25-Apr-96	—	bailer	<0.1	14	8	19	541	255
196k	30-Apr-96	—	bailer	<0.1	14	5	13	515	250
196k	02-May-96	—	bailer	0.1	14	5	12	513	250

Table 2

Water Analyses to Date (24-May-96) of Shallow Delineation Wells and Shallow Monitor Wells in Vicinity of Well I196-5

Crow Butte Resources, Inc.
Crow Butte Project

Sample Location	Sample Date	Time If Multiple Daily Samples	Sampling Method	U3O8 (ppm)	Na (ppm)	Cl (ppm)	SO4 (ppm)	Conductivity (umhos / cm)	Alkalinity (ppm)
196L	30-Apr-96	—	bailer	0.2	14	2	14	435	210
196L	01-May-96	—	bailer	0.1	15	2	13	423	210
196L	02-May-96	—	bailer	0.1	14	2.3	12	434	210
196m	02-May-96	—	bailer	0.2	30	1.5	8	529	210
196m	06-May-96	—	bailer	<0.1	33	12	32	536	210
196n	08-May-96	—	bailer	2.3	207	221	374	2,030	370
196n	09-May-96	—	bailer	—	—	—	—	2,090	—
196n	16-May-96	—	pump	2.9	245	204	329	1,933	400
196n	23-May-96	—	bailer	—	—	—	—	1,382	—
196 o	07-May-96	—	bailer	<0.1	18	2.3	18	443	200
196 o	23-May-96	—	bailer	0.1	21	0.8	15	474	220

Table 3

Water Recovery History (through 24-May-96) using Shallow Pumping Wells in Vicinity of Well I196-5

Crow Butte Resources, Inc.
Crow Butte Project

Pumping Well	Date	Conductivity of Recoverd Solutions (umhos / cm)		Time Pumping During Day (minutes)	Average Daily Flowrate (GPM)	Daily Volume Recovered (gallons)	Cumulative Volume Recovered (gallons)	Comments
		Morning	Afternoon					
196a	22-Apr-96	—	—	—	—	25	25	First water sample.
196a	25-Apr-96	—	—	272	0.91	247	272	
196a	26-Apr-96	—	—	415	1.13	467	739	
196a	29-Apr-96	—	2,490	249	0.86	215	954	
196a	30-Apr-96	—	2,210	497	2.37	1,177	2,131	
196a	01-May-96	—	2,410	498	3.06	1,524	3,655	
196a	02-May-96	2,140	2,590	240	3.04	729	4,384	
196a	03-May-96	2,040	—	30	2.33	70	4,454	
196a	06-May-96	2,140	2,710	385	3.00	1,155	5,609	
196a	07-May-96	2,660	2,730	1,406	2.31	3,252	8,861	Start continuous pumping.
196a	08-May-96	2,770	2,620	1,440	2.10	3,024	11,885	Continuous pumping.
196a	09-May-96	2,650	—	275	2.00	550	12,435	Turned off at 1135 hr. Switched to well 196n.
196n	09-May-96	—	2,510	75	1.11	83	12,518	First time pumping. Shut down overnight.
196n	10-May-96	2,140	2,240	462	2.24	1,037	13,555	Pump during day. Shut down for weekend.
196n	13-May-96	2,210	2,180	1,238	2.25	2,786	16,341	Restarted pump after weekend.
196n	14-May-96	2,040	1,978	1,440	2.25	3,240	19,581	Continuous pumping since 5-13-96, AM.
196n	15-May-96	1,971	1,985	1,440	2.53	3,648	23,229	Continuous pumping since 5-13-96, AM.
196n	16-May-96	1,942	—	1,440	2.80	4,032	27,261	Continuous pumping since 5-13-96, AM.
196n	17-May-96	1,891	—	505	2.85	1,439	28,700	Friday, Shut down for weekend.
196a	21-May-96	—	1,988	25	2.52	63	28,763	Let aquifer recover to measure Static Water
196a	22-May-96	1,983	1,800	495	0.85	421	29,184	Levels, then move pump from 196n back
196a	23-May-96	—	1,692	112	1.70	190	29,374	to well 196a.
196a	24-May-96	—	—	0	0.00	0	29,374	2" discharge line plugged with sand.