Table 3.6-24 Comparison of Nitrogen Dioxide Annual Average Values for Wind Cave and Badlands, SD Monitor Sites

Table 3.6-24 Comparison of Nitrogen Dioxide Annual Average Values for Wind Cave and Badlands, SD Monitor Sites

Monitoring Site	2005	2006	2007	2008	2009	2010
	Parts per billion (ppb)					
Wind Cave	0.8	0.9	1.1	0.2	0.6	0.2
Badlands	1.3	1.2	0.5	0.8	0.5	0.5

SD DENR Standards: Nitrogen Dioxide: 0.053 ppm (annual mean)

Table 3.6-25 Ozone Yearly 4th Highest 8-Hour Averages for Regional Monitoring Sites [a, b]

Table 3.6-25 Ozone Yearly 4th Highest 8-Hour Averages for Regional Monitoring Sites [a, b]

Location	2003	2004	2005	2006	2007	2008	2009	2010	3-Year Average (2008-2010)	Attainment Status [c]
	ppm									
Wind Cave, SD	ND	ND	0.070	0.073	0.069	0.059	0.062	0.059	0.060	Yes
Bad Lands, SD	0.067	0.063	0.069	0.071	0.064	0.053	0.055	0.058	0.055	Yes
Black Hawk	ND	ND	ND	ND	0.053	0.060	0.058	0.057	0.058	Yes
Agate Fossil Beds [d]	ND	ND	ND	ND	0.066	0.067	0.062	ND	0.066	--

[a] The design value is the 3-year average of the 4th highest maximum for each year. The 4th highest 8-hour average is used to evaluate compliance with the ozone standard.
[b] NAAQS = 0.075 ppm (8-hour average). Standard promulgated 3/27/2008.The EPA has proposed new standards for ozone that are expected to lower the standards to between 60 and 70 ppb (action is currently pending).
[c] Attainment status is for the current standard of 0.075 ppm.
[d] The ozone monitor at the Agate Fossil beds operated by the National park Service does not generate data acceptable for determinations of NAAQS compliance (for general reference only)
ND = No data

Table 3.6-26 Prevention of Significant Deterioration (PSD) of Air Quality Allowable Increments

Table 3.6-26 Prevention of Significant Deterioration (PSD) of Air Quality Allowable Increments

Pollutant	Averaging Time	PSD Increment ug/m_3	
		Class I	Class II
Particulate Matter (PM_{10})	24-Hour Maximum	8	30
	Annual Arithmetic Mean	4	17
Sulfur Dioxide (SO^2)	24-Hour Maximum	5	91
	3-Hour Maximum	25	512
	Annual Arithmetic Mean	2	20
Nitrogen Dioxide (NO^2)	Annual Arithmetic Mean	2.5	25

Table 3.9-1 Scenic Quality Inventory and Evaluation for the Marsland Expansion Area

Table 3.9-1 Scenic Quality Inventory and Evaluation for the Marsland Expansion Area

Key Factor	Rating Criteria	Score
Landform	Flat to rolling terrain with no interesting landscape features	1
Vegetation	Some variety of vegetation; cropland, range, riparian	3
Water	Water is present, but not evident as viewed from residences and roads	0
Color	Some variety in colors and contrasts with vegetation and soil.	3
Influence of adjacent scenery	Low influence due to lack of topographical relief and similar adjacent scenery	1
Scarcity	Landscape is common for the region	1
Cultural modifications	Existing modifications are agricultural, and introduce no discordant elements.	0
	Total Score	9

Table 3.9-2 Determining BLM Visual Resource Inventory Classes

Table 3.9-2 Determining BLM Visual Resource Inventory Classes

Visual Sensitivity		High			Medium			Low
Special Areas		I	I	I	I	I	I	I
Scenic Quality	A	II	II	II	II	II	II	II
	B	II	III	III/IV	III	IV	IV	IV
	C	III	IV	IV	IV	IV	IV	IV
Distance Zones		f/m	b	ss	f/m	b	ss	ss

f/m = foreground-middleground
b = background
ss = seldom seen

Table 3.10-1 Historical and Current Population Change for Counties and Cities within 80 Km of Marsland Expansion Area 1970-2010

Table 3.10-1 Historical and Current Population Change for Counties and Cities within 80 Km of Marsland Expansion Area 1970-2010

State County City	Population					Average Annual Percent Change			
	1970	1980	1990	2000	2010	1970/ 1980	1980/ 1990	1990/ 2000	2000/ 2010
Nebraska									
Dawes County	**9,761**	**9,609**	**9,021**	**9,060**	**9,182**	**-1.6%**	**-6.1%**	**0.4%**	**1.3%**
Chadron	5,921	5,933	5,588	5,634	5,851	0.2%	-5.8%	0.8%	3.9%
Crawford	1,291	1,315	1,115	1,107	997	1.9%	-15.2%	-0.7%	-9.9%
Fort Robinson	NA	NA	NA	NA	NA	NA	NA	NA	NA
Marsland	17	27	NA	NA	NA	58.8%	NA	NA	NA
Whitney	82	72	38	87	77	-12.2%	-47.2%	128.9%	-11.5%
Box Butte County	**10,094**	**13,696**	**13,130**	**12,158**	**11,308**	**35.7%**	**-4.1%**	**-7.4%**	**-7.0%**
Alliance	6,862	9,869	9,765	8,959	8,491	43.8%	-1.1%	-8.3%	-5.2%
Berea	NA	NA	NA	NA	41	NA	NA	NA	NA
Hemingford	734	1,023	953	993	803	39.4%	-6.8%	4.2%	-19.1%
Garden County	**2,929**	**2,802**	**2,460**	**2,292**	**2,057**	**-4.3%**	**-12.2%**	**-6.8%**	**-10.3%**
Morrill County	**5,813**	**6,085**	**5,423**	**5,440**	**5,042**	**4.7%**	**-10.9%**	**0.3%**	**-7.3%**
Scotts Bluff County	**36,432**	**38,344**	**36,025**	**36,951**	**36,970**	**5.2%**	**-6.0%**	**2.6%**	**0.1%**
Minatare	939	969	807	810	816	3.2%	-16.7%	0.4%	0.7%
Mintle	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mitchell	1,842	1,956	1,743	1,831	1,702	6.2%	-10.9%	5.0%	-7.0%
Scottsbluff	14,507	14,156	13,711	14,732	15,039	-2.4%	-3.1%	7.4%	2.1%
Sheridan County	**7,285**	**7,544**	**6,750**	**6,198**	**5,469**	**3.6%**	**-10.5%**	**-8.2%**	**-11.8%**
Clinton	NA	NA	NA	30	41	NA	NA	NA	36.7%
Hay Springs	682	794	693	652	570	16.4%	-12.7%	-5.9%	-12.6%
Pine Ridge	NA	NA	16	14	NA	NA	NA	-12.5%	NA
Rushville	1,137	1,217	1,127	999	890	7.0%	-7.4%	-11.4%	-10.9%
Sioux County	**2,034**	**1,845**	**1,549**	**1,475**	**1,311**	**-9.3%**	**-16.0%**	**-4.8%**	**-11.1%**
Harrison	377	361	241	279	251	-4.2%	-33.2%	15.8%	-10.0%

Table 3.10-1 Historical and Current Population Change for Counties and Cities within 80 Km of Marsland Expansion Area 1970-2010

State County City	Population					Average Annual Percent Change			
	1970	1980	1990	2000	2010	1970/ 1980	1980/ 1990	1990/ 2000	2000/ 2010
South Dakota									
Fall River County	**7,505**	**8,439**	**7,353**	**7,453**	**7,044**	**12.4%**	**-12.9%**	**1.4%**	**-5.5%**
Hot Springs	4,434	4,742	4,325	4,129	3,711	6.9%	-8.8%	-4.5%	-10.1%
Oelrichs	94	124	138	145	126	31.9%	11.3%	5.1%	-13.1%
Rumford	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ardmore	14	16	NA	NA	NA	14.3%	NA	NA	NA
Shannon County	**8,198**	**11,323**	**9,902**	**12,466**	**13,586**	**38.1%**	**-12.5%**	**25.9%**	**9.0%**
Wyoming									
Goshen County	**10,885**	**12,040**	**12,373**	**12,538**	**13,249**	**10.6%**	**2.8%**	**1.3%**	**5.7%**
Niobrara County	**2,924**	**2,924**	**2,499**	**2,407**	**2,484**	**0.0%**	**-14.5%**	**-3.7%**	**3.2%**
Van Tassell	21	10	8	19	15	-52.4%	-20.0%	137.5%	-21.1%

[1] 1980 was the last year that Ardmore had a recorded population.
Sources: USBC 2011

Table 3.10-2 Population by Age and Sex for Counties within the 80-Km Radius of the Marsland Expansion Area 2010

Table 3.10-2 Population by Age and Sex for Counties within the 80-Km Radius of the Marsland Expansion Area 2010

County	Age	Male	Female	Total	Total Percent Breakdown
Nebraska					
Box Butte	Under 18	1433	1416	2849	25.2%
	18 - 64	3395	3351	6746	59.7%
	65+	713	1000	1713	15.1%
	Total	5541	5767	11308	100.0%
Dawes	Under 18	906	860	1766	19.2%
	18 - 64	2999	2917	5916	64.4%
	65+	654	846	1500	16.3%
	Total	4559	4623	9182	100.0%
Morrill	Under 18	615	595	1210	24.0%
	18 - 64	1462	1389	2851	56.5%
	65+	440	541	981	19.5%
	Total	2517	2525	5042	100.0%
Scotts Bluff	Under 18	4637	4515	9152	25.1%
	18 - 64	10574	11029	21603	59.2%
	65+	2602	3613	6215	17.0%
	Total	17813	18657	36470	100.0%
Sheridan	Under 18	661	632	1293	23.6%
	18 - 64	1473	1491	2964	54.2%
	65+	520	692	1212	22.2%
	Total	2654	2815	5469	100.0%
Sioux	Under 18	159	134	293	22.3%
	18 - 64	384	354	738	56.3%
	65+	130	150	280	21.4%
	Total	673	638	1311	100.0%
South Dakota					
Fall River	Under 18	706	628	1334	18.8%
	18 - 64	2106	2016	4122	58.1%
	65+	291	1347	1638	23.1%
	Total	3603	3491	7094	100.0%
Shannon	Under 18	2737	2605	5342	39.3%
	18 - 64	3636	3809	7445	54.8%
	65+	328	471	799	5.9%
	Total	6701	6885	13586	100.0%
Wyoming					
Goshen	Under 18	1411	1290	2701	20.4%
	18 - 64	4340	3708	8048	60.7%
	65+	1155	1345	2500	18.9%
	Total	6906	6343	13249	100.0%
Niobrara	Under 18	259	211	470	18.9%
	18 - 64	665	836	1501	60.4%
	65+	235	278	513	20.7%
	Total	1159	1325	2484	100.0%

Source: USCB 2009a

Table 3.10-3 Population Projections for Counties within an 80-Km Radius of the Current Crow Butte Project Area 2000-2020

Table 3.10-3 Population Projections for Counties within an 80-Km Radius of the Current Crow Butte Project Area 2000-2020

County	Census 2000	Census 2010	Projected 2020	Projected 2025	Projected 2030
Box Butte	12,158	11,308	9,588	8,827	8,050
Dawes	9,060	9,182	8,646	8,451	8,207
Garden	2,292	2,057	1,737	1,664	1,595
Morrill	5,423	5,042	4,886	4,761	4,625
Scotts Bluff	36,025	36,970	35,627	35,148	34,647
Sheridan	6,198	5,469	5,261	5,170	5,086
Sioux	1,475	1,311	1,271	1,189	1,103
Fall River	7,453	7,094	NA	NA	NA
Shannon	12,466	13,586	NA	NA	NA
Goshen	12,538	13,249	11,820	11,790	11,800
Niobrara	2,407	2,484	2,330	2,330	2,240

N/A No projection available
Sources: University of Nebraska-Lincoln, Bureau of Business Research 2009.
Wyoming Department of Administration and Information 2010.

Table 3.10-4 2010 Population within an 80-Km Radius of the Marsland Expansion Area

Table 3.10-4 2010 Population within an 80-Km Radius of the Marsland Expansion Area

	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	Total
N	0	0	0	1	1	525	37	58	73	107	137	162	183	1,284
NNE	0	0	0	1	1	327	44	63	88	113	137	169	289	1,232
NE	0	0	0	1	1	7	33	60	249	233	134	133	682	1,533
ENE	0	0	0	1	1	7	29	48	679	5100	138	159	437	6,599
E	0	0	0	1	1	7	29	48	70	103	282	733	247	1,521
ESE	0	0	0	1	1	7	29	48	68	114	187	128	63	646
SE	0	0	0	1	1	7	29	58	161	242	262	471	8230	9,462
SSE	0	0	0	1	1	7	29	111	188	211	158	185	640	1,531
S	0	0	0	1	1	7	29	88	128	136	133	193	875	1,591
SSW	0	0	0	1	1	6	15	21	29	62	97	115	1083	1,430
SW	0	0	0	1	1	3	13	21	29	41	69	103	315	596
WSW	0	0	0	0	0	3	13	21	29	38	58	85	98	345
W	0	0	0	0	0	3	13	21	29	38	52	62	72	290
WNW	0	0	0	0	0	3	13	21	29	38	33	32	37	206
NW	0	0	0	1	1	3	13	21	29	38	60	89	66	321
NNW	0	0	0	1	11	270	17	21	29	65	133	153	168	868
Total	0	0	0	13	23	1,192	385	792	1,907	6,679	2,070	2,972	13,485	29,455

Notes:
[a] Current population living between 10 and 80 km of the mine site were estimated using 2010 Census data. See Section 2.3.1 for a detailed description of the methodology.

Table 3.10-5 Annual Average Labor Force and Employment Economic Sectors for Dawes and Box Butte Counties 1994 and 2009

Table 3.10-5 Annual Average Labor Force and Employment Economic Sectors for Dawes and Box Butte Counties 1994 and 2009

Sectors	Dawes		Box Butte	
	1994	**2009**	**1994**	**2009**
Labor Force	4,490	4,788	6,156	5,821
Unemployment	149	210	235	397
Unemployment Rate	3.3	4.4	3.8	6.8
Employment	4,341	4,578	5,921	5,424
Farm Employment	862	877	763	213
Non-Farm Employment Total	3,479	3,701	5,446	5,315
Manufacturing	165	13	402	N/A
Construction and Mining	136	228	80	126
Transportation, Communication, and Utilities	N/A	N/A	1,909	2,305
Retail	824	673	840	429
Wholesale	128	87	265	298
Financial, Insurance, and Real Estate	77	123	215	168
Information	N/A	46	N/A	103
Professional and Business Services	N/A	N/A	N/A	170
Education and Health Services	N/A	449	N/A	428
Leisure and Hospitality	N/A	507	N/A	433
Other Services	N/A	119	N/A	145
Government	1,384	1,000	955	1,095
Federal	144	124	65	61
State	721	297	67	75
Local	519	579	824	960

N/A = not available
Sources: NDOL 2010

Table 3.10-6 Population and Demographics for Census Blocks Overlain or Adjacent to the MEA with Populations Recorded in 2010 Census

Table 3.10-6 Population and Demographics for Census Blocks Overlain or Adjacent to the MEA with Populations Recorded in 2010 Census

Population	Nebraska	Percent of Nebraska Pop.	Dawes County	Percent of Dawes County Pop.	Block Group 3, Census Tract 9506, Dawes County									
					Block 3332	% of Block 3332	Block 3446	% of Block 3446	Block 3457	% of Block 3457	Block 3572	% of Block 3572	Block 3573	% of Block 3573
Total Population	1,826,341	100.0%	9,182	100.0%	19	100%	1	100%	1	100%	3	100%	8	100%
White alone	1,572,838	86.1	8,208	89.4	19	100%	1	100%	1	100%	3	100%	8	100%
Black or African American	82,885	4.5	134	1.5	0	0%	0	0%	0	0%	0	0%	0	0%
American Indian and Alaska Native	18,427	1.0	362	3.9	0	0%	0	0%	0	0%	0	0%	0	0%
Asian alone	32,293	1.8	95	1.0	0	0%	0	0%	0	0%	0	0%	0	0%
Native Hawaiian and Other Pacific Islander	1,279	0.1	46	0.5	0	0%	0	0%	0	0%	0	0%	0	0%
Some other race	79,109	4.3	104	1.1	0	0%	0	0%	0	0%	0	0%	0	0%
Two or more races	39,510	2.2	233	2.5	0	0%	0	0%	0	0%	0	0%	0	0%
Hispanic or Latino	167,405	9.2	306	3.3	1	5.3%	0	0%	0	0%	0	0%	0	0%
Percent below poverty level:[+]	12.2%	-	20.4%	-	-	-	-	-	-	-	-	-	-	-

* data for Block Group only
+ USCB 2009b [SAIPE data for 2009 (SAPIE = Small Area Income and Poverty Estimates]
Source: USCB 2011

Table 3.11-1 Crow Butte Resources Excursion Summary

Table 3.11-1 Crow Butte Resources Excursion Summary

Monitor Well ID	Date On Excursion	Date Off Excursion	Causal Factor(s)
SM4-5	January 25, 1995	March 9, 1995	Poor Well Development
SM4-2	April 2, 1995	March 13, 1996	Poor Well Development
SM4-7	December 27, 1995	March 13, 1996	Poor Well Development
I-196	March 29, 1996	August 19, 1999	Casing Leak
I-752	November 8, 1996	May 7, 1997	Casing Leak
SM6-26	March 19, 1998	No record available	High Water Table
CM6-6	July 1, 1999	September 23, 1999	Excursion of mining solutions
I-567	September 20, 1999	October 12, 1999	Casing Leak
PR-15	January 13, 2000	March 23, 2000	Mine Unit 1 interior monitor well affected by adjacent groundwater restoration (unrelated to mining activities)
SM6-18	March 6, 2000	April 11, 2001	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
IJ-13	April 20, 2000	July 20, 2000	Mine Unit 1 interior monitor well affected by adjacent groundwater restoration (unrelated to mining activities)
SM7-23	April 27, 2000	January 13, 2004	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM6-28	May 25, 2000	June 22, 2000	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM6-13	May 25, 2000	July 20, 2000	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM6-12	September 8, 2000	November 2, 2000	Surface leak
SM6-13	March 1, 2001	April 12, 2001	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM7-23	December 4, 2001	January 9, 2004	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
CM5-11	September 10, 2002	June 3, 2003	Excursion of mining solutions
CM6-7	April 4, 2002	April 25, 2002	Excursion of mining solutions
PR-8	December 23, 2003	July 27, 2010	Mine Unit 1 interior monitor well affected by adjacent groundwater restoration (unrelated to mining activities)
CM5-19	May 2, 2005	July 26, 2005	Excursion of mining solutions
SM6-28	June 16, 2005	July 5, 2005	High water table due to heavy spring rains (unrelated to mining activities)
SM6-12	June 27, 2005	July 26, 2005	High water table due to heavy spring rains (unrelated to mining activities)
CM9-16	August 4, 2005	November 8, 2005	Excursion of mining solutions
CM8-21	January 18, 2006	April 4, 2006	Excursion of mining solutions
PR-15	September 26, 2006	February 4, 2011	See IJ-13 and PR-8
CM9-5	May 15, 2008	June 24, 2008	Excursion of mining solutions
CM9-3	May 30, 2008	July 15, 2008	Excursion of mining solutions
SM6-20	April 27, 2009	August 25, 2009	Excursion of mining solutions
CM9-4	June 11, 2009	July 21, 2009	Excursion of mining solutions
SM6-20	March 16, 2010	July 26, 2011	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM8-6	April 12, 2010	August 31, 2010	Natural fluctuation of shallow groundwater

Table 3.11-1 Crow Butte Resources Excursion Summary

Monitor Well ID	Date On Excursion	Date Off Excursion	Causal Factor(s)
			quality (unrelated to mining activities)
SM6-23	June 16, 2010	July 29, 2010	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM6-28	June 16, 2010	July 29, 2010	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM8-28	June 16, 2010	July 29, 2010	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM6-21	June 22, 2010	August 10, 2010	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM8-5	June 22, 2010	August 3, 2010	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
CM8-12	July 8, 2010	August 19, 2010	Excursion of mining solutions
CM-8	March 15, 2011	June 28, 2011	Excursion of mining solutions
SM6-20	May 23, 2011	July 26, 2011	Excursion of mining solutions
SM8-6	May 24, 2011	August 23, 2011	Excursion of mining solutions
SM6-28	May 26, 2011	July 20, 2011	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM8-28	May 26, 2011	July 20, 2011	Excursion of mining solutions
IJ13P	October 4, 2011	February 24, 2012	Excursion of mining solutions

Table 3.12-1 Deep Disposal Well No. 1 Injection Radiological Data for Crow Butte Central Processing Facility (2008 - 2012)

Table 3.12-1 Deep Disposal Well No. 1 Injection Radiological Data for Crow Butte Central Processing Facility (2008 - 2012)

Month	Total Gallons Injected	Average Natural Uranium (mg/l)[a]	Total Natural Uranium Injected (mg)	Total Natural Uranium Injected (uCi)	Average Radium-226 (uCi/l)[a]	Total Radium-226 Injected (uCi/l)
January 2012	7,785,326	4	1.18E+08	7.98E+04	857	2.53E+04
February 2012	6,463,164	5	1.22E+08	8.28E+04	1,030	2.52E+04
March 2012	7,498,767	8	2.27E+08	1.54E+05	773	2.19E+04
April 2012	6,285,700	5	1.19E+08	8.05E+04	723	1.72E+04
May 2012	6,986,706	5	1.32E+08	8.95E+04	795	2.10E+04
June 2012	6,369,456	9	2.17E+08	1.47E+05	713	1.72E+04
Semiannual Totals	**41,389,119**	**--**	**9.35E+08**	**6.33E+05**	**--**	**1.28E+05**
July 2012	5,615,358	2	4.25E+07	2.88E+04	593	1.26E+04
August 2012	5,290,499	4	8.01E+07	5.42E+04	568	1.14E+04
September 2012	4,598,394	4	6.96E+07	4.71E+04	712	1.24E+04
October 2012	5,688,878	3	6.46E+07	4.37E+04	794	1.71E+04
November 2012	6,458,651	5	1.22E+08	8.28E+04	1,110	2.71E+04
December 20122	8,157,401	4	124E=08	8.36E+04	828	2.56E+04
Semiannual Totals	**35,809,181**	**--**	**5.03E+08**	**3.40E+05**	**--**	**1.06E+05**
January 2011	7,114,952	11	2.96E+08	2.01E+05	893	2.41E+04
February 2011	6,385,945	7	1.69E+08	1.15E+05	668	1.61E+04
March 2011	7,617,730	6	1.73E+08	1.17E+05	579	1.67E+04
April 2011	7,170,161	5	1.36E+08	9.19E+04	969	2.63E+04
May 2011	7,759,529	6	1.76E+08	1.19E+05	721	2.12E+04
June 2011	8,271,982	8	2.50E+08	1.70E+05	766	2.40E+04
Semiannual Totals	**44,320,299**	**--**	**1.20E+09**	**8.13E+05**	**--**	**1.28E+05**
July 2011	8,399,906	5	1.59E+08	1.08E+05	645	2.05E+04
August 2011	8,561,281	7	2.27E+08	1.54E+05	906	2.94E+04
September 2011	8,408,541	7	2.23E+08	1.51E+05	779	2.48E+04
October 2011	7,720,546	6	1.75E+08	1.19E+05	769	2.25E+04

Table 3.12-1 Deep Disposal Well No. 1 Injection Radiological Data for Crow Butte Central Processing Facility (2008 - 2012)

Month	Total Gallons Injected	Average Natural Uranium (mg/l)[a]	Total Natural Uranium Injected (mg)	Total Natural Uranium Injected (uCi)	Average Radium-226 (uCi/l)[a]	Total Radium-226 Injected (uCi/l)
November 2011	7,982,590	7	2.12E+08	1.43E+05	875	2.64E+04
December 2011	7,542,422	6	1.71E+08	1.16E+05	1,100	3.14E+04
Semiannual Totals	**44,615,286**	**--**	**1.17E+09**	**7.90E+05**	**--**	**1.55E+05**
January 2010	6,934,560	5	1.31E+08	8.89E+04	946	2.48E+04
February 2010	6,582,075	6	1.49E+08	1.01E+05	1,400	3.49E+04
March 2010	7,419,844	7	1.97+08	1.33E+05	1,170	3.29E+04
April 2010	7,129,607	8	2.16E+08	1.46E+05	1,490	4.02E+04
May 2010	7,103,123	7	1.88E+08	1.27E+05	1,660	4.46E+04
June 2010	6,914,870	9	2.36E+08	1.59E+05	1,420	3.72E+04
Semiannual Totals	**42,084,079**	**--**	**1.12E+09**	**7.56E+05**	**--**	**2.15E+05**
July 2010	6,827,844	12	3.10E+08	2.01E+05	1,600	4.14E+04
August 2010	7,485,430	11	3.12E+08	2.11E+05	876	2.48E+04
September 2010	6,979,672	9	2.38E+08	1.61E+05	851	2.25E+04
October 2010	7,360,919	9	2.51E+08	1.70E+05	964	2.69E+04
November 2010	6,484,832	10	2.45E+08	1.66E+05	1,470	3.61E+04
December 2010	6,838,592	14	3.62E+08	2.45E+05	931	2.41E+04
Semiannual Totals	**41,977,289**	**--**	**1.72E+09**	**1.16E+06**	**--**	**1.76E+05**
January 2009	4,656,906	5	8.81E+07	5.97E+04	707	1.25E+04
February 2009	4,208,406	3	4.78E+07	3.24E+04	752	1.20E+04
March 2009	3,849,464	3	4.37E+07	2.96E+04	656	9.56E+03
April 2009	3,761,898	5	7.12E+07	4.82E+04	686	9.77E+03
May 2009	4,821,589	4	7.30E+07	4.94E+04	892	1.63E+04
June 2009	5,634,712	4	8.53E+07	5.78E+04	1,000	2.13E+04
Semiannual Totals	**26,932,975**	**--**	**4.09E+08**	**2.77E+05**	**--**	**8.14E+04**

Table 3.12-1 Deep Disposal Well No. 1 Injection Radiological Data for Crow Butte Central Processing Facility (2008 - 2012)

Month	Total Gallons Injected	Average Natural Uranium (mg/l)[a]	Total Natural Uranium Injected (mg)	Total Natural Uranium Injected (uCi)	Average Radium-226 (uCi/l)[a]	Total Radium-226 Injected (uCi/l)
July 2009	5,467,407	3	6.21E+07	4.20E+04	1,120	2.32E+04
August 2009	5,519,131	6	1.25E+08	8.49E+04	991	2.07E+04
September 2009	5,418,568	5	1.03E+08	6.94E+04	652	1.34E+04
October 2009	5,791,232	4	8.77E+07	5.94E+04	866	1.90E+04
November 2009	6,060,190	6	1.38E+08	9.32E+04	1,090	2.50E+04
December 2009	6,730,245	7	1.78E+08	1.21E+05	1,250	3.18E+04
Semiannual Totals	**34,986,773**	**--**	**6.94E+08**	**4.70E+05**	**--**	**1.33E+05**
January 2008	5,132,667	3	5.83E+07	3.95E+04	669	1.30E+04
February 2008	3,388,598	4	5.13E+07	3.47E+04	751	9.63E+03
March 2008	2,565,135	5	4.85E+07	3.29E+04	795	7.72E+03
April 2008	3,724,924	3	4.23E+07	2.86E+04	818	1.15E+04
May 2008	3,650,359	4	5.53E+07	3.74E+04	818	1.13E+04
June 2008	3,946,776	3	4.48E+07	3.03E+04	739	1.10E+04
Semiannual Totals	**22,408,459**	**--**	**3.01E+08**	**2.03E+05**	**--**	**6.42 E+04**
July 2008	4,051,240	4	6.13E+07	4.15E+04	698	1.07E+04
August 2008	4,664,934	5	8.83E+07	5.98E+04	775	1.37E+04
September 2008	4,823,374	6	1.10E+08	7.42E+04	753	1.37E+04
October 2008	5,202,468	5	9,85E+07	6.67E+04	693	1.36E+04
November 2008	4,823,009	4	7.30E+07	4.94E+04	763	1.39E+04
December 2008	4,553,541	6	1.03E+08	7.00E+04	741	1.28E+04
Semiannual Totals	**28,118,566**	**--**	**5.34E+08**	**3.62E+05**	**--**	**7.85E+04**

[a] Maximum deep well injection limits: ra-226 – 5,000 uCi/l; U-Natural – 25 mg/l

Table 3.12-2 Deep Disposal Well No. 2 Injection Radiological Data for Crow Butte Central Processing Facility (2012)

Table 3.12-2 Deep Disposal Well No. 2 Injection Radiological Data for Crow Butte Central Processing Facility (2012)

Month	Total Gallons Injected	Average Natural Uranium (mg/l)[a]	Total Natural Uranium Injected (mg)	Total Natural Uranium Injected (uCi)	Average Radium-226 (uCi/l)[a]	Total Radium-226 Injected (uCi/l)
January 2012	884,393	1	3.35E+06	2.27E+03	861	2.88E+03
February 2012	1,387,183	1	5.25E+06	3.55E+03	929	4.88E+03
March 2012	1,967,755	2	1.49E+07	1.01E+04	732	5.45E+03
April 2012	2,000,692	1	7.57E=06	5.13E+03	810	6.13E+03
May 2012	1,615,176	1	6.11E+06	4.14E+03	965	5.90E+03
June 2012	1,891,017	2	1.43E+07	9.69E+03	878	6.28E+03
Semiannual Totals	**9,746,216**	**--**	**5.15E+07**	**3.49E+04**	**--**	**3.15E+04**
July 2012	1,873,150	1	7.09E+06	4.80E+03	895	6.35E+03
August 2012	1,859,679	1	7.04E+06	4.77E+03	836	5.88E+03
September 2012	1,779,184	1	6.73E+06	4.56E+03	896	6.03E+03
October 2012	1,823,402	1	6.90E+06	4.67E+03	894	6.17E+03
November 2012	1,758,934	2	1.33E+07	9.02E+03	824	5.49E+03
December 2012	1,773,377	2	1.34E+07	9.09E+03	1,370	9.20E+03
Semiannual Totals	**10,867,726**	**--**	**5.45E+07**	**3.69E+04**	**--**	**3.91E+04**

[a] Maximum deep well injection limits: ra-226 – 5,000 uCi/l; U-Natural – 25 mg/l

Table 3.12-3 Deep Disposal Well Injection Non-radiological Data for Current Crow Butte Operations 2012

Table 3.12-3 Deep Disposal Wells Injection Non-Radiological Data for Current Crow Butte Operations for 2012

Parameter	Annual Composite Results		Maximum Injection Level
	mg/l[a]		
	Annual Average	Range	
DDW #1			
Sodium	3,180	1,334 – 6,506	40,000
Calcium	104	91 – 148	Report Only
Sulfate	1,406	933 – 1,930	10,000
Chloride	3.148	558 – 8,243	40,000
Vanadium	4.0	1.0 – 9.0	100
Alkalinity	1,623	1,400 – 2,300	4,100
pH (std. units)	8.22	7.83 – 8.51	5.0 – 9.5
Arsenic	0.1	<0.1 – 0.2	5
Barium	<0.1	<0.1 – <0.1	100
Cadmium	<0.1	<0.1 – <0.1	1
Chromium	<0.5	<0.5 – <0.5	5
Lead	<0.5	<0.5 – <0.5	5
Mercury	<0.0001	<0.0001 – <0.0001	0.2
Selenium	<0.1	<0.1 – <0.1	1
Silver	<0.5	<0.5 – <0.5	5
Total Gallons Injected: 77,193,300			
DDW #2			
Sodium	1,487	1,392 – 1,582	40,000
Calcium	83	76 – 88	Report Only
Sulfate	995	952 – 1,034	10,000
Chloride	697	565 – 877	40,000
Vanadium	1.7	1 – 2	100
Alkalinity	1,482	1,412 – 1,650	4,100
pH (std. units)	8.06	7.94 – 8.2	5.0 – 9.5
Arsenic	<0.1	<0.1 - <0.1	5
Barium	<0.1	<0.1 - <0.1	100
Cadmium	<0.1	<0.1 - <0.1	1
Chromium	<0.5	<0.5 - <0.5	5
Lead	<0.5	<0.5 - <0.5	5
Mercury	<0.0001	<0.0001 - <0.0001	0.2
Selenium	0.25	0.2 – 0.4	1
Silver	<0.5	<0.5 - <0.5	5
Total Gallons Injected: 20,613,942			

[a] mg/l unless noted otherwise.

Note: Reporting data based on 12 monthly samples (January – December 2012) for Deep Disposal Well No. 1 and 2.

Table 3.12-4 Disposal Water Balance for Marsland Expansion Area

Table 3.12-4
Disposal Water Balance (Marsland Expansion Area)
Crow Butte Resources, Inc.
Crawford, NE

Year	2015				2016				2017				2018			
Elapsed Time (Quarters)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Prod Flow	1100	1700	2100	2100	2100	2700	3400	3600	3500	3900	4500	4700	4500	4800	5300	5400
Prod Bleed 1.2%	13	20	25	25	25	32	41	43	42	47	54	56	54	58	64	65
MU1 IX Bleed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU1 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU2 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU3 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU4 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU5 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU6 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU7 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU8 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU9 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU10 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU11 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total disposal capacity needed (gpm)	13	20	25	25	25	32	41	43	42	47	54	56	54	58	64	65
Production bleed capacity needed (gpm)	13	20	25	25	25	32	41	43	42	47	54	56	54	58	64	65
Restoration capacity needed (gpm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total disposal capacity needed (gpm)	**13**	**20**	**25**	**25**	**25**	**32**	**41**	**43**	**42**	**47**	**54**	**56**	**54**	**58**	**64**	**65**
Disposal Option(s)	DDW1	DDW1	DDW1	DDW1	DDW1	DDW1	DDW1	DDW1	DDW1	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)
Surge tank storage capacity (hr)*	126	82	66	66	66	51	41	39	40	36	31	30	31	29	26	26

Notes:
(1) Additional deep disposal wells will be installed as needed
Assumed start date = 1Q 2015
*Capacity assumed to be 100,000 gallons, flow into tanks not to exceed 45 gpm
gpm - gallons per minute
hr - hours
DD1 - Deep Disposal Well 1
DD2 - Deep Disposal Well 2
Assumed sustainable DDW injection rates = 45 gpm

Table 3.12-4
Disposal Water Balance (Marsland Expansion Area)
Crow Butte Resources, Inc.
Crawford, NE

Year	2019				2020				2021			
Elapsed Time (Quarters)	17	18	19	20	21	22	23	24	25	26	27	28
Prod Flow	5100	5300	5300	5300	4500	4500	4200	4100	4100	4600	4500	4300
Prod Bleed 1.2%	61	64	64	64	54	54	50	49	49	55	54	52
MU1 IX Bleed	0	0	0	0	0	16	16	16	4	0	0	0
MU1 RO Bleed	0	0	0	0	0	0	0	0	167	167	167	167
MU2 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU3 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU4 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU5 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU6 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU7 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU8 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU9 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU10 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU11 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
Total disposal capacity needed (gpm)	61	64	64	64	54	70	66	65	220	222	221	218
Production bleed capacity needed (gpm)	61	64	64	64	54	54	50	49	49	55	54	52
Restoration capacity needed (gpm)	0	0	0	0	0	16	16	16	170.667	167	166.667	166.667
Total disposal capacity needed (gpm)	**61**	**64**	**64**	**64**	**54**	**70**	**66**	**65**	**220**	**222**	**221**	**218**
Disposal Option(s)	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]
Surge tank storage capacity (hr)*	27	26	26	26	31	24	25	26	8	8	8	8

Notes:
(1) Additional deep disposal wells will be installed as needed
Assumed start date = 1Q 2015
*Capacity assumed to be 100,000 gallons, flow into tanks not to exceed 45 gpm
gpm - gallons per minute
hr - hours
DD1 - Deep Disposal Well 1
DD2 - Deep Disposal Well 2
Assumed sustainable DDW injection rates = 45 gpm

Table 3.12-4
Disposal Water Balance (Marsland Expansion Area)
Crow Butte Resources, Inc.
Crawford, NE

Year	2022				2023				2024			
Elapsed Time (Quarters)	29	30	31	32	33	34	35	36	37	38	39	40
Prod Flow	4300	4800	4800	4500	4500	5000	5100	4800	4800	5300	5400	5100
Prod Bleed 1.2%	52	58	58	54	54	60	61	58	58	64	65	61
MU1 IX Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU1 RO Bleed	167	167	167	167	167	0	0	0	0	0	0	0
MU2 RO Bleed	83	83	83	83	83	167	167	167	167	167	167	167
MU3 RO Bleed	0	0	0	0	0	83	83	83	83	83	83	83
MU4 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU5 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU6 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU7 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU8 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU9 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU10 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU11 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
Total disposal capacity needed (gpm)	302	308	308	304	304	310	311	308	308	314	315	311
Production bleed capacity needed (gpm)	52	58	58	54	54	60	61	58	58	64	65	61
Restoration capacity needed (gpm)	250	250	250	250	250	250	250	250	250	250	250	250
Total disposal capacity needed (gpm)	**302**	**308**	**308**	**304**	**304**	**310**	**311**	**308**	**308**	**314**	**315**	**311**
Disposal Option(s)	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]
Surge tank storage capacity (hr)*	6	5	5	5	5	5	5	5	5	5	5	5

Notes:
(1) Additional deep disposal wells will be installed as needed
Assumed start date = 1Q 2015
*Capacity assumed to be 100,000 gallons, flow into tanks not to exceed 45 gpm
gpm - gallons per minute
hr - hours
DD1 - Deep Disposal Well 1
DD2 - Deep Disposal Well 2
Assumed sustainable DDW injection rates = 45 gpm

Table 3.12-4
Disposal Water Balance (Marsland Expansion Area)
Crow Butte Resources, Inc.
Crawford, NE

Year	2025				2026				2027			
Elapsed Time (Quarters)	41	42	43	44	45	46	47	48	49	50	51	52
Prod Flow	5300	5300	5200	4700	4300	3700	3900	3600	3400	3700	3900	3500
Prod Bleed 1.2%	64	64	62	56	52	44	47	43	41	44	47	42
MU1 IX Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU1 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU2 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU3 RO Bleed	167	167	167	167	167	167	0	0	0	0	0	0
MU4 RO Bleed	83	83	83	83	83	83	167	167	167	167	167	167
MU5 RO Bleed	0	0	0	0	0	0	83	83	83	83	83	83
MU6 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU7 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU8 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU9 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU10 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU11 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
Total disposal capacity needed (gpm)	314	314	312	306	302	294	297	293	291	294	297	292
Production bleed capacity needed (gpm)	64	64	62	56	52	44	47	43	41	44	47	42
Restoration capacity needed (gpm)	250	250	250	250	250	250	250	250	250	250	250	250
Total disposal capacity needed (gpm)	**314**	**314**	**312**	**306**	**302**	**294**	**297**	**293**	**291**	**294**	**297**	**292**
Disposal Option(s)	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]
Surge tank storage capacity (hr)*	5	5	5	5	6	6	6	6	6	6	6	6

Notes:
(1) Additional deep disposal wells will be installed as needed
Assumed start date = 1Q 2015
*Capacity assumed to be 100,000 gallons, flow into tanks not to exceed 45 gpm
gpm - gallons per minute
hr - hours
DD1 - Deep Disposal Well 1
DD2 - Deep Disposal Well 2
Assumed sustainable DDW injection rates = 45 gpm

Table 3.12-4
Disposal Water Balance (Marsland Expansion Area)
Crow Butte Resources, Inc.
Crawford, NE

Year	2028				2029				2030			
Elapsed Time (Quarters)	53	54	55	56	57	58	59	60	61	62	63	64
Prod Flow	3200	2900	2600	2400	2200	1800	1600	1500	1400	1300	1200	900
Prod Bleed 1.2%	38	35	31	29								
MU1 IX Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU1 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU2 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU3 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU4 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU5 RO Bleed	167	167	167	167	167	167	0	0	0	0	0	0
MU6 RO Bleed	83	83	83	83	83	83	167	167	167	167	167	167
MU7 RO Bleed	0	0	0	0	0	0	83	83	83	83	83	83
MU8 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU9 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU10 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU11 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
Total disposal capacity needed (gpm)	288	285	281	279	250	250	250	250	250	250	250	250
Production bleed capacity needed (gpm)	38	35	31	29	0	0	0	0	0	0	0	0
Restoration capacity needed (gpm)	250	250	250	250	250	250	250	250	250	250	250	250
Total disposal capacity needed (gpm)	**288**	**285**	**281**	**279**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**
Disposal Option(s)	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]
Surge tank storage capacity (hr)*	6	6	6	6	7	7	7	7	7	7	7	7

Notes:
(1) Additional deep disposal wells will be installed as needed
Assumed start date = 1Q 2015
*Capacity assumed to be 100,000 gallons, flow into tanks not to exceed 45 gpm
gpm - gallons per minute
hr - hours
DD1 - Deep Disposal Well 1
DD2 - Deep Disposal Well 2
Assumed sustainable DDW injection rates = 45 gpm

Table 3.12-4
Disposal Water Balance (Marsland Expansion Area)
Crow Butte Resources, Inc.
Crawford, NE

Year	2031				2032				2033			
Elapsed Time (Quarters)	65	66	67	68	69	70	71	72	73	74	75	76
Prod Flow	800	700	600	500	400	200	200	200	200	200	200	0
Prod Bleed 1.2%												
MU1 IX Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU1 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU2 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU3 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU4 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU5 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU6 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU7 RO Bleed	167	167	167	167	167	167	0	0	0	0	0	0
MU8 RO Bleed	83	83	83	83	83	83	167	167	167	167	167	167
MU9 RO Bleed	0	0	0	0	0	0	83	83	83	83	83	83
MU10 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU11 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
Total disposal capacity needed (gpm)	250	250	250	250	250	250	250	250	250	250	250	250
Production bleed capacity needed (gpm)	0	0	0	0	0	0	0	0	0	0	0	0
Restoration capacity needed (gpm)	250	250	250	250	250	250	250	250	250	250	250	250
Total disposal capacity needed (gpm)	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**
Disposal Option(s)	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]
Surge tank storage capacity (hr)*	7	7	7	7	7	7	7	7	7	7	7	7

Notes:
(1) Additional deep disposal wells will be installed as needed
Assumed start date = 1Q 2015
*Capacity assumed to be 100,000 gallons, flow into tanks not to exceed 45 gpm
gpm - gallons per minute
hr - hours
DD1 - Deep Disposal Well 1
DD2 - Deep Disposal Well 2
Assumed sustainable DDW injection rates = 45 gpm

Table 3.12-4
Disposal Water Balance (Marsland Expansion Area)
Crow Butte Resources, Inc.
Crawford, NE

Year	2034				2035				2036			
Elapsed Time (Quarters)	77	78	79	80	81	82	83	84	85	86	87	88
Prod Flow	0	0	0	0	0	0	0	0	0	0	0	0
Prod Bleed 1.2%												
MU1 IX Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU1 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU2 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU3 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU4 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU5 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU6 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU7 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU8 RO Bleed	0	0	0	0	0	0	0	0	0	0	0	0
MU9 RO Bleed	167	167	167	167	167	167	0	0	0	0	0	0
MU10 RO Bleed	83	83	83	83	83	83	167	167	167	167	167	167
MU11 RO Bleed	0	0	0	0	0	0	83	83	83	83	83	83
Total disposal capacity needed (gpm)	250	250	250	250	250	250	250	250	250	250	250	250
Production bleed capacity needed (gpm)	0	0	0	0	0	0	0	0	0	0	0	0
Restoration capacity needed (gpm)	250	250	250	250	250	250	250	250	250	250	250	250
Total disposal capacity needed (gpm)	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**
Disposal Option(s)	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]	DDW1, DDW2[(1)]
Surge tank storage capacity (hr)*	7	7	7	7	7	7	7	7	7	7	7	7

Notes:
(1) Additional deep disposal wells will be installed as needed
Assumed start date = 1Q 2015
*Capacity assumed to be 100,000 gallons, flow into tanks not to exceed 45 gpm
gpm - gallons per minute
hr - hours
DD1 - Deep Disposal Well 1
DD2 - Deep Disposal Well 2
Assumed sustainable DDW injection rates = 45 gpm

Table 3.12-4
Disposal Water Balance (Marsland Expansion Area)
Crow Butte Resources, Inc.
Crawford, NE

Year	2037				2038				2039	
Elapsed Time (Quarters)	89	90	91	92	93	94	95	96	97	98
Prod Flow	0	0	0	0	0	0	0	0	0	0
Prod Bleed 1.2%										
MU1 IX Bleed	0	0	0	0	0	0	0	0	0	0
MU1 RO Bleed	0	0	0	0	0	0	0	0	0	0
MU2 RO Bleed	0	0	0	0	0	0	0	0	0	0
MU3 RO Bleed	0	0	0	0	0	0	0	0	0	0
MU4 RO Bleed	0	0	0	0	0	0	0	0	0	0
MU5 RO Bleed	0	0	0	0	0	0	0	0	0	0
MU6 RO Bleed	0	0	0	0	0	0	0	0	0	0
MU7 RO Bleed	0	0	0	0	0	0	0	0	0	0
MU8 RO Bleed	0	0	0	0	0	0	0	0	0	0
MU9 RO Bleed	0	0	0	0	0	0	0	0	0	0
MU10 RO Bleed	0	0	0	0	0	0	0	0	0	0
MU11 RO Bleed	250	250	250	250	0	0	0	0	0	0
Total disposal capacity needed (gpm)	250	250	250	250	0	0	0	0	0	0
Production bleed capacity needed (gpm)	0	0	0	0	0	0	0	0	0	0
Restoration capacity needed (gpm)	250	250	250	250	0	0	0	0	0	0
Total disposal capacity needed (gpm)	**250**	**250**	**250**	**250**	**0**	**0**	**0**	**0**	**0**	**0**
Disposal Option(s)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	--	--	--	--	--	--
Surge tank storage capacity (hr)*	7	7	7	7	--	--	--	--	--	--

Notes:
(1) Additional deep disposal wells will be installed as needed
Assumed start date = 1Q 2015
*Capacity assumed to be 100,000 gallons, flow into tanks not to exceed 45 gpm
gpm - gallons per minute
hr - hours
DD1 - Deep Disposal Well 1
DD2 - Deep Disposal Well 2
Assumed sustainable DDW injection rates = 45 gpm

Figure 3.1-1 Marsland Expansion Area Land Use

K:\CBR_Projects\CO001636_Marsland\2_GIS\ArcMaps\0005_NRC_ER\ER Figure 3_1-1 Land Use.mxd - 3/21/2012 @ 10:58:36 PM

LEGEND

- Proposed Marsland Satellite Plant Centroid
- Compass Sector Boundary
- Proposed Marsland Expansion Area
- Area of Review
- Nebraska National Forest Boundary

Land Use*

- Cropland
- Drainage/Potential Wetland
- Forest Land
- Rangeland
- Recreational Land

* Land use data were interpreted from aerial image. The delineation of "Drainage/Potential Wetland" type also referenced NHD Flowlines and NWI Wetland Dataset.

N

0 2,250 4,500

Feet

PROJECTION: NAD1927, STATE PLANE NEBRASKA NORTH, FIPS 2601
SOURCES: USDA NAIP IMAGERY 2010

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FIGURE 3.1-1
MARSLAND EXPANSION AREA
LAND USE

PROJECT: CO001636 MAPPED BY: JC CHECKED BY: MS

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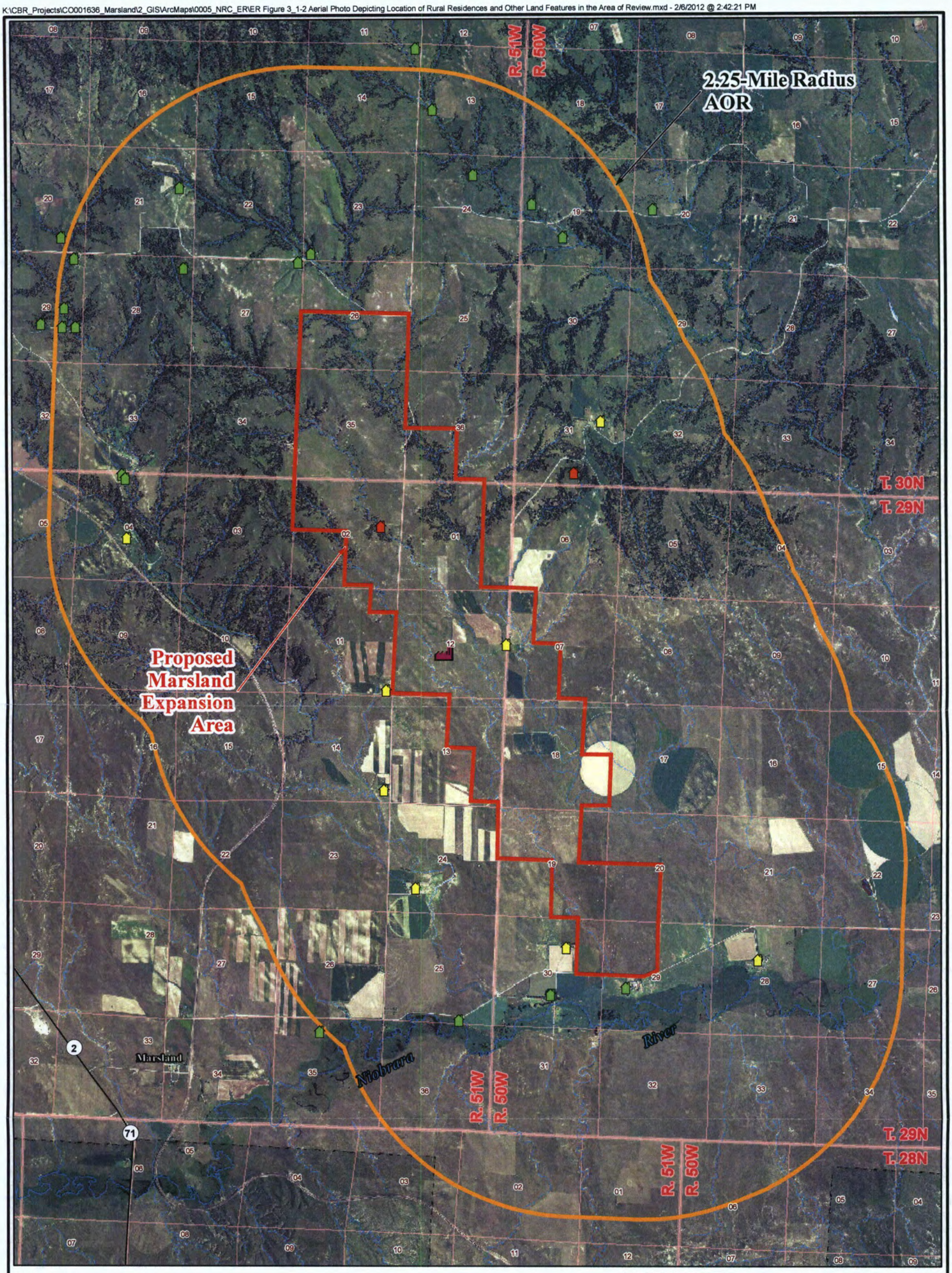
Figure 3.1-2 Aerial Photo Depicting Location of Rural Residences and Other Land Features in the Area of Review

K:\CBR_Projects\CO001636_Marsland\2_GIS\ArcMaps\0005_NRC_ER\ER Figure 3_1-2 Aerial Photo Depicting Location of Rural Residences and Other Land Features in the Area of Review.mxd - 2/6/2012 @ 2:42:21 PM



LEGEND

- Structure
- Satellite Plant
- Occupied Residence
- Unoccupied Residence
- Proposed Marsland Expansion Area
- Area of Review (AOR)
- Intermittent Stream/River
- Perennial Stream/River

N

0 3,000 6,000

Feet

PROJECTION: NAD1927, STATE PLANE NEBRASKA NORTH, FIPS 2601
SOURCES: USDA NAIP IMAGERY 2010

CROW BUTTE RESOURCES, INC.

FIGURE 3.1-2
AERIAL PHOTO DEPICTING LOCATION OF RURAL RESIDENCES AND OTHER LAND FEATURES IN THE AREA OF REVIEW

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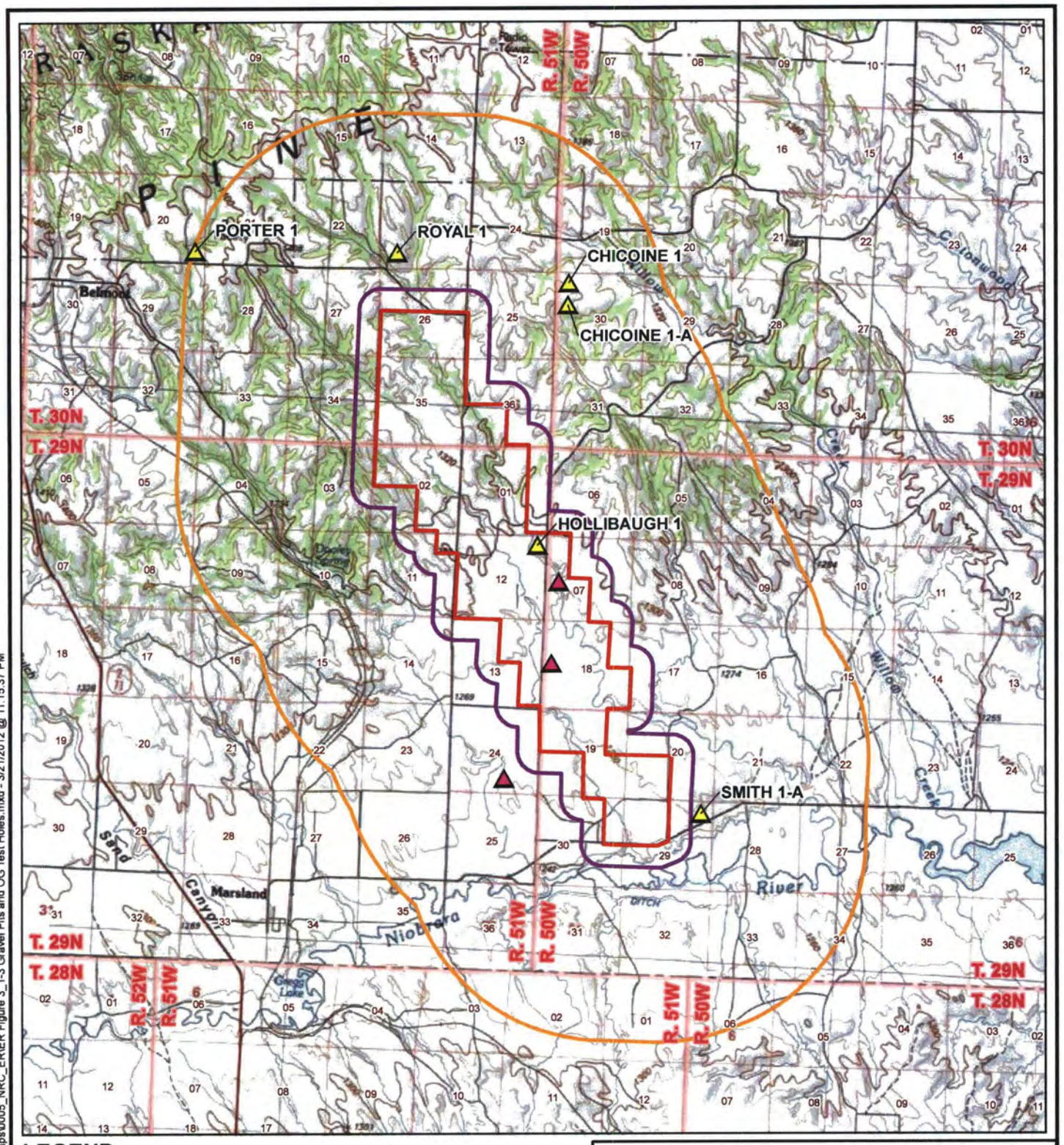
Figure 3.1-3 Marsland Expansion Area Location of Gravel Pits and Oil/Gas Test Holes



LEGEND

- Sand/Gravel Pit, Inactive
- Dry Hole, Dry and Abandoned
- Proposed Marsland Expansion Area
- ZOEI Boundary (1/4-mile fixed radius)
- AOR Boundary (2-mile fixed radius)

ZOEI = Zone of Endangering Influence
AOR = Area of Review

Sources for Sand/Gravel Pits

1. Dawes County, (http://dawes.assessor.gisworkshop.com/Assessor/index.jsp), Accessed on 08/03/2011, and
2. Burchett, R.R. 1971. Directory of Nebraska Quarries, Pits and Mines. Resource Report Number 5. University of Nebraska Conservation and Survey Division, Lincoln. March.

Sources for Oil/Gas Test Holes

Nebraska Oil and Gas Conservation Commission, (http://www.nogcc.ne.gov/NOGCCPublications.aspx), Accessed on 08/01/2011

N

0 4,000 8,000

Feet

PROJECTION: NAD 1927, STATE PLANE NEBRASKA NORTH, FIPS 2601
SOURCES: US TOPO MAPS, SERVICED BY ESRI ARCGIS ONLINE

CROW BUTTE RESOURCES, INC.

FIGURE 3.1-3
MARSLAND EXPANSION AREA
LOCATIONS OF GRAVEL PITS AND OIL/GAS TEST HOLES

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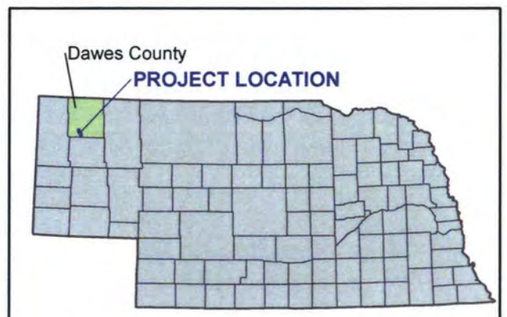
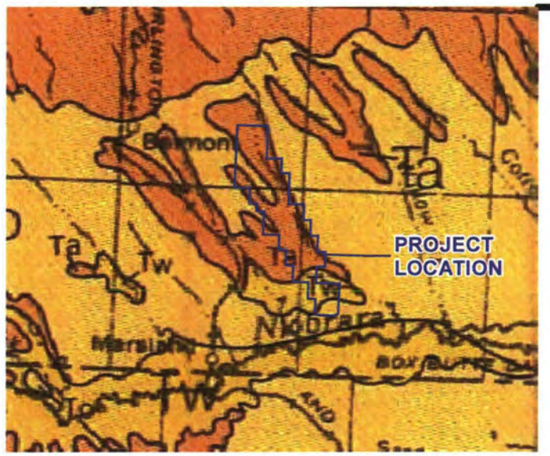
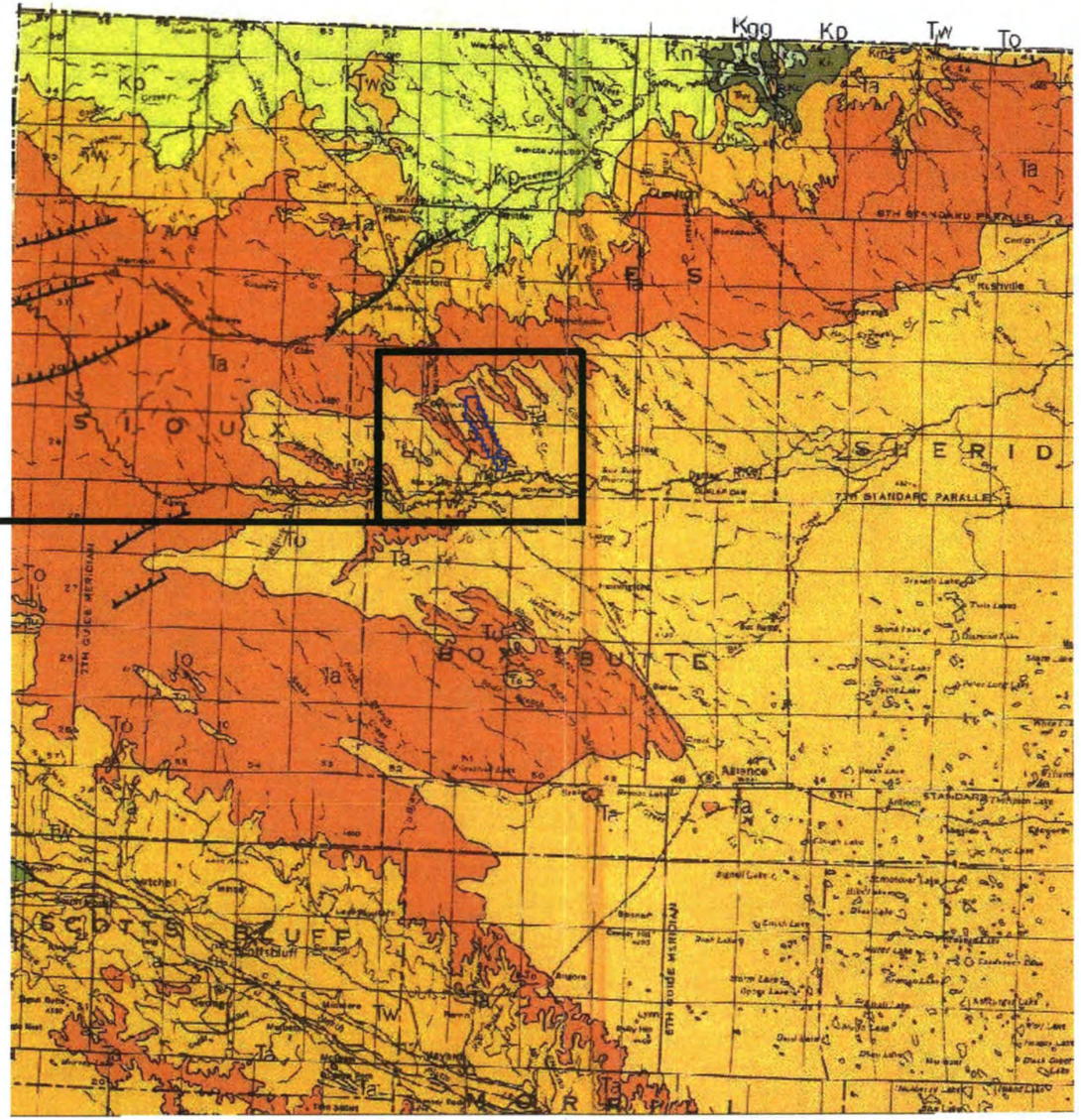
K:\CBR_Projects\CO001636_Marsland\2_GIS\ArcMaps\0005_NRC_ER\ER Figure 3_1-3 Gravel Pits and OG Test Holes.mxd - 3/21/2012 @ 11:15:37 PM

Figure 3.3-1 Bedrock Geology Map of the Three Crow Expansion Area





0 5 10
Miles



0 20 40
Miles

LEGEND

GEOLOGIC PERIOD	SERIES	GROUP OR FORMATION		
TERTIARY	MIOCENE		OGALLALA	To
			ARIKAREE	Ta
	OLIGOCENE		WHITE RIVER	Tw
CRETACEOUS	UPPER CRETACEOUS	MONTANA	Fox Hills	Kf
			Pierre	Kp
			Niobrara	Kn
		COLORADO	Carlile	Kc
			Greenhorn-Graneros	Kgg
	LOWER CRETACEOUS		DAKOTA	Kd
JURASSIC				
PERMIAN				
PENNSYLVANIAN	BIG BLUE		CHASE	Pc
			COUNCIL GROVE	Pcg
			ADMIRE	Pa
			WABAUNSEE	Pw
	VIRGIL		SHAWNEE	Ps
			DOUGLAS	Pd
	MISSOURI		LANSING	Pl
			KANSAS CITY	Pkc
	DES MOINES		MARMATON	Pm
MISSISSIPPIAN				
DEVONIAN				
SILURIAN				
ORDOVICIAN (Middle & Upper)				
CAMBRIAN & ORDOVICIAN (Lower)				
PRECAMBRIAN				

Source:
Burchett, R.R., 1986, Geologic bedrock map of Nebraska: University of Nebraska Conservation and Survey Division, Geologic Maps and Charts 1, scale 1:1000000.

N

PROJECTION: NAD 1927, STATE PLANE NEBRASKA NORTH FIPS 2601

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FIGURE 3.3-1
BEDROCK GEOLOGY OF THE MARSLAND EXPANSION AREA

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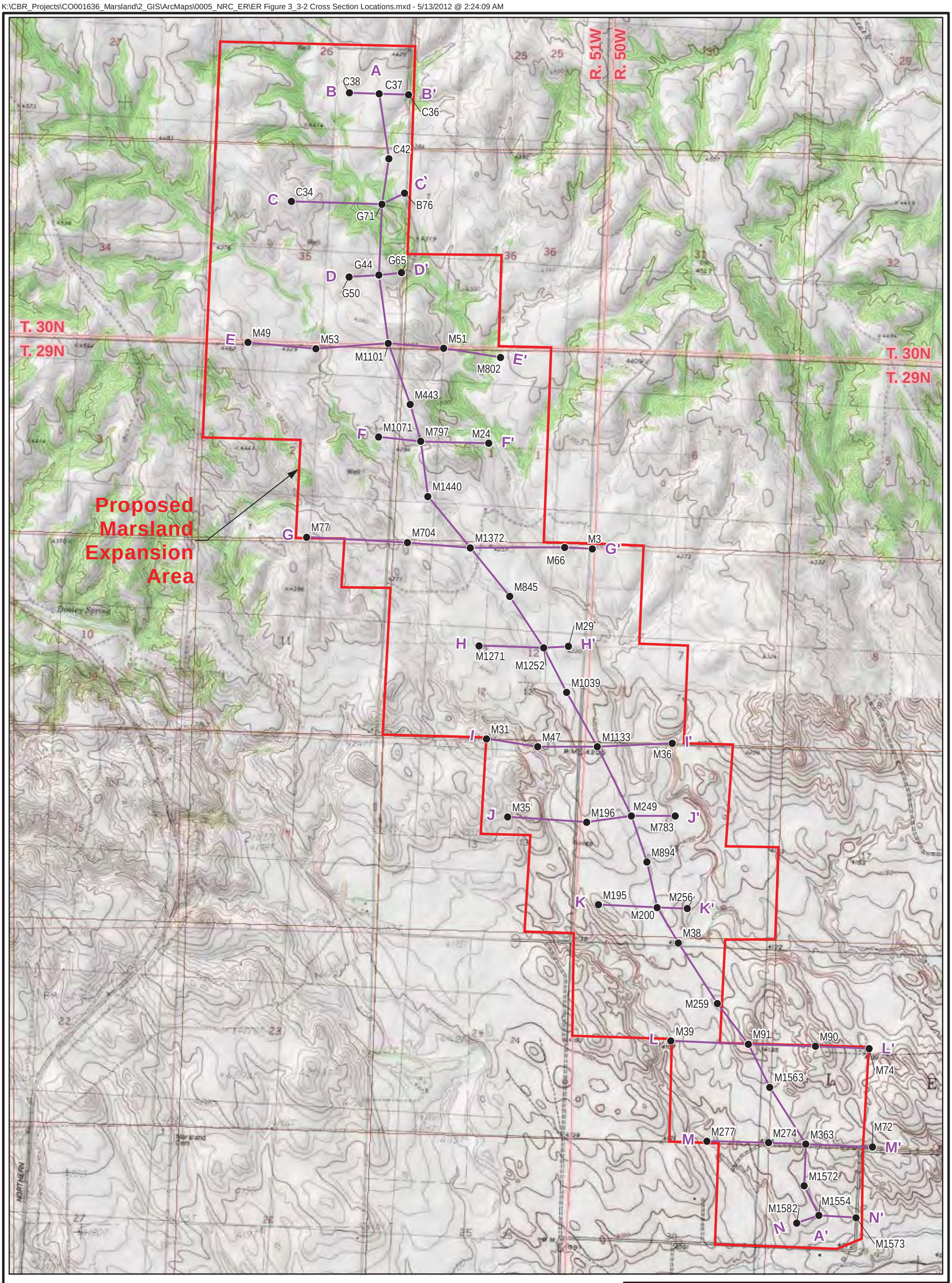
K:\CBR_Projects\CO001636_Marsland\2_GIS\Arc\Maps\0005_NRC_ERIER Figure 3_3-1 Bedrock Geology of the Marsland Expansion Area.mxd - 2/6/2012 @ 3:03:49 PM

Figure 3.3-2 Marsland Cross-Section Map Showing Artificial Penetrations

K:\CBR_Projects\CO001636_Marsland\2_GIS\ArcMaps\0005_NRC_ER\ER Figure 3_3-2 Cross Section Locations.mxd - 5/13/2012 @ 2:24:09 AM



LEGEND

- Borehole
- Cross Section Line
- Proposed Marsland Expansion Area

N

0 1,500 3,000

Feet

PROJECTION: NAD 1927, STATE PLANE NEBRASKA NORTH, FIPS 2601
SOURCES: US TOPO MAPS, SERVICED BY ESRI ARCGIS ONLINE

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FIGURE 3.3-2
MARSLAND CROSS-SECTION MAP SHOWING ARTIFICIAL PENETRATIONS

PROJECT: CO001636 MAPPED BY: JC CHECKED BY: JA

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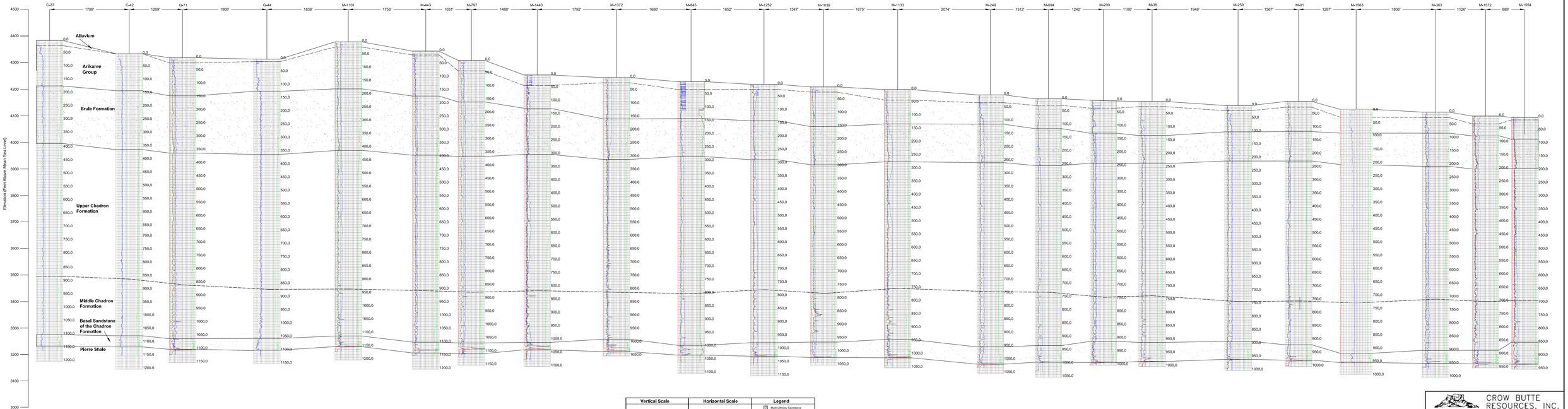
Figure 3.3-3a Marsland Structural Cross Section A – A'

A
North

A'
South



Vertical Scale	Horizontal Scale	Legend
0 50 meters 0 100 200 feet	0 150 meters 0 300 600 feet	Main Lithology Sandstone Gamma Curve Neutron or SP Curve Resistivity Curve

Source: Cameco Resources, 2013

CROW BUTTE RESOURCES, INC.

FIGURE 3.3-3a
MARSLAND CROSS-SECTION A-A'

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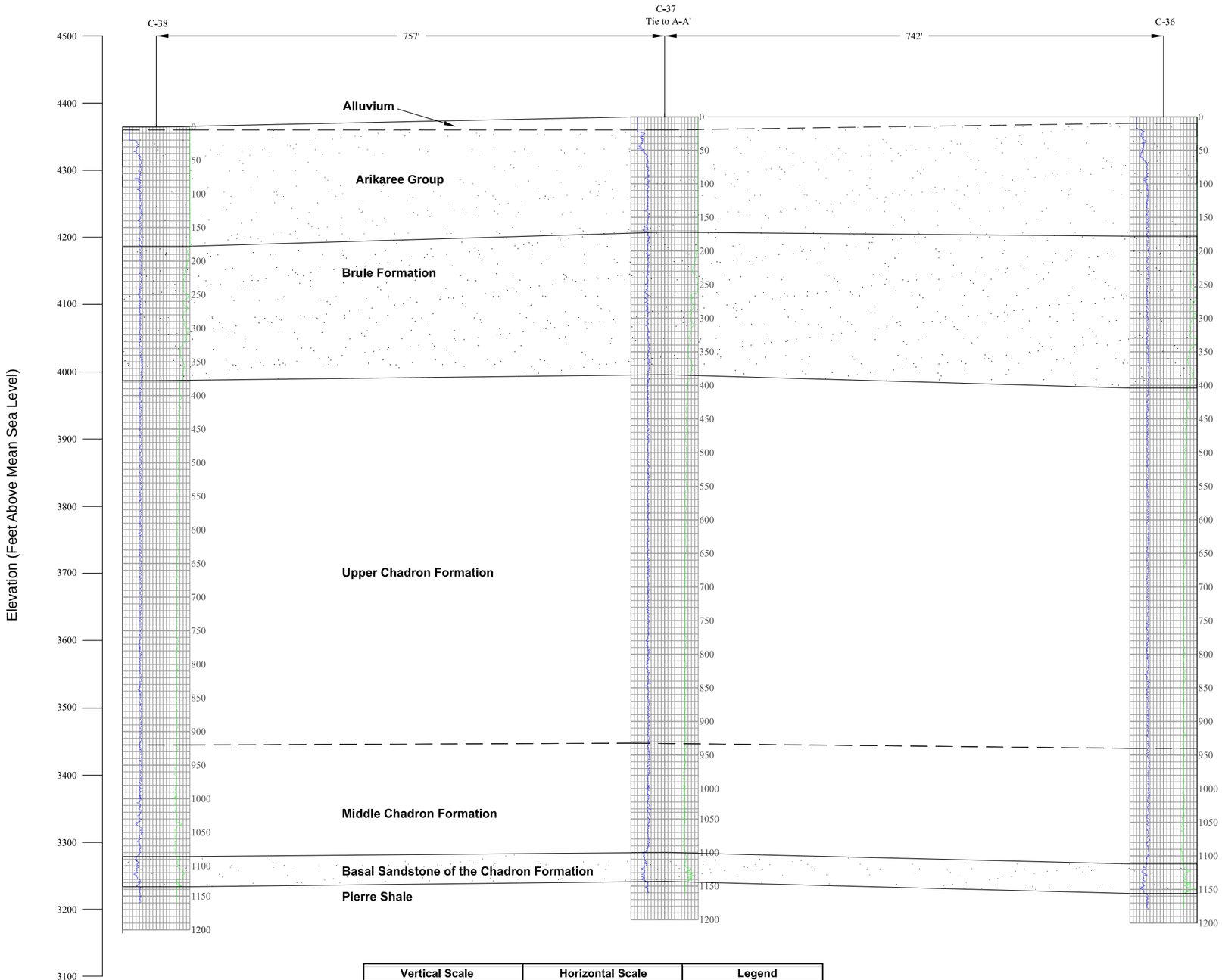
Figure 3.3-3b Marsland Structural Cross Section B – B'

B
West

B’
East



Vertical Scale	Horizontal Scale	Legend
0 50 meters 0 100 200 feet	0 50 meters 0 100 200 feet	Main Litholoy Sandstone Gamma Curve Neutron or SP Curve Resistivity Curve

Source: Cameco Resources, 2013

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FIGURE 3.3-3b
MARSLAND STRUCTURAL CROSS-SECTION B-B’

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PATH: K:\CBR_Projects\CO001636_Marsland\3_IMAGES\Illustrator\CrossSections\AEP_Figure 3-4b XS BB. ai @ 10/24/2013 SOURCE FILE: 1_ACAD\CrossSections_fromCameco_Oct2013\Figure E.1-3b_B-B'.dwg

Figure 3.3-3c Marsland Structural Cross Section C – C'

C
West

C'
East

C-34

G-71
Tie to A-A'

B-76

2772'

3006'

Elevation (Feet Above Mean Sea Level)

4500
4400
4300
4200
4100
4000
3900
3800
3700
3600
3500
3400
3300
3200
3100

Alluvium

Arikaree Group

Brule Formation

Upper Chadron Formation

Middle Chadron Formation

Basal Sandstone of the Chadron Formation

Pierre Shale

Vertical Scale	Horizontal Scale	Legend
0 50 meters 0 100 200 feet	0 100 meters 0 200 400 feet	Main Litholoy Sandstone Gamma Curve Neutron or SP Curve Resistivity Curve

Source: Cameco Resources, 2013

CROW BUTTE RESOURCES, INC.

FIGURE 3.3-3c
MARSLAND STRUCTURAL CROSS-SECTION C-C'

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PATH: K:CBR_Projects\CO001636_Marsland\3_IMAGES\Illustrator\CrossSections\AEP_Figure 3-4c XS CC. ai @ 10/24/2013 SOURCE FILE: 1_ACAD\CrossSections_fromCameco_Oct2013\Figure E.1-3c_C-C'.dwg

Figure 3.3-3d Marsland Structural Cross Section D – D'

D

West

D'

East

G-50

G-44

Tie to A-A'

G-65

804'

610'

Elevation (Feet Above Mean Sea Level)

4400
4300
4200
4100
4000
3900
3800
3700
3600
3500
3400
3300
3200

Alluvium

Arikaree Group

Brule Formation

Upper Chadron Formation

Middle Chadron Formation

Basal Sandstone of the Chadron Formation

Pierre Shale

Vertical Scale	Horizontal Scale	Legend
0 50 meters 0 100 200 feet	0 50 meters 0 100 200 feet	Main Lithology Sandstone Gamma Curve Neutron or SP Curve Resistivity Curve

Source: Cameco Resources, 2013

CROW BUTTE RESOURCES, INC.

FIGURE 3.3-3d
MARSLAND STRUCTURAL CROSS-SECTION D-D'

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PATH: K:\CBR_Projects\CO001636_Marsland\3_IMAGES\Illustrator\CrossSections\AEP_Figure 3-4d XS DD..ai @ 10/24/2013 SOURCE FILE: 1_ACAD\CrossSections_fromCameco_Oct2013\Figure E.1-3d D-D'.dwg

Figure 3.3-3e Marsland Structural Cross Section E – E'

E

West

E'

East

M-49 | 1547' | M-53 | 1496' | M-1101 Tie to A-A' | 1496' | M-51 | 1547' | M-802

Elevation (Feet Above Mean Sea Level)

Alluvium

Arikaree Group

Brule Formation

Upper Chadron Formation

Middle Chadron Formation

Basal Sandstone of the Chadron Formation

Pierre Shale

Vertical Scale	Horizontal Scale	Legend
0 50 meters 0 100 200 feet	0 150 meters 0 300 600 feet	Main Litholoy Sandstone Gamma Curve Neutron or SP Curve Resistivity Curve

Source: Cameco Resources, 2013

CROW BUTTE RESOURCES, INC.

FIGURE 3.3-3e
MARSLAND STRUCTURAL CROSS-SECTION E-E'

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PATH: K:CBR_Projects\CO001636_Marsland\3_IMAGES\Illustrator\CrossSections\AEP_Figure 3-4e XS EE .ai @ 10/24/2013 SOURCE FILE: 1_ACAD\CrossSections_fromCameco_Oct2013\Figure E.1-3de E-E'.dwg

Figure 3.3-3f Marsland Structural Cross Section F – F'

F

West

F'

East

M-1071

1142'

M-797
Tie to A-A'

1826'

M-24

Elevation (Feet Above Mean Sea Level)

4400
4300
4200
4100
4000
3900
3800
3700
3600
3500
3400
3300
3200
3100

Alluvium

Arikaree Group

Brule Formation

Upper Chadron Formation

Middle Chadron Formation

Basal Sandstone of the Chadron Formation

Pierre Shale

Vertical Scale	Horizontal Scale	Legend
0 50 meters 0 100 200 feet	0 50 meters 0 100 200 feet	Main Litholoy Sandstone Gamma Curve Neutron or SP Curve Resistivity Curve

Source: Cameco Resources, 2013

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FIGURE 3.3-3f
MARSLAND STRUCTURAL CROSS-SECTION F-F'

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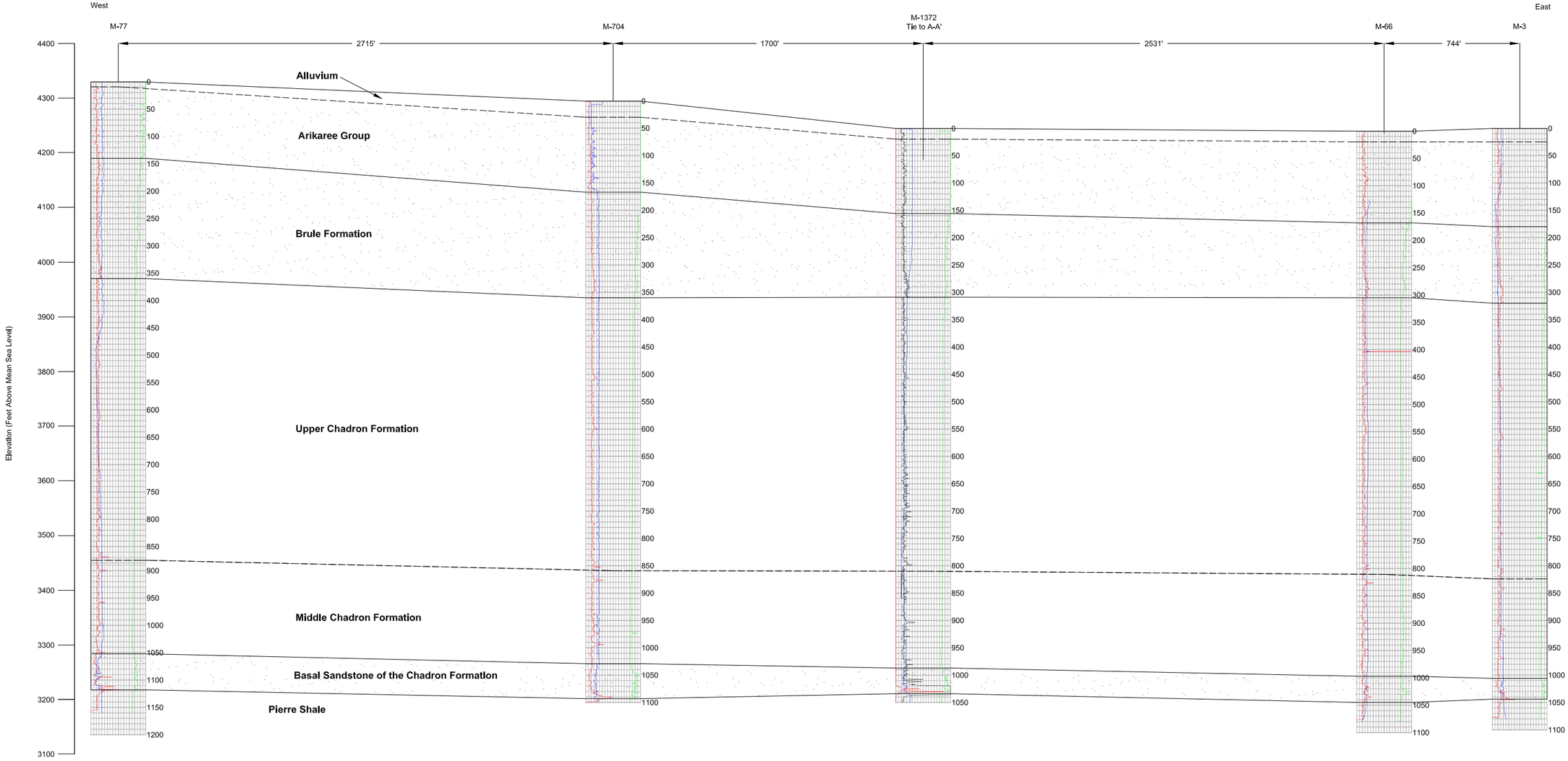
Figure 3.3-3g Marsland Structural Cross Section G – G'

G — G'

West — East



Vertical Scale	Horizontal Scale	Legend
0 — 50 meters 0 — 100 — 200 feet	0 — 150 meters 0 — 300 — 600 feet	Main Litholoy Sandstone Gamma Curve Neutron or SP Curve Resistivity Curve

Source: Cameco Resources, 2013

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FIGURE 3.3-3g
MARSLAND STRUCTURAL CROSS-SECTION G-G'

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Figure 3.3-3h Marsland Structural Cross Section H – H'