3.6.3.2 LCI Wells

There are seven existing or planned water supply wells and numerous monitor wells permitted and bonded by WSEO and WDEQ, respectively, to LCI and its affiliates. The existing and planned water supply wells and their completion horizons include:

- In the FG horizon, well LC1W would be used for dust suppression and drill water. An additional potable water well (not yet named) is planned for the FG also.
- Well LC28M is completed in the middle HJ horizon and would be used for drill water and dust suppression. The M horizon has three drill water and dust suppression wells completed in it; they are LC32W, LC229W and LC606W.
- The final on-site well for drill water and dust suppression is LC33W, which is completed in the N horizon.

The existing monitor wells include 27 wells that were used to establish baseline conditions in the Permit Area and 63 wells that were used for aquifer testing and water quality sampling for MU1. All of these wells are completed in the DE, FG, HJ, and KM Horizons.

Five deep UIC Class I wells are planned for injection of waste water from the Plant (**Section 2.1.4**), and one of the five was installed in the southwest portion of the Permit Area to obtain subsurface information to ensure the feasibility of this disposal option. The well was completed in the Fort Union Formation.

3.6.4 Groundwater Quality

This section summarizes the regional and Permit Area groundwater quality. The groundwater quality in the Permit Area is separated on the basis of: site-wide characteristics of the ore-bearing and associated aquifers; characteristics within MU1 in the ore-bearing and associated aquifers; and characteristics of the deeper formations evaluated for the UIC Class I wells.

3.6.4.1 Regional Groundwater Quality

Water quality within the Basin ranges from very poor to excellent. Groundwater in the near surface, more permeable aquifers is generally of better quality than groundwater in deeper and less permeable aquifers. Groundwater with TDS less than 3,000 mg/L can generally be found at depths less than 1,500 feet within the Tertiary aquifer system, which includes the Battle Spring/Wasatch, Fort Union and Lance aquifers (Collentine et al., 1981).

Water quality within the shallow Tertiary aquifers generally represents sodium-bicarbonate to sodium-sulfate water types. TDS levels within the Wasatch aquifer

in the west and south parts of the Basin tend to be high relative to the EPA's Secondary Drinking Water Standard (SDWS) of 500 mg/L, even at shallower depth. TDS levels within the Battle Spring/Wasatch aquifers are generally below 500 mg/L along the northern flank of the Basin (which includes the Permit Area). Elevated TDS levels (greater than 3,000 mg/L) are present within the Wasatch aquifer along the eastern edge of the Washakie Basin and within the Fort Union and Lance aquifers along the east side of the Rock Springs uplift. Elsewhere within the Great Divide and Washakie Basins, TDS levels in the Tertiary aquifer system are typically between 1,000 and 3,000 mg/L (Collentine et al., 1981).

Low-TDS waters within the Battle Spring aquifer are predominately sodium-bicarbonate type waters. With increasing salinity, the water type tends to become more calcium-sulfate dominated. However, this trend is not exhibited in the Wasatch, Fort Union and Lance aquifers within the Great Divide and Washakie Basins. The Wasatch and Lance aquifers are characterized by predominately sodium-sulfate type waters, particularly near outcrop areas. The Fort Union is more variable in composition.

Water quality within the Battle Spring aquifer is generally good in the northeast portion of the Basin, with TDS levels usually less than 1,000 mg/L and frequently less than 200 mg/L. The water type of the Battle Spring aquifer is typically sodium-bicarbonate to sodium-sulfate. Mason and Miller (2005) reviewed eighteen groundwater samples collected from the Battle Spring aquifer and observed that those samples represented some of the best overall quality of those studied in Sweetwater County. Sulfate levels can be elevated in Tertiary aquifers, but are generally low in the shallow aquifers of the Battle Spring Formation. Out of 18 samples included in the Mason and Miller (2005) study, only one sample exceeded the WDEQ Class I Drinking Water Standard for sulfate of 250 mg/L. Most of the samples were also below the WDEQ TDS Class I Drinking Water Standard of 500 mg/L. Nitrate, fluoride and arsenic levels were below WDEQ and EPA standards for all of the samples.

Notable exceptions to the relatively good water quality included waters with elevated radionuclides. Uranium and radium-226 (Ra-226) concentrations exceeded their respective EPA Maximum Contaminant Levels (MCLs) of 0.03 mg/L and 5 pCi/L in some samples; radon-222 (Rn-222) concentrations were also relatively high in some samples (Mason and Miller, 2005). The presence of high levels of uranium in Tertiary sediments and groundwater of the Basin has been well documented. The Lost Creek Shroeckingerite deposit located northwest of the Permit Area is noted for high uranium levels in groundwater. Uranium-bearing coals are also present in the Basin. Sediments of the Battle Spring Formation were derived from the Granite Mountains and contain from 0.0005 to 0.001 percent uranium (Masursky, 1962). Based on historical exploration results, certain areas of the Battle Spring Formation (e.g., Lost Creek) contain much higher uranium concentrations. The BLM Battle Spring Draw Well No. 4551 is an example of the higher radium and uranium concentrations (**Table 3.6-7**).

3.6.4.2 Site Groundwater Quality, Ore-Bearing and Associated Aquifers

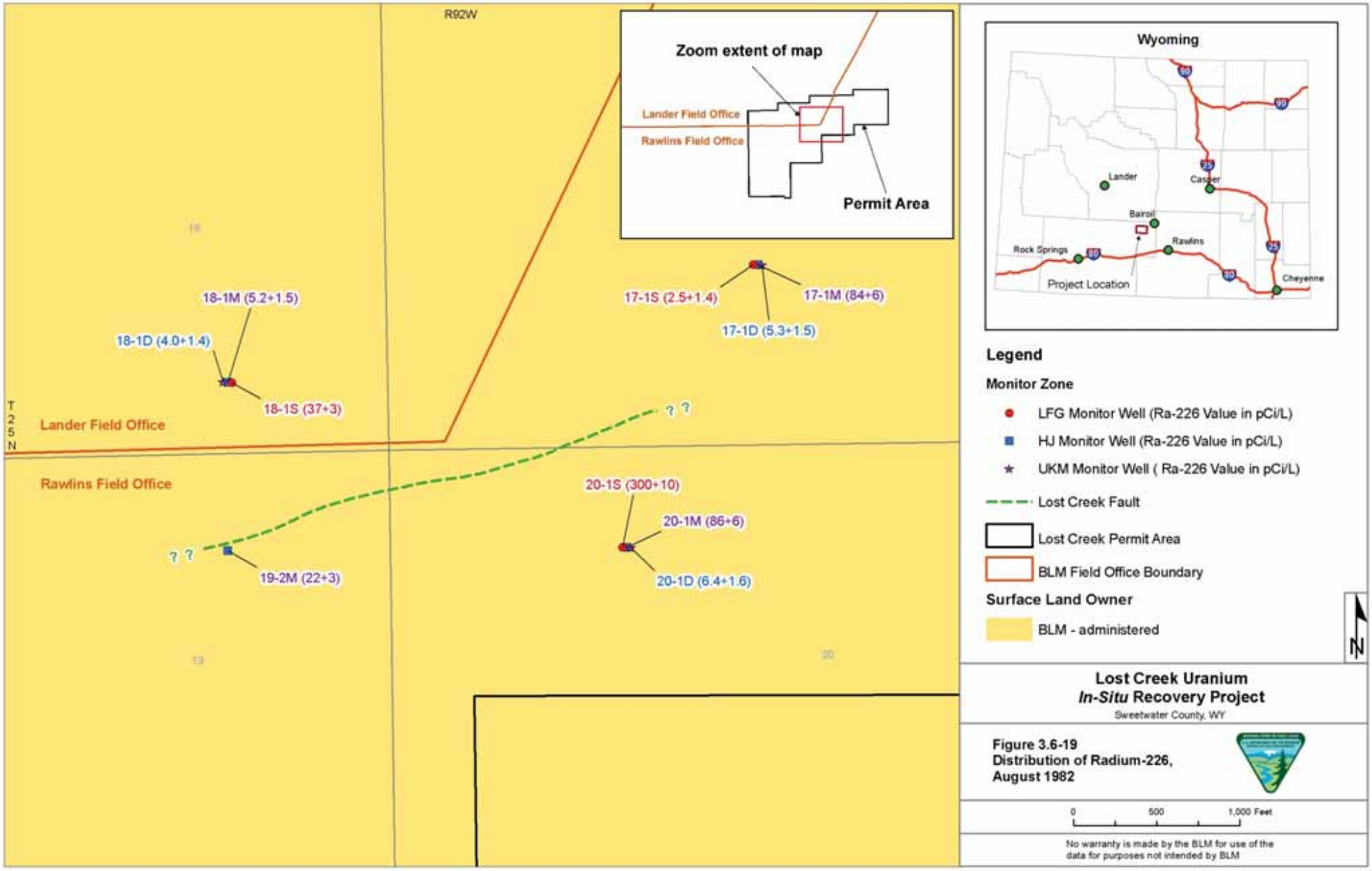
Information on the Permit Area groundwater quality is primarily derived from reconnaissance studies conducted by Conoco (Hydro-Search, Inc., 1982) and more detailed studies by LCI. The historical well locations were generally closer to the ore trend (**Figure 3.6-4**), while the wells installed by LCI include locations close to and well away from the ore trend.

Historical Data

Conoco installed 12 wells, separated into four groups, to evaluate aquifer properties and water quality of the uranium ore-bearing sands and overlying and underlying aquifers within the Permit Area. Three of the groups included wells completed within the HJ Horizon aquifer and the overlying (LFG) and underlying (UKM) aquifers. The fourth group included three wells completed within the HJ Horizon aquifer. The location of the wells is shown on **Figure 3.6-4**. These 12 wells were installed as part of a joint venture between Conoco and Texasgulf Inc. The twelve wells were abandoned as documented in a September 16, 1987 letter from Texasgulf Inc. to WSEO.

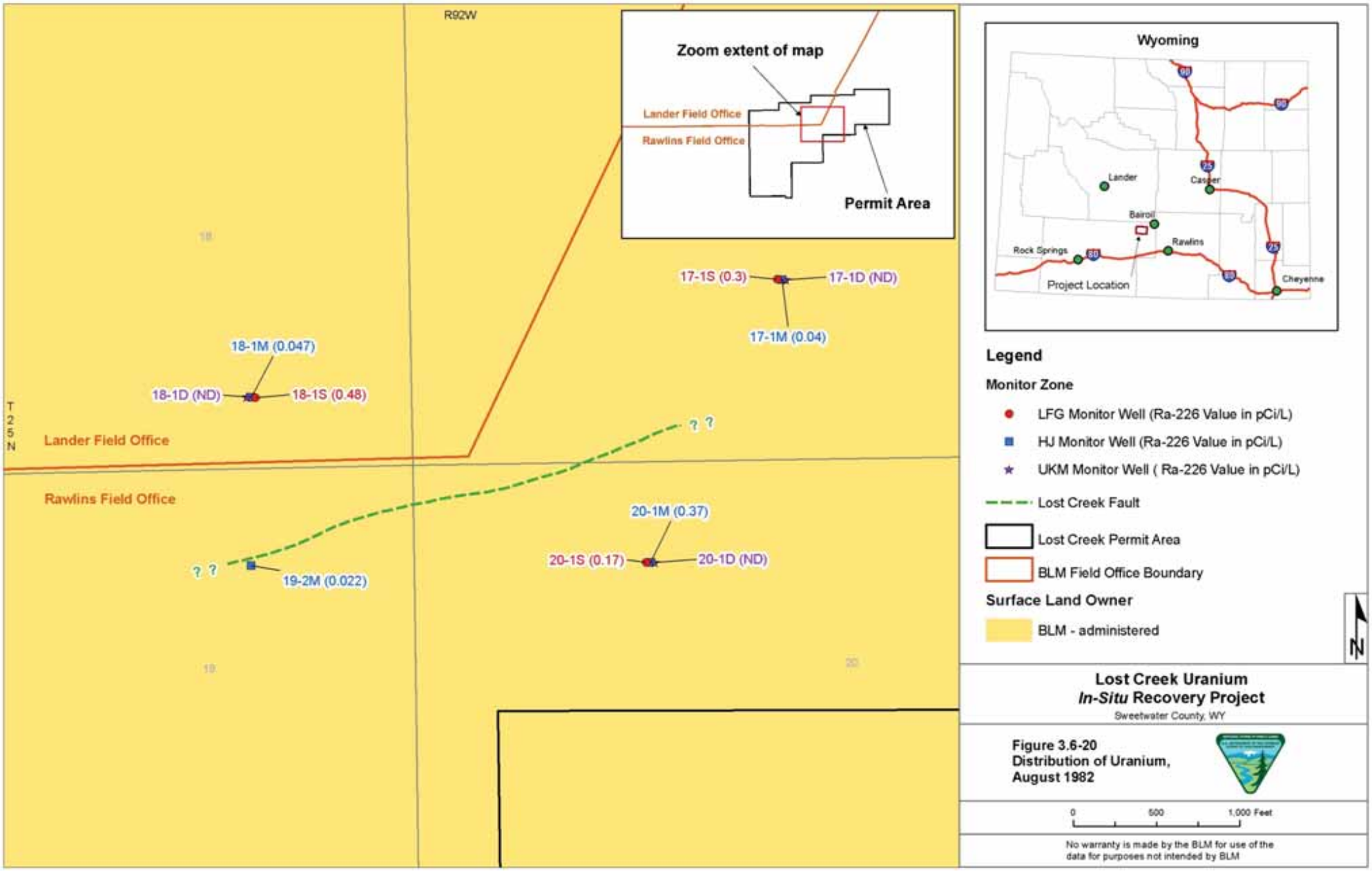
Ten of the 12 monitor wells installed by Conoco were sampled in August 1982. Hydro-Search, Inc. reported that there were no major differences in water quality between the HJ Horizon aquifer and the overlying and underlying aquifers (1982). The predominant ions were calcium and sulfate. TDS values were all below the WDEQ Class I Standard of 500 mg/L, ranging from 200 to 490 mg/L. The pH of the waters ranged from 7.1 to 8.5, indicating slightly alkaline conditions. Chloride levels were very low, ranging from seven to 18 mg/L.

Most trace constituents were below the detection limits. Selenium was present in two samples at 0.023 mg/L, which was above the WDEQ and EPA drinking water standards at that time (0.01 mg/L). The WDEQ Class I Standard and the EPA MCL are currently 0.05 mg/L. Ra-226 was detected in all of the samples, with a range of 2.5 to 300 pCi/L. Only two samples, one collected from the overlying aquifer and one from the underlying aquifer, were below the WDEQ Class I Standard and EPA MCL of 5.0 pCi/L for Ra-226 (**Figure 3.6-19**). Uranium levels ranged from below detection (less than 0.005 mg/L) to 0.48 mg/L. Six of the ten samples exceeded the current EPA MCL for uranium of 0.03 mg/L (**Figure 3.6-20**).



Lost Creek Uranium
***In-Situ* Recovery Project**
Sweetwater County, WY

Figure 3.6-19
Distribution of Radium-226, August 1982


R92W
T 25 N
Zoom extent of map
Lander Field Office
Rawlins Field Office
Permit Area
Wyoming
Lander
Casper
Bairoil
Rawlins
Rock Springs
Cheyenne
Project Location
17-1S (0.3)
17-1D (ND)
17-1M (0.04)
18-1M (0.047)
18-1D (ND)
18-1S (0.48)
Lander Field Office
Rawlins Field Office
? ?
20-1M (0.37)
20-1S (0.17)
20-1D (ND)
19-2M (0.022)
Legend
Monitor Zone
LFG Monitor Well (Ra-226 Value in pCi/L)
HJ Monitor Well (Ra-226 Value in pCi/L)
UKM Monitor Well (Ra-226 Value in pCi/L)
Lost Creek Fault
Lost Creek Permit Area
BLM Field Office Boundary
Surface Land Owner
BLM - administered
N
Lost Creek Uranium
In-Situ Recovery Project
Sweetwater County, WY
Figure 3.6-20
Distribution of Uranium,
August 1982
0
500
1,000 Feet
No warranty is made by the BLM for use of the data for purposes not intended by BLM

Current Data

LCI has conducted baseline sampling since September 2006. Per WDEQ-LQD requirements, at least four quarters of baseline data are required to determine variability and if there are any trends in the variability fluctuations (e.g., seasonal changes). The baseline sampling locations, which cover all portions of the Permit Area and are completed in different Sands, are shown in **Figure 3.6-4**, and the sampling results are summarized in **Table 3.6-8**. The raw laboratory data are presented in Attachment D6-4 of Appendix D6, of the WDEQ-LQD Permit to Mine (LCI, 2011b).

In **Table 3.6-8**, those analytical results which exceed specific WDEQ or EPA criteria are highlighted, and the WDEQ and EPA criteria used for the comparison are included in **Table 3.6-9**. The table shows that the WDEQ TDS Class I standard is exceeded at one well in each of the DE, HJ and UKM aquifers, Wells LC31M, LC26M, and LC23M, respectively. Twenty-two out of the 25 wells have TDS levels below the Class I Standard. Sulfate exceeds the WDEQ Class I Standard (250 mg/L) in one DE monitor well (LC31M) and one HJ monitor well (LC26M). As with the Conoco monitoring results, chloride values are low with all but five samples at 10 mg/L or lower.

Piper diagrams have been developed to compare groundwater quality between individual wells (**Figure 3.6-21**) and between different aquifers (**Figure 3.6-22**). The individual well comparison plots the average value for each of the wells for all of the samples analyzed. The Piper diagram comparing different aquifers represents the average water quality for all wells sampled within individual aquifers (DE, LFG, HJ and UKM). Groundwater within the shallow Battle Springs aquifers beneath the Permit Area is a calcium sulfate to calcium bicarbonate type water. There is some variability in water chemistry when the wells are compared individually.

With the exception of four UKM monitor wells (LC17M, LC23M, LC27M, and LC28M), one LFG monitor well (MB-5), and one HJ monitor well (MB-6), every well exceeded the EPA uranium MCL of 0.03 mg/L in at least one quarter. Similarly, with the exception of one DE monitor well (MB-1), one LFG monitor well (MB-2), one HJ monitor well (MB-3B), and one UKM monitor well (MB-4), every well exceeded the WDEQ Class I Standard and EPA MCL for radium-226+228 of 5.0 pCi/L. The distributions of radium and uranium in the DE, FG, HJ, and UKM Horizons are shown on **Figures 3.6-23 and 3.6-24**.

Table 3.6-8 Analytical Results of Baseline Monitoring (Page 1 of 17)

Major Cations and Anions												
Well ID	Completion Zone	Sample Date	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	Cl (mg/L)	HCO_3 (mg/L)	CO_3 (mg/L)	SO_4 (mg/L)	SiO_2 (mg/L)	NO_3+NO_2 (mg/L)
LC29M	DE	9/20/06	26.0	2.0	57.0	4.0	6.0	137.0	ND	108.0	12.0	ND
LC29M	DE	11/26/06	26.0	3.0	64.0	4.0	4.0	98.0	ND	131.0	17.2	ND
LC29M	DE	3/1/07	24.0	2.0	57.0	3.0	4.0	205.0	ND	54.0	18.1	ND
LC29M	DE	5/4/07	27.0	2.0	47.0	3.0	10.0	183.0	ND	21.0	15.3	0.90
LC30M	DE	9/20/06	29.0	2.0	33.0	2.0	6.0	122.0	ND	31.0	14.7	1.40
LC30M	DE	11/26/06	25.0	1.0	31.0	2.0	5.0	124.0	ND	26.0	13.7	1.20
LC30M	DE	3/1/07	51.0	2.0	33.0	2.0	6.0	156.0	ND	51.0	17.4	0.60
LC30M	DE	5/3/07	62.0	2.0	28.0	2.0	6.0	176.0	ND	55.0	17.7	ND
LC31M	DE	9/21/06	40.0	3.0	140.0	9.0	7.0	140.0	ND	***316.0***	15.0	0.80
LC31M	DE	11/26/06	39.0	3.0	120.0	8.0	7.0	145.0	ND	***280.0***	13.9	0.40
LC31M	DE	2/28/07	64.0	3.0	108.0	7.0	8.0	156.0	ND	***277.0***	17.0	0.30
LC31M	DE	5/3/07	71.0	3.0	99.0	6.0	6.0	159.0	ND	***279.0***	15.9	0.20
MB-1	DE	8/27/09	22.0	3.0	10.0	ND	12.0	ND	18.0	22.0	15.7	1.55
MB-1	DE	1/4/10	23.0	2.0	11.0	ND	8.0	59.0	ND	21.0	14.4	1.60
MB-1	DE	3/30/10	29.0	3.0	19.0	1.0	6.0	108.0	ND	21.0	14.2	1.80
MB-1	DE	6/29/10	28.0	3.0	20.0	1.0	6.0	112.0	ND	20.0	14.3	1.60
MB-7	DE	8/26/09	Insufficient water to sample.									
MB-10	DE	8/26/09	Insufficient water to sample.									

Table 3.6-8 Analytical Results of Baseline Monitoring (Page 2 of 17)

			General Water Quality				Radionuclides					
Well ID	Completion Zone	Sample Date	TDS (mg/L)	Specific Conductivity	Lab pH (SU)	Alkalinity (mg/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)	Ra-226 (pCi/L)	Ra-228 (pCi/L)	Ra-226 + Ra-228 (pCi/L)	Uranium (mg/L)
LC29M	DE	9/20/06	283.0			112.0	***328.0***	142.0	1.9	ND	1.9	***0.499***
LC29M	DE	11/26/06	298.0	491.0	7.68	80.0	***158.0***	54.0	1.7	4.7	***6.4***	***0.246***
LC29M	DE	3/1/07	265.0	385.0	7.77		***265.0***	86.1	4.0	ND	4.0	***0.318***
LC29M	DE	5/4/07	219.0	356.0	7.75		***200.0***	84.6	3.0	ND	3.0	***0.251***
LC30M	DE	9/20/06	184.0			100.0	***129.0***	41.5	1.0	ND	1.0	***0.141***
LC30M	DE	11/26/06	170.0	288.0	7.33	102.0	***107.0***	32.3	0.9	1.6	2.5	***0.154***
LC30M	DE	3/1/07	241.0	393.0	8.02		***108.0***	31.9	5.7	ND	***5.7***	***0.162***
LC30M	DE	5/3/07	260.0	440.0	8.07		***109.0***	40.0	2.1	ND	2.1	***0.130***
LC31M	DE	9/21/06	***602.0***	800.0	7.85	114.0	***1120.0***	405.0	2.0	1.7	3.7	***1.890***
LC31M	DE	11/26/06	***528.0***	838.0	7.79	119.0	***1430.0***	395.0	2.6	3.2	***5.8***	***2.100***
LC31M	DE	2/28/07	***563.0***	817.0	7.94		***967.0***	262.0	7.2	1.0	***8.2***	***1.400***
LC31M	DE	5/3/07	***559.0***	860.0	7.79		***1030.0***	319.0	1.9	2.4	4.3	***1.610***
MB-1	DE	8/27/09	121.0	186.0	***10.10***		***21.4***	10.1	0.7	0.9	1.6	0.011
MB-1	DE	1/4/10	95.0	183.0	***9.27***	55.0	***74.7***	18.9	0.3	1.6	1.9	***0.063***
MB-1	DE	3/30/10	167.0	235.0	8.42	88.0	***158.0***	27.1	0.3	1.0	1.3	***0.135***
MB-1	DE	6/29/10	133.0	242.0	***8.61***	92.0	***173.0***	36.7	0.2	0.9	1.1	***0.126***
MB-7	DE	8/26/09	Insufficient water to sample.									
MB-10	DE	8/26/09	Insufficient water to sample.									

Table 3.6-8 Analytical Results of Baseline Monitoring (Page 3 of 17)

Trace Parameters (Dissolved unless otherwise noted.)											
Well ID	Completion Zone	Sample Date	Al (mg/L)	NH_3-N (mg/L)	As (mg/L)	Ba (mg/L)	B (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	F (mg/L)
LC29M	DE	9/20/06	ND	**1.07**	0.002	ND	ND	ND	ND	ND	0.30
LC29M	DE	11/26/06	ND	**0.57**	0.003	ND	ND	ND	ND	ND	0.30
LC29M	DE	3/1/07	ND	0.26	0.005	ND	ND	ND	ND	ND	0.20
LC29M	DE	5/4/07	ND	0.18	ND	ND	ND	ND	ND	ND	0.20
LC30M	DE	9/20/06	ND	0.11	0.002	ND	ND	ND	ND	ND	0.50
LC30M	DE	11/26/06	ND	0.08	0.002	ND	ND	ND	ND	ND	0.50
LC30M	DE	3/1/07	ND	0.07	0.004	ND	ND	ND	ND	ND	0.50
LC30M	DE	5/3/07	ND	0.06	0.007	ND	ND	ND	ND	ND	0.50
LC31M	DE	9/21/06	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC31M	DE	11/26/06	ND	0.07	ND	ND	ND	ND	ND	ND	0.20
LC31M	DE	2/28/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC31M	DE	5/3/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
MB-1	DE	8/27/09	ND	ND	0.00	ND	ND	ND	ND	ND	ND
MB-1	DE	1/4/10	ND	ND	0.00	ND	ND	ND	ND	ND	0.30
MB-1	DE	3/30/10	ND	ND	0.00	ND	ND	ND	ND	ND	ND
MB-1	DE	6/29/10	ND	ND	0.00	ND	ND	ND	ND	ND	0.30
MB-7	DE	8/26/09	Insufficient water to sample.								
MB-10	DE	8/26/09	Insufficient water to sample.								

Table 3.6-8 Analytical Results of Baseline Monitoring (Page 4 of 17)

Trace Parameters (Dissolved unless otherwise noted.)													
Well ID	Completion Zone	Sample Date	Fe (mg/L)		Hg (mg/L)	Mn (mg/L)		Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	V (mg/L)	Zn (mg/L)
			Dissolved	Total		Dissolved	Total						
LC29M	DE	9/20/06	0.09	0.09	ND	***0.12***	***0.11***	ND	ND	ND	0.002	ND	ND
LC29M	DE	11/26/06	***0.67***	***0.46***	ND	***0.48***	***0.32***	ND	ND	ND	ND	ND	ND
LC29M	DE	3/1/07	***0.40***	***0.40***	ND	***0.24***	***0.24***	ND	ND	ND	ND	ND	ND
LC29M	DE	5/4/07	0.14	0.14	ND	0.04	0.04	ND	ND	ND	ND	ND	ND
LC30M	DE	9/20/06	ND	ND	ND	0.01	ND	ND	ND	ND	0.016	ND	ND
LC30M	DE	11/26/06	ND	ND	ND	0.01	0.01	ND	ND	ND	0.016	ND	ND
LC30M	DE	3/1/07	0.11	0.11	ND	***0.08***	***0.08***	ND	ND	ND	0.006	ND	ND
LC30M	DE	5/3/07	0.09	0.09	ND	***0.07***	***0.07***	ND	ND	ND	0.003	ND	ND
LC31M	DE	9/21/06	ND	ND	ND	0.01	ND	ND	ND	ND	***0.215***	ND	ND
LC31M	DE	11/26/06	ND	ND	ND	***0.06***	0.05	ND	ND	ND	***0.211***	ND	ND
LC31M	DE	2/28/07	0.10	0.10	ND	***0.10***	***0.10***	ND	ND	ND	***0.151***	ND	ND
LC31M	DE	5/3/07	0.07	0.07	ND	0.02	0.02	ND	ND	ND	***0.111***	ND	ND
MB-1	DE	8/27/09	***0.40***	***0.42***	ND	ND	ND	ND	ND	ND	0.003	ND	ND
MB-1	DE	1/4/10	0.03	0.10	ND	ND	ND	ND	ND	ND	0.004	ND	ND
MB-1	DE	3/30/10	ND	ND	ND	ND	ND	ND	ND	ND	0.004	ND	ND
MB-1	DE	6/29/10	ND	0.14	ND	ND	ND	ND	ND	ND	0.004	ND	ND
MB-7	DE	8/26/09	Insufficient water to sample										
MB-10	DE	8/26/09	Insufficient water to sample										

Table 3.6-8 Analytical Results of Baseline Monitoring (Page 5 of 17)

Major Cations and Anions												
Well ID	Completion Zone	Sample Date	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	Cl (mg/L)	HCO_3 (mg/L)	CO_3 (mg/L)	SO_4 (mg/L)	SiO_2 (mg/L)	NO_3+NO_2 (mg/L)
LC15M	LFG	9/12/06	31.0	4.0	86.0	4.0	8.0	127.0	ND	180.0	16.0	ND
LC15M	LFG	11/26/06	31.0	2.0	84.0	4.0	6.0	134.0	ND	157.0	14.3	ND
LC15M	LFG	3/1/07	33.0	3.0	89.0	5.0	1.0	130.0	ND	180.0	14.8	0.20
LC15M	LFG	5/4/07	34.0	9.0	46.0	3.0	6.0	85.0	ND	142.0	13.0	0.40
LC18M	LFG	9/20/06	35.0	3.0	61.0	3.0	5.0	122.0	ND	122.0	13.2	ND
LC18M	LFG	11/22/06	31.0	2.0	55.0	3.0	5.0	117.0	ND	117.0	12.4	ND
LC18M	LFG	3/1/07	33.0	2.0	60.0	3.0	5.0	120.0	ND	120.0	13.6	ND
LC18M	LFG	5/4/07	30.0	3.0	49.0	3.0	5.0	112.0	ND	119.0	12.6	ND
LC21M	LFG	9/20/06	33.0	2.0	46.0	3.0	6.0	121.0	5.0	62.0	15.8	1.00
LC21M	LFG	11/26/06	30.0	2.0	41.0	3.0	5.0	132.0	ND	59.0	13.9	0.80
LC21M	LFG	2/28/07	31.0	3.0	35.0	3.0	5.0	120.0	ND	60.0	15.2	1.00
LC21M	LFG	5/3/07	30.0	2.0	41.0	3.0	5.0	124.0	ND	58.0	13.7	1.00
LC25M	LFG	9/21/06	35.0	4.0	73.0	2.0	6.0	100.0	2.0	146.0	14.1	0.30
LC25M	LFG	11/17/06	34.0	2.0	70.0	4.0	6.0	120.0	ND	139.0	14.6	0.20
LC25M	LFG	3/1/07	32.0	2.0	72.0	4.0	6.0	126.0	ND	150.0	14.7	0.20
LC25M	LFG	5/3/07	34.0	4.0	34.0	3.0	4.0	36.0	ND	133.0	13.5	ND
MB-2	LFG	8/27/09	29.0	2.0	37.0	3.0	8.0	121.0	ND	53.0	16.1	1.2
MB-2	LFG	12/14/09	27.0	2.0	34.0	3.0	8.0	124.0	ND	58.0	14.7	1.1
MB-2	LFG	3/30/10	34.0	3.0	38.0	2.0	8.0	128.0	ND	58.0	16.5	1.2
MB-2	LFG	7/6/10	31.0	2.0	37.0	3.0	8.0	128.0	ND	59.0	15.1	1.1
MB-5	LFG	8/27/09	24.0	3.0	63.0	3.0	6.0	132.0	ND	105.0	17.2	ND
MB-5	LFG	12/14/09	24.0	2.0	61.0	3.0	7.0	134.0	ND	114.0	15.9	ND
MB-5	LFG	3/31/10	25.0	2.0	62.0	3.0	6.0	141.0	ND	108.0	12.8	ND
MB-5	LFG	7/6/10	26.0	2.0	61.0	3.0	6.0	139.0	ND	109.0	16.2	ND
MB-8	LFG	8/26/09	24.0	3.0	70.0	4.0	5.0	159.0	ND	121.0	16.9	0.0
MB-8	LFG	1/4/10	27.0	2.0	74.0	5.0	6.0	154.0	ND	129.0	17.5	ND
MB-8	LFG	3/30/10	26.0	2.0	73.0	5.0	6.0	163.0	ND	130.0	16.8	ND
MB-8	LFG	6/29/10	25.0	2.0	72.0	5.0	6.0	159.0	ND	131.0	16.1	ND

Table 3.6-8 Analytical Results of Baseline Monitoring (Page 6 of 17)

			General Water Quality				Radionuclides					
Well ID	Completion Zone	Sample Date	TDS (mg/L)	Specific Conductivity	Lab pH (SU)	Alkalinity (mg/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)	Ra-226 (pCi/L)	Ra-228 (pCi/L)	Ra-226 + Ra-228 (pCi/L)	Uranium (mg/L)
LC15M	LFG	9/12/06	390.0				***263.0***	83.3	5.3	0.9	***6.2***	***0.489***
LC15M	LFG	11/26/06	370.0	605.0	7.84	110.0	***334.0***	116.0	3.8	4.8	***8.6***	***0.472***
LC15M	LFG	3/1/07	390.0	587.0	7.32		***374.0***	92.7	6.0	3.5	***9.5***	***0.467***
LC15M	LFG	5/4/07	296.0	492.0	8.27		***236.0***	92.1	3.6	ND	3.6	***0.358***
LC18M	LFG	9/20/06	303.0			100.0	***518.0***	192.0	43.0	2.8	***45.8***	***0.523***
LC18M	LFG	11/22/06	277.0	461.0	8.33	98.0	***490.0***	199.0	63.5	3.9	***67.4***	***0.546***
LC18M	LFG	3/1/07	296.0	460.0	7.86		***439.0***	148.0	ND	ND	0.0	***0.533***
LC18M	LFG	5/4/07	277.0	467.0	8.09		***385.0***	115.0	26.4	ND	***26.4***	***0.419***
LC21M	LFG	9/20/06	233.0			106.0	***219.0***	70.3	1.6	1.2	2.8	***0.251***
LC21M	LFG	11/26/06	219.0	373.0	8.17	108.0	***205.0***	49.2	1.2	12.0	***13.2***	***0.278***
LC21M	LFG	2/28/07	214.0	333.0	8.25		***815.0***	62.6	230.0	ND	***230.0***	***0.270***
LC21M	LFG	5/3/07	219.0	371.0	8.17		***202.0***	65.2	3.7	ND	3.7	***0.236***
LC25M	LFG	9/21/06	336.0	452.0	8.37	91.0	***353.0***	124.0	3.1	3.3	***6.4***	***0.465***
LC25M	LFG	11/17/06	330.0	516.0	8.28		***301.0***	138.0	3.1	ND	3.1	***0.460***
LC25M	LFG	3/1/07	344.0	519.0	7.97		***369.0***	107.0	2.3	2.3	4.6	***0.517***
LC25M	LFG	5/3/07	244.0	390.0	***8.57***		***194.0***	72.5	2.9	ND	2.9	***0.289***
MB-2	LFG	8/27/09	220.0	337.0	8.17		***223.0***	61.4	1.7	2.0	3.7	***0.164***
MB-2	LFG	12/14/09	195.0	345.0	8.07		***175.0***	61.9	1.5	1.3	2.8	***0.172***
MB-2	LFG	3/30/10	231.0	341.0	8.14	105.0	***196.0***	34.2	1.4	2.1	3.5	***0.191***
MB-2	LFG	7/6/10	236.0	344.0	7.78	105.0	***185.0***	56.7	1.0	1.5	2.5	***0.178***
MB-5	LFG	8/27/09	295.0	438.0	7.99		***80.9***	28.4	32.0	3.3	***35.3***	0.017
MB-5	LFG	12/14/09	298.0	449.0	7.92		***70.2***	30.9	29.0	2.8	***31.8***	0.018
MB-5	LFG	3/31/10	301.0	440.0	7.90	115.0	***67.9***	24.5	32.0	2.5	***34.5***	0.016
MB-5	LFG	7/6/10	311.0	439.0	7.57	114.0	***67.9***	23.6	34.0	2.2	***36.2***	0.016
MB-8	LFG	8/26/09	333.0	487.0	7.91		***204.0***	54.9	3.2	2.4	***5.6***	***0.152***
MB-8	LFG	1/4/10	306.0	501.0	7.94	126.0	***261.0***	60.6	1.8	3.0	4.8	***0.190***
MB-8	LFG	3/30/10	332.0	505.0	7.86	133.0	***195.0***	35.9	1.7	2.6	4.3	***0.204***
MB-8	LFG	6/29/10	325.0	509.0	7.78	130.0	***291.0***	52.0	2.1	2.5	4.6	***0.207***

Table 3.6-8 Analytical Results of Baseline Monitoring (Page 7 of 17)

Trace Parameters (Dissolved unless otherwise noted.)											
Well ID	Completion Zone	Sample Date	Al (mg/L)	NH_3-N (mg/L)	As (mg/L)	Ba (mg/L)	B (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	F (mg/L)
LC15M	LFG	9/12/06	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC15M	LFG	11/26/06	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC15M	LFG	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC15M	LFG	5/4/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC18M	LFG	9/20/06	ND	ND	0.004	ND	ND	ND	ND	ND	0.20
LC18M	LFG	11/22/06	ND	ND	0.002	ND	ND	ND	ND	ND	0.20
LC18M	LFG	3/1/07	ND	ND	0.002	ND	ND	ND	ND	ND	0.20
LC18M	LFG	5/4/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC21M	LFG	9/20/06	ND	0.08	ND	ND	ND	ND	ND	ND	0.30
LC21M	LFG	11/26/06	ND	ND	ND	ND	ND	ND	ND	ND	0.30
LC21M	LFG	2/28/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC21M	LFG	5/3/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC25M	LFG	9/21/06	ND	ND	0.004	ND	ND	ND	ND	ND	0.20
LC25M	LFG	11/17/06	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC25M	LFG	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC25M	LFG	5/3/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
MB-2	LFG	8/27/09	ND	0.14	0.00	ND	ND	ND	ND	ND	ND
MB-2	LFG	12/14/09	ND	ND	0.00	ND	ND	ND	ND	ND	0.20
MB-2	LFG	3/30/10	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB-2	LFG	7/6/10	ND	ND	0.00	ND	ND	ND	ND	ND	ND
MB-5	LFG	8/27/09	ND	0.08	ND	ND	ND	ND	ND	ND	ND
MB-5	LFG	12/14/09	ND	ND	ND	ND	ND	ND	ND	ND	0.10
MB-5	LFG	3/31/10	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB-5	LFG	7/6/10	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB-8	LFG	8/26/09	ND	0.13	ND	ND	ND	ND	ND	ND	ND
MB-8	LFG	1/4/10	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB-8	LFG	3/30/10	ND	ND	ND	ND	ND	ND	ND	ND	
MB-8	LFG	6/29/10	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 3.6-8 Analytical Results of Baseline Monitoring (Page 8 of 17)

Trace Parameters (Dissolved unless otherwise noted.)													
Well ID	Completion Zone	Sample Date	Fe (mg/L)		Hg (mg/L)	Mn (mg/L)		Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	V (mg/L)	Zn (mg/L)
			Dissolved	Total		Dissolved	Total						
LC15M	LFG	9/12/06	0.03	ND	ND	ND	ND	ND	ND	ND	0.019	ND	ND
LC15M	LFG	11/26/06	ND	ND	ND	ND	ND	ND	ND	ND	0.016	ND	ND
LC15M	LFG	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	0.017	ND	ND
LC15M	LFG	5/4/07	ND	ND	ND	ND	ND	ND	ND	ND	0.010	ND	ND
LC18M	LFG	9/20/06	***0.53***	***0.53***	ND	ND	ND	ND	ND	ND	0.024	ND	ND
LC18M	LFG	11/22/06	***0.51***	***0.51***	ND	ND	ND	ND	ND	ND	0.015	ND	ND
LC18M	LFG	3/1/07	***0.67***	***0.67***	ND	ND	ND	ND	ND	ND	0.016	ND	ND
LC18M	LFG	5/4/07	0.10	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC21M	LFG	9/20/06	***0.40***	***0.40***	ND	0.02	0.02	ND	ND	ND	0.040	ND	ND
LC21M	LFG	11/26/06	ND	ND	ND	ND	ND	ND	ND	ND	0.039	ND	ND
LC21M	LFG	2/28/07	ND	ND	ND	ND	ND	ND	ND	ND	0.034	ND	ND
LC21M	LFG	5/3/07	ND	ND	ND	ND	ND	ND	ND	ND	0.032	ND	ND
LC25M	LFG	9/21/06	ND	ND	ND	ND	ND	ND	ND	ND	0.027	ND	ND
LC25M	LFG	11/17/06	ND	ND	ND	ND	ND	ND	ND	ND	0.027	ND	ND
LC25M	LFG	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	0.025	ND	ND
LC25M	LFG	5/3/07	ND	ND	ND	ND	ND	ND	ND	ND	0.015	ND	ND
MB-2	LFG	8/27/09	0.20	ND	ND	ND	ND	ND	ND	ND	0.013	ND	ND
MB-2	LFG	12/14/09	ND	ND	ND	ND	ND	ND	ND	ND	0.013	ND	ND
MB-2	LFG	3/30/10	ND	ND	ND	ND	ND	ND	ND	ND	0.015	ND	ND
MB-2	LFG	7/6/10	ND	ND	ND	ND	ND	ND	ND	ND	0.013	ND	ND
MB-5	LFG	8/27/09	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB-5	LFG	12/14/09	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND
MB-5	LFG	3/31/10	ND	0.04	ND	0.01	0.01	ND	ND	ND	ND	ND	ND
MB-5	LFG	7/6/10	ND	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB-8	LFG	8/26/09	0.10	***0.42***	ND	ND	ND	ND	ND	ND	0.003	ND	0.05
MB-8	LFG	1/4/10	ND	ND	ND	ND	ND	ND	ND	ND	0.003	ND	ND
MB-8	LFG	3/30/10	ND	ND	ND	ND	ND	ND	ND	ND	0.004	ND	ND
MB-8	LFG	6/29/10	ND	ND	ND	ND	ND	ND	ND	ND	0.004	ND	ND

Table 3.6-8 Analytical Results of Baseline Monitoring (Page 9 of 17)

Major Cations and Anions												
Well ID	Completion Zone	Sample Date	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	Cl (mg/L)	HCO_3 (mg/L)	CO_3 (mg/L)	SO_4 (mg/L)	SiO_2 (mg/L)	NO_3+NO_2 (mg/L)
LC16M	HJ	9/12/06	27.0	2.0	77.0	4.0	5.0	134.0	ND	144.0	16.0	ND
LC16M	HJ	11/10/06	29.3	8.0	80.1	3.9	7.0	128.0	ND	136.0		ND
LC16M	HJ	3/1/07	30.0	2.0	74.0	4.0	4.0	132.0	ND	138.0	15.0	ND
LC16M	HJ	5/4/07	29.0	2.0	74.0	4.0	5.0	137.0	ND	139.0	14.8	ND
LC19M	HJ	9/20/06	35.0	3.0	66.0	3.0	6.0	103.0	2.0	139.0		ND
LC19M	HJ	11/3/06	32.8	2.1	72.9	3.2	6.0	132.0	ND	146.0	15.0	ND
LC19M	HJ	3/5/07	40.0	13.0	41.0	3.0	6.0	73.0	ND	124.0	14.5	ND
LC19M	HJ	5/4/07	33.0	8.0	45.0	3.0	5.0	93.0	ND	137.0	14.8	ND
LC22M	HJ	9/21/06	40.0	2.0	74.0	3.0	5.0	113.0	ND	170.0	15.0	ND
LC22M	HJ	11/16/06	36.0	2.0	62.0	3.0	4.0	109.0	ND	154.0	12.8	ND
LC22M	HJ	3/1/07	37.0	4.0	60.0	3.0	6.0	110.0	ND	142.0	14.2	ND
LC22M	HJ	5/3/07	35.0	4.0	64.0	3.0	5.0	113.0	ND	137.0	13.0	ND
LC26M	HJ	9/21/06	35.0	4.0	133.0	6.0	6.0	168.0	ND	***269.0***	17.7	ND
LC26M	HJ	11/17/06	33.0	3.0	127.0	5.0	6.0	166.0	ND	***256.0***	17.0	ND
LC26M	HJ	3/1/07	33.0	3.0	125.0	5.0	5.0	159.0	ND	***253.0***	16.2	ND
LC26M	HJ	5/3/07	34.0	8.0	90.0	5.0	5.0	57.0	ND	***259.0***	17.5	ND
MB-3B	HJ	8/27/09	31.0	4.0	37.0	2.0	11.0	108.0	ND	66.0	17.2	0.9
MB-3B	HJ	12/14/09	30.0	3.0	37.0	2.0	10.0	112.0	ND	70.0	15.3	0.8
MB-3B	HJ	3/30/10	32.0	2.0	35.0	3.0	10.0	118.0	ND	71.0	15.1	0.8
MB-3B	HJ	7/6/10	32.0	3.0	38.0	2.0	9.0	120.0	ND	71.0	16.0	0.8
MB-6	HJ	8/27/09	38.0	3.0	38.0	1.0	4.0	77.0	ND	106.0	16.8	ND
MB-6	HJ	12/14/09	19.0	2.0	50.0	2.0	5.0	142.0	ND	71.0	16.7	ND
MB-6	HJ	3/31/10	21.0	2.0	52.0	2.0	6.0	149.0	ND	71.0	13.4	ND
MB-6	HJ	7/7/10	22.0	2.0	55.0	2.0	5.0	146.0	ND	73.0	16.9	ND
MB-9	HJ	8/27/09	24.0	3.0	70.0	4.0	5.0	159.0	ND	121.0	16.9	0.0
MB-9	HJ	12/15/09	21.0	6.0	47.0	2.0	5.0	117.0	ND	75.0	19.0	ND
MB-9	HJ	3/30/10	24.0	5.0	48.0	2.0	6.0	136.0	ND	75.0	18.5	ND
MB-9	HJ	7/6/10	23.0	4.0	48.0	2.0	5.0	136.0	ND	75.0	18.9	ND

Table 3.6-8 Analytical Results of Baseline Monitoring (Page 10 of 17)

			General Water Quality				Radionuclides					
Well ID	Completion Zone	Sample Date	TDS (mg/L)	Specific Conductivity	Lab pH (SU)	Alkalinity (mg/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)	Ra-226 (pCi/L)	Ra-228 (pCi/L)	Ra-226 + Ra-228 (pCi/L)	Uranium (mg/L)
LC16M	HJ	9/12/06	330.0				***299.0***	109.0	166.0	4.3	***170.3***	***0.164***
LC16M	HJ	11/10/06	304.0	517.0			***274.0***	120.0	2.0	78.4	***80.4***	***0.133***
LC16M	HJ	3/1/07	333.0	509.0	7.92		***290.0***	79.7	65.1	3.8	***68.9***	***0.134***
LC16M	HJ	5/4/07	335.0	534.0	8.01		***188.0***	69.2	122.0	3.2	***125.2***	***0.122***
LC19M	HJ	9/20/06	319.0			87.0	***985.0***	540.0	366.0	4.8	***370.8***	***0.336***
LC19M	HJ	11/3/06	328.0	506.0	7.85	108.0	***863.0***	592.0	547.0	4.1	***551.1***	***0.051***
LC19M	HJ	3/5/07	278.0	432.0	8.02		***1220.0***	473.0	316.0	3.4	***319.4***	***0.844***
LC19M	HJ	5/4/07	266.0	482.0	8.11		***1470.0***	603.0	423.0	1.0	***424.0***	***0.762***
LC22M	HJ	9/21/06	366.0	511.0	8.14	93.0	***810.0***	358.0	261.0	3.2	***264.2***	***0.342***
LC22M	HJ	11/16/06	328.0	531.0	8.15		***597.0***	258.0	247.0	1.9	***248.9***	***0.185***
LC22M	HJ	3/1/07	319.0	483.0	7.87		***86.5***	97.9	1.7	3.6	***5.3***	***0.129***
LC22M	HJ	5/3/07	316.0	513.0	8.11		***576.0***	186.0	308.0	3.8	***311.8***	***0.097***
LC26M	HJ	9/21/06	***554.0***	741.0	8.16	138.0	***306.0***	111.0	87.7	4.6	***92.3***	***0.107***
LC26M	HJ	11/17/06	***528.0***	786.0	8.06		***300.0***	119.0	77.2	3.8	***81.0***	***0.072***
LC26M	HJ	3/1/07	***519.0***	745.0	7.85		***30.5***	46.1	ND	3.6	3.6	***0.045***
LC26M	HJ	5/3/07	449.0	653.0	8.44		***50.2***	23.4	12.4	ND	***12.4***	***0.037***
MB-3B	HJ	8/27/09	231.0	353.0	8.29		***255.0***	48.8	1.9	3.1	5.0	***0.179***
MB-3B	HJ	12/14/09	220.0	358.0	8.17		***215.0***	61.8	1.5	1.5	3.0	***0.186***
MB-3B	HJ	3/30/10	246.0	359.0	8.23	97.0	***204.0***	31.9	1.5	1.5	3.0	***0.174***
MB-3B	HJ	7/6/10	247.0	361.0	7.86	98.0	***235.0***	57.1	1.9	1.3	3.2	***0.194***
MB-6	HJ	8/27/09	256.0	374.0	***8.79***		10.2	8.9	3.4	3.8	***7.2***	0.000
MB-6	HJ	12/14/09	242.0	373.0	7.98		***21.0***	12.9	5.9	3.8	***9.7***	0.007
MB-6	HJ	3/31/10	265.0	370.0	7.90	122.0	***27.9***	12.9	5.5	3.1	***8.6***	0.006
MB-6	HJ	7/7/10	259.0	374.0	7.66	120.0	***24.3***	13.4	4.6	4.5	***9.1***	0.006
MB-9	HJ	8/27/09	333.0	487.0	7.91		***204.0***	54.9	3.2	2.4	***5.6***	***0.152***
MB-9	HJ	12/15/09	240.0	361.0	8.47		12.5	12.3	2.9	4.4	***7.3***	0.004
MB-9	HJ	3/30/10	231.0	369.0	8.05	111.0	***19.2***	13.0	2.2	4.4	***6.6***	0.004
MB-9	HJ	7/6/10	254.0	366.0	7.53	111.0	12.4	6.8	2.7	3.7	***6.4***	0.004

Table 3.6-8 Analytical Results of Baseline Monitoring (Page 11 of 17)

Trace Parameters (Dissolved unless otherwise noted.)											
Well ID	Completion Zone	Sample Date	Al (mg/L)	NH_3-N (mg/L)	As (mg/L)	Ba (mg/L)	B (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	F (mg/L)
LC16M	HJ	9/12/06	ND	ND	0.002	ND	ND	ND	ND	ND	0.10
LC16M	HJ	11/10/06	ND	ND	ND	ND	ND	ND	ND	ND	0.10
LC16M	HJ	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC16M	HJ	5/4/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC19M	HJ	9/20/06	ND	ND	***0.014***	ND	ND	ND	ND	ND	ND
LC19M	HJ	11/3/06	ND	ND	0.002	ND	ND	ND	ND	ND	ND
LC19M	HJ	3/5/07	ND	0.06	0.008	ND	ND	ND	ND	ND	0.20
LC19M	HJ	5/4/07	ND	ND	0.007	ND	ND	ND	ND	ND	ND
LC22M	HJ	9/21/06	ND	ND	0.005	ND	ND	ND	ND	ND	ND
LC22M	HJ	11/16/06	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC22M	HJ	3/1/07	ND	ND	0.002	ND	ND	ND	ND	ND	0.20
LC22M	HJ	5/3/07	ND	ND	0.002	ND	ND	ND	ND	ND	0.20
LC26M	HJ	9/21/06	ND	ND	0.003	ND	ND	ND	ND	ND	ND
LC26M	HJ	11/17/06	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC26M	HJ	3/1/07	ND	0.07	ND	ND	ND	ND	ND	ND	ND
LC26M	HJ	5/3/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
MB-3B	HJ	8/27/09	ND	0.25	0.00	ND	ND	ND	ND	ND	ND
MB-3B	HJ	12/14/09	ND	ND	ND	ND	ND	ND	ND	ND	0.20
MB-3B	HJ	3/30/10	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB-3B	HJ	7/6/10	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB-6	HJ	8/27/09	ND	ND	0.00	ND	ND	ND	ND	ND	ND
MB-6	HJ	12/14/09	ND	ND	ND	ND	ND	ND	ND	ND	0.20
MB-6	HJ	3/31/10	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB-6	HJ	7/7/10	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB-9	HJ	8/27/09	ND	0.13	ND	ND	ND	ND	ND	ND	ND
MB-9	HJ	12/15/09	ND	ND	0.01	ND	ND	ND	ND	ND	0.20
MB-9	HJ	3/30/10	ND	ND	0.00	ND	ND	ND	ND	ND	ND
MB-9	HJ	7/6/10	ND	ND	0.00	ND	ND	ND	ND	ND	ND

Table 3.6-8 Analytical Results of Baseline Monitoring (Page 12 of 17)

Trace Parameters (Dissolved unless otherwise noted.)													
Well ID	Completion Zone	Sample Date	Fe (mg/L)		Hg (mg/L)	Mn (mg/L)		Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	V (mg/L)	Zn (mg/L)
			Dissolved	Total		Dissolved	Total						
LC16M	HJ	9/12/06	0.03	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC16M	HJ	11/10/06	0.06	0.06	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC16M	HJ	3/1/07	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC16M	HJ	5/4/07	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC19M	HJ	9/20/06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC19M	HJ	11/3/06	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC19M	HJ	3/5/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC19M	HJ	5/4/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC22M	HJ	9/21/06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC22M	HJ	11/16/06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC22M	HJ	3/1/07	ND	ND	ND	0.02	0.01	ND	ND	ND	ND	ND	ND
LC22M	HJ	5/3/07	ND	0.03	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC26M	HJ	9/21/06	ND	ND	ND	0.02	0.02	ND	ND	ND	ND	ND	ND
LC26M	HJ	11/17/06	0.23	0.23	ND	0.03	0.03	ND	ND	ND	ND	ND	ND
LC26M	HJ	3/1/07	ND	ND	ND	0.02	0.02	ND	ND	ND	ND	ND	ND
LC26M	HJ	5/3/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB-3B	HJ	8/27/09	0.20	ND	ND	ND	ND	ND	ND	ND	0.02	ND	0.01
MB-3B	HJ	12/14/09	ND	ND	ND	ND	ND	ND	ND	ND	0.02	ND	ND
MB-3B	HJ	3/30/10	ND	ND	ND	ND	ND	ND	ND	ND	0.01	ND	ND
MB-3B	HJ	7/6/10	ND	0.10	ND	ND	ND	ND	ND	ND	0.02	ND	ND
MB-6	HJ	8/27/09	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB-6	HJ	12/14/09	ND	0.04	ND	ND	0.01	ND	ND	ND	ND	ND	ND
MB-6	HJ	3/31/10	ND	0.04	ND	0.01	0.01	ND	ND	ND	ND	ND	ND
MB-6	HJ	7/7/10	ND	0.14	ND	ND	0.01	ND	ND	ND	ND	ND	ND
MB-9	HJ	8/27/09	0.10	***0.42***	ND	ND	ND	ND	ND	ND	0.00	ND	0.05
MB-9	HJ	12/15/09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB-9	HJ	3/30/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB-9	HJ	7/6/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 3.6-8 Analytical Results of Baseline Monitoring (Page 13 of 17)

Major Cations and Anions												
Well ID	Completion Zone	Sample Date	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	Cl (mg/L)	HCO_3 (mg/L)	CO_3 (mg/L)	SO_4 (mg/L)	SiO_2 (mg/L)	NO_3+NO_2 (mg/L)
LC17M	UKM	9/12/06	27.0	4.0	55.0	2.0	4.0	107.0	4.0	107.0	15.2	ND
LC17M	UKM	11/26/06	27.0	2.0	55.0	2.0	5.0	120.0	ND	94.0	15.1	ND
LC17M	UKM	3/1/07	29.0	2.0	62.0	3.0	5.0	124.0	ND	105.0	16.8	ND
LC17M	UKM	5/4/07	27.0	2.0	61.0	3.0	4.0	142.0	ND	108.0	15.9	ND
LC20M	UKM	9/21/06	32.0	3.0	56.0	2.0	6.0	113.0	2.0	102.0	17.2	ND
LC20M	UKM	11/22/06	32.0	5.0	38.0	ND	6.0	63.0	3.0	80.0	12.7	ND
LC20M	UKM	3/1/07	36.0	11.0	15.0	ND	5.0	39.0	ND	95.0	14.6	ND
LC20M	UKM	5/4/07	35.0	11.0	12.0	ND	6.0	34.0	2.0	91.0	14.1	ND
LC23M	UKM	9/21/06	44.0	8.0	58.0	ND	5.0	83.0	6.0	165.0	13.9	ND
LC23M	UKM	11/26/06	41.0	7.0	50.0	2.0	3.0	85.0	ND	150.0	14.1	ND
LC23M	UKM	3/1/07	64.0	48.0	52.0	ND	15.0	7.0	137.0	146.0	10.7	ND
LC23M	UKM	5/3/07	63.0	52.0	86.0	ND	5.0	4.0	66.0	126.0	9.4	ND
LC24M	UKM	9/21/06	32.0	3.0	68.0	4.0	5.0	109.0	ND	138.0	16.1	ND
LC24M	UKM	11/26/06	29.0	2.0	66.0	3.0	4.0	126.0	2.0	121.0	14.7	ND
LC24M	UKM	3/1/07	31.0	7.0	43.0	3.0	5.0	73.0	ND	126.0	14.8	ND
LC24M	UKM	5/4/07	31.0	7.0	48.0	3.0	5.0	85.0	ND	126.0	14.6	ND
LC27M	UKM	9/26/06	19.5	4.1	29.5	0.6	4.0	93.0	1.0	29.0	15.3	ND
LC27M	UKM	11/16/06	21.0	4.0	27.0	ND	6.0	82.0	2.0	29.0	15.5	ND
LC27M	UKM	3/1/07	21.0	5.0	11.0	ND	4.0	38.0	ND	39.0	16.4	ND
LC27M	UKM	5/3/07	22.0	5.0	7.0	ND	4.0	33.0	5.0	32.0	17.8	ND
LC28M	UKM	9/21/06	27.0	3.0	60.0	3.0	6.0	125.0	ND	101.0	16.1	ND
LC28M	UKM	11/26/06	24.0	2.0	58.0	3.0	4.0	127.0	ND	88.0	15.7	ND
LC28M	UKM	2/28/07	25.0	2.0	59.0	3.0	6.0	127.0	ND	95.0	16.9	ND
LC28M	UKM	5/3/07	25.0	2.0	62.0	3.0	6.0	130.0	ND	96.0	15.0	ND
MB-4	UKM	8/31/09	32.0	8.0	32.0	ND	10.0	ND	23.0	61.0	19.5	0.5
MB-4	UKM	12/14/09	33.0	8.0	19.0	ND	32.0	15.0	10.0	66.0	14.0	0.7
MB-4	UKM	3/30/10	32.0	5.0	21.0	ND	7.0	23.0	16.0	73.0	17.4	0.9
MB-4	UKM	7/7/10	29.0	3.0	19.0	ND	6.0	35.0	10.0	72.0	16.0	ND

Table 3.6-8 Analytical Results of Baseline Monitoring (Page 14 of 17)

			General Water Quality				Radionuclides					
Well ID	Completion Zone	Sample Date	TDS (mg/L)	Specific Conductivity	Lab pH (SU)	Alkalinity (mg/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)	Ra-226 (pCi/L)	Ra-228 (pCi/L)	Ra-226 + Ra-228 (pCi/L)	Uranium (mg/L)
LC17M	UKM	9/12/06	262.0				***28.4***	13.7	10.6	1.1	***11.7***	0.0135
LC17M	UKM	11/26/06	262.0	436.0	8.02	98.0	***29.0***	15.5	8.8	12.9	***21.7***	0.010
LC17M	UKM	3/1/07	284.0	433.0	7.88		***26.8***	11.5	5.5	ND	***5.5***	0.011
LC17M	UKM	5/4/07	291.0	467.0	8.11		***17.3***	9.1	7.2	1.5	***8.7***	0.009
LC20M	UKM	9/21/06	274.0	388.0	***8.56***	96.0	***44.4***	24.0	9.6	3.9	***13.5***	***0.036***
LC20M	UKM	11/22/06	216.0	362.0	***8.91***	56.0	***38.7***	19.5	9.3	3.4	***12.7***	0.025
LC20M	UKM	3/1/07	197.0	305.0	7.66		***65.3***	23.9	47.8	ND	***47.8***	0.024
LC20M	UKM	5/4/07	188.0	322.0	***9.04***		***31.9***	23.6	9.2	2.6	***11.8***	0.025
LC23M	UKM	9/21/06	341.0	451.0	***8.87***	76.0	***32.8***	17.5	3.3	ND	3.3	0.023
LC23M	UKM	11/26/06	303.0	498.0	7.97	70.0	***35.0***	14.9	4.7	6.7	***11.4***	0.019
LC23M	UKM	3/1/07	452.0	1180.0	***11.60***		5.3	34.8	1.9	1.0	2.9	0.002
LC23M	UKM	5/3/07	***526.0***	1720.0	***11.60***		***15.1***	44.7	4.7	1.5	***6.2***	0.002
LC24M	UKM	9/21/06	321.0	455.0	8.30	91.0	***107.0***	43.2	6.5	1.5	***8.0***	***0.134***
LC24M	UKM	11/26/06	302.0	500.0	8.33	105.0	***86.8***	27.6	5.9	5.8	***11.7***	***0.100***
LC24M	UKM	3/1/07	266.0	410.0	7.99		***48.6***	22.6	1.8	2.0	3.8	***0.062***
LC24M	UKM	5/4/07	277.0	452.0	8.08		***49.1***	23.8	8.9	1.5	***10.4***	***0.052***
LC27M	UKM	9/26/06	136.0				10.7	9.7	1.1	0.4	1.5	0.0026
LC27M	UKM	11/16/06	145.0	243.0	***8.66***		6.8	9.4	1.1	3.6	4.7	0.002
LC27M	UKM	3/1/07	117.0	171.0	***8.74***		***77.7***	4.1	26.6	ND	***26.6***	0.001
LC27M	UKM	5/3/07	111.0	178.0	***9.51***		2.9	3.9	0.4	ND	0.4	0.002
LC28M	UKM	9/21/06	276.0	394.0	8.14	103.0	***30.7***	19.4	8.1	3.4	***11.5***	0.017
LC28M	UKM	11/26/06	259.0	435.0	8.00	104.0	***18.1***	14.4	8.4	4.2	***12.6***	0.006
LC28M	UKM	2/28/07	269.0	400.0	8.15		***27.0***	13.0	7.7	2.1	***9.8***	0.007
LC28M	UKM	5/3/07	273.0	440.0	8.01		***19.4***	11.2	7.1	3.7	***10.8***	0.023
MB-4	UKM	8/31/09	209.0	474.0	***11.10***		***49.8***	22.4	0.5	1.7	2.2	0.017
MB-4	UKM	12/14/09	183.0	329.0	***9.65***		***59.2***	23.0	0.9	1.2	2.1	***0.065***
MB-4	UKM	3/30/10	198.0	285.0	***9.91***	45.0	***58.6***	13.2	ND	ND	ND	***0.037***
MB-4	UKM	7/7/10	182.0	259.0	***9.36***	45.0	***70.5***	20.5	0.2	0.3	0.5	***0.044***

Table 3.6-8 Analytical Results of Baseline Monitoring (Page 15 of 17)

Trace Parameters (Dissolved unless otherwise noted.)											
Well ID	Completion Zone	Sample Date	Al (mg/L)	NH_3-N (mg/L)	As (mg/L)	Ba (mg/L)	B (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	F (mg/L)
LC17M	UKM	9/12/06	ND	ND	0.006	ND	ND	ND	ND	ND	0.20
LC17M	UKM	11/26/06	ND	ND	0.003	ND	ND	ND	ND	ND	0.20
LC17M	UKM	3/1/07	ND	0.06	0.002	ND	ND	ND	ND	ND	0.20
LC17M	UKM	5/4/07	ND	ND	0.002	ND	ND	ND	ND	ND	0.20
LC20M	UKM	9/21/06	ND	ND	***0.012***	ND	ND	ND	ND	ND	ND
LC20M	UKM	11/22/06	ND	ND	***0.012***	ND	ND	ND	ND	ND	0.20
LC20M	UKM	3/1/07	ND	ND	***0.012***	ND	ND	ND	ND	ND	0.20
LC20M	UKM	5/4/07	ND	ND	***0.011***	ND	ND	ND	ND	ND	0.20
LC23M	UKM	9/21/06	ND	ND	0.009	ND	ND	ND	ND	ND	ND
LC23M	UKM	11/26/06	ND	ND	0.004	ND	ND	ND	ND	ND	0.20
LC23M	UKM	3/1/07	ND	**0.86**	0.003	0.30	ND	ND	ND	ND	0.40
LC23M	UKM	5/3/07	***0.20***	**0.75**	0.002	0.30	ND	ND	ND	ND	0.20
LC24M	UKM	9/21/06	ND	0.13	0.003	ND	ND	ND	ND	ND	ND
LC24M	UKM	11/26/06	ND	0.08	ND	ND	ND	ND	ND	ND	0.20
LC24M	UKM	3/1/07	ND	0.08	ND	ND	ND	ND	ND	ND	ND
LC24M	UKM	5/4/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC27M	UKM	9/26/06	ND	ND	0.009	ND	ND	ND	ND	ND	0.20
LC27M	UKM	11/16/06	ND	ND	0.006	ND	ND	ND	ND	ND	0.30
LC27M	UKM	3/1/07	ND	ND	0.007	ND	ND	ND	ND	ND	0.30
LC27M	UKM	5/3/07	ND	ND	0.005	ND	ND	ND	ND	ND	0.30
LC28M	UKM	9/21/06	ND	ND	0.005	ND	ND	ND	ND	ND	ND
LC28M	UKM	11/26/06	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC28M	UKM	2/28/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC28M	UKM	5/3/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
MB-4	UKM	8/31/09	***0.30***	0.07	0.00	ND	ND	ND	ND	ND	ND
MB-4	UKM	12/14/09	ND	ND	0.01	ND	ND	ND	ND	ND	0.30
MB-4	UKM	3/30/10	ND	ND	0.01	ND	ND	ND	ND	ND	ND
MB-4	UKM	7/7/10	ND	ND	0.01	ND	ND	ND	ND	ND	ND

Table 3.6-8 Analytical Results of Baseline Monitoring (Page 16 of 17)

Trace Parameters (Dissolved unless otherwise noted.)													
Well ID	Completion Zone	Sample Date	Fe (mg/L)		Hg (mg/L)	Mn (mg/L)		Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	V (mg/L)	Zn (mg/L)
			Dissolved	Total		Dissolved	Total						
LC17M	UKM	9/12/06	0.03	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC17M	UKM	11/26/06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC17M	UKM	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC17M	UKM	5/4/07	0.05	0.05	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC20M	UKM	9/21/06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC20M	UKM	11/22/06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC20M	UKM	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC20M	UKM	5/4/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC23M	UKM	9/21/06	ND	ND	ND	ND	ND	ND	ND	ND	0.002	ND	ND
LC23M	UKM	11/26/06	ND	ND	ND	ND	ND	ND	ND	ND	0.002	ND	ND
LC23M	UKM	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC23M	UKM	5/3/07	ND	ND	ND	ND	ND	ND	ND	0.002	0.005	ND	ND
LC24M	UKM	9/21/06	***0.32***	***0.32***	ND	ND	ND	ND	ND	ND	0.002	ND	ND
LC24M	UKM	11/26/06	0.16	0.16	ND	ND	ND	ND	ND	ND	0.002	ND	ND
LC24M	UKM	3/1/07	0.06	0.06	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC24M	UKM	5/4/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC27M	UKM	9/26/06	0.15	0.15	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC27M	UKM	11/16/06	0.08	0.08	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC27M	UKM	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC27M	UKM	5/3/07	0.04	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 3.6-8 Analytical Results of Baseline Monitoring (Page 17 of 17)

Trace Parameters (Dissolved unless otherwise noted.)													
Well ID	Completion Zone	Sample Date	Fe (mg/L)		Hg (mg/L)	Mn (mg/L)		Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	V (mg/L)	Zn (mg/L)
			Dissolved	Total		Dissolved	Total						
LC28M	UKM	9/21/06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC28M	UKM	11/26/06	0.04	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC28M	UKM	2/28/07	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC28M	UKM	5/3/07	0.05	0.05	ND	ND	0.01	ND	ND	ND	0.002	ND	ND
MB-4	UKM	8/31/09	0.30	ND	ND	ND	ND	ND	ND	ND	0.016	ND	ND
MB-4	UKM	12/14/09	ND	ND	ND	ND	ND	ND	ND	ND	0.014	ND	ND
MB-4	UKM	3/30/10	ND	0.12	ND	ND	ND	ND	ND	ND	0.015	ND	ND
MB-4	UKM	7/7/10	ND	ND	ND	ND	ND	ND	ND	ND	0.02	ND	ND

ND - Concentration was below the laboratory detection limit.

Blank - Sample not analyzed for this parameter.

WQD and EPA criteria listed in Table D6-15b.

Bold Concentration exceeds WQD Domestic Class-of-Use (Class I).

Bold Concentration exceeds WQD Agricuture Class-of-Use (Class II).

Bold Concentration exceeds WQD Livestock Class-of-Use (Class III).

Bold Concentration exceeds EPA criteria.

Highlight for concentration exceeding WQD criteria is based on the lowest criteria exceeded. If EPA concentration also exceeded, both highlight and pattern are shown. Pattern for concentration exceeding EPA criteria is based on lowest criteria exceeded. For pH, narrowest range is used.

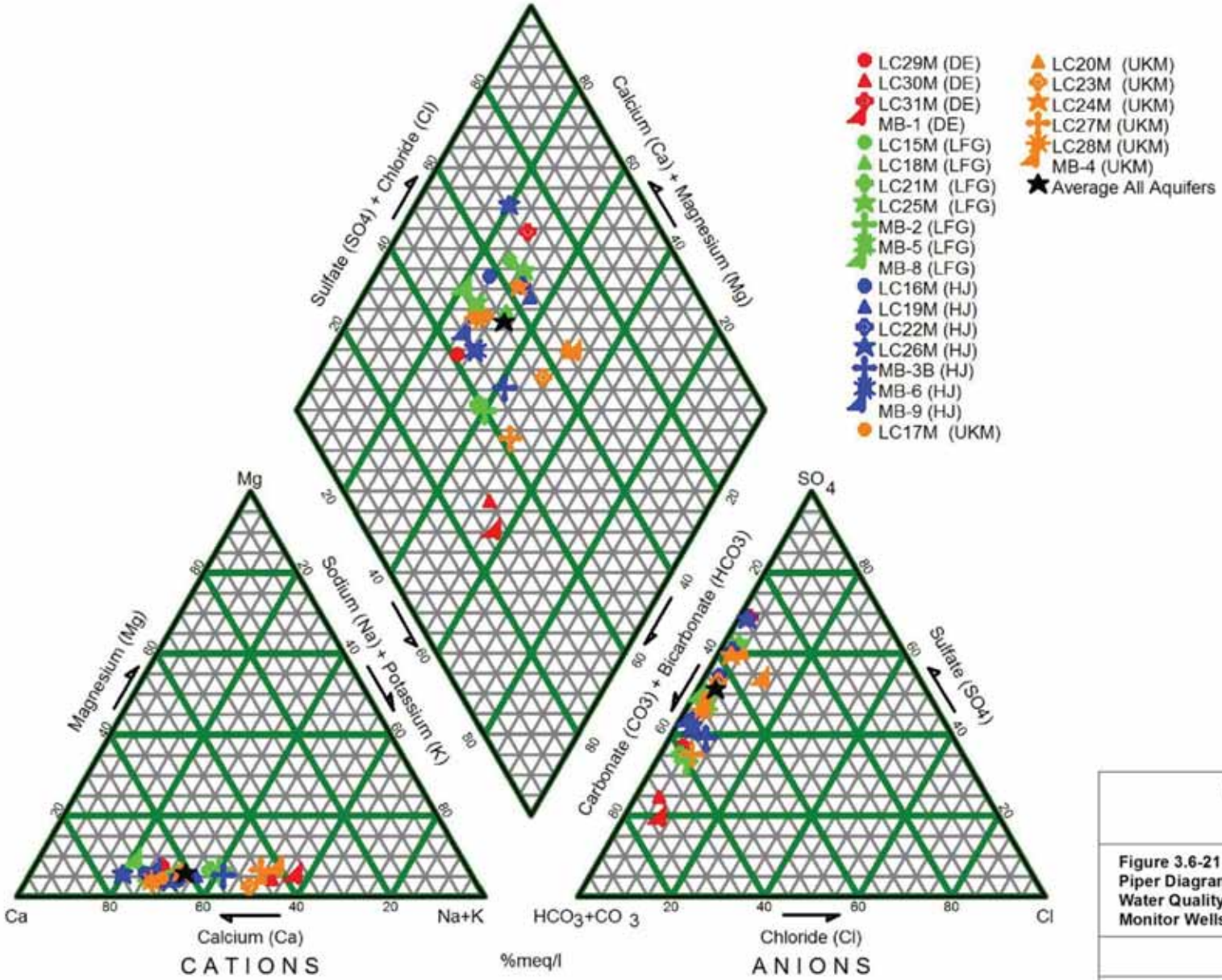
Table 3.6-9 State and Federal Groundwater Quality Criteria for Specified Parameters

Parameter	WQD Class-of-Use Criteria				EPA Drinking Water Criteria		
	Domestic (Class I)	Agriculture (Class II)	Livestock (Class III)		MCL	Treatment Action Level	Secondary Standard
Aluminum	--	5.0	5.0		--	--	0.05 to 0.2
Ammonia	0.5	--	--		--	--	--
Arsenic	0.05	0.1	0.2		0.010	--	--
Barium	2.0	--	--		2.0	--	--
Boron	0.75	0.75	5.0		--	--	--
Cadmium	0.005	0.01	0.05		0.005	--	--
Chloride	250.0	100.0	2000.0		--	--	250.0
Chromium	0.1	0.1	0.05		0.005	--	--
Copper	1.0	0.2	0.5		--	1.0	--
Fluoride	4.0	--	--		4.0	--	2.0
Gross Alpha (pCi/L, including Ra-226, excluding Radon and Uranium)	15.0	15.0	15.0		15.0	--	--
Lead	0.015	5.0	0.1		--	0.015	--
Manganese	0.05	0.2	--		0.05	--	--
Mercury	0.002	--	0.00005		0.002	--	--
Nickel	--	0.2	--		--	--	--
Nitrate	10.0	--	--		10.0	--	--
pH (SU)	6.5 - 8.5	4.5 - 9.0	6.5 - 8.5		--	--	6.5 - 8.5
Ra-226+Ra-228 (pCi/L)	5.0	5.0	5.0		5.0	--	--
Selenium	0.05	0.02	0.05		0.05	--	--
Sulfate	250.0	200.0	3000.0		--	--	250.0
TDS	500.0	2000.0	5000.0		--	--	500.0
Uranium	--	--	--		0.03	--	--
Vanadium	--	0.1	0.1		--	--	--
Zinc	5.0	2.0	25.0		--	--	5.0

All concentrations are in mg/L unless otherwise noted. Dashes indicate no criteria have been established.

WQD Class-of-Use criteria are from Table I in Chapter 8 (Quality Standards for Wyoming Groundwater) of the WQD Rules and Regulations, available at http://deq.state.wy.us/wqd/WQDrules/Chapter_08.pdf, accessed on November 3, 2008.

EPA Drinking Water Criteria are from http://www.epa.gov/safewater/consumer/pdf/mcl.pdf, accessed on November 3, 2008.

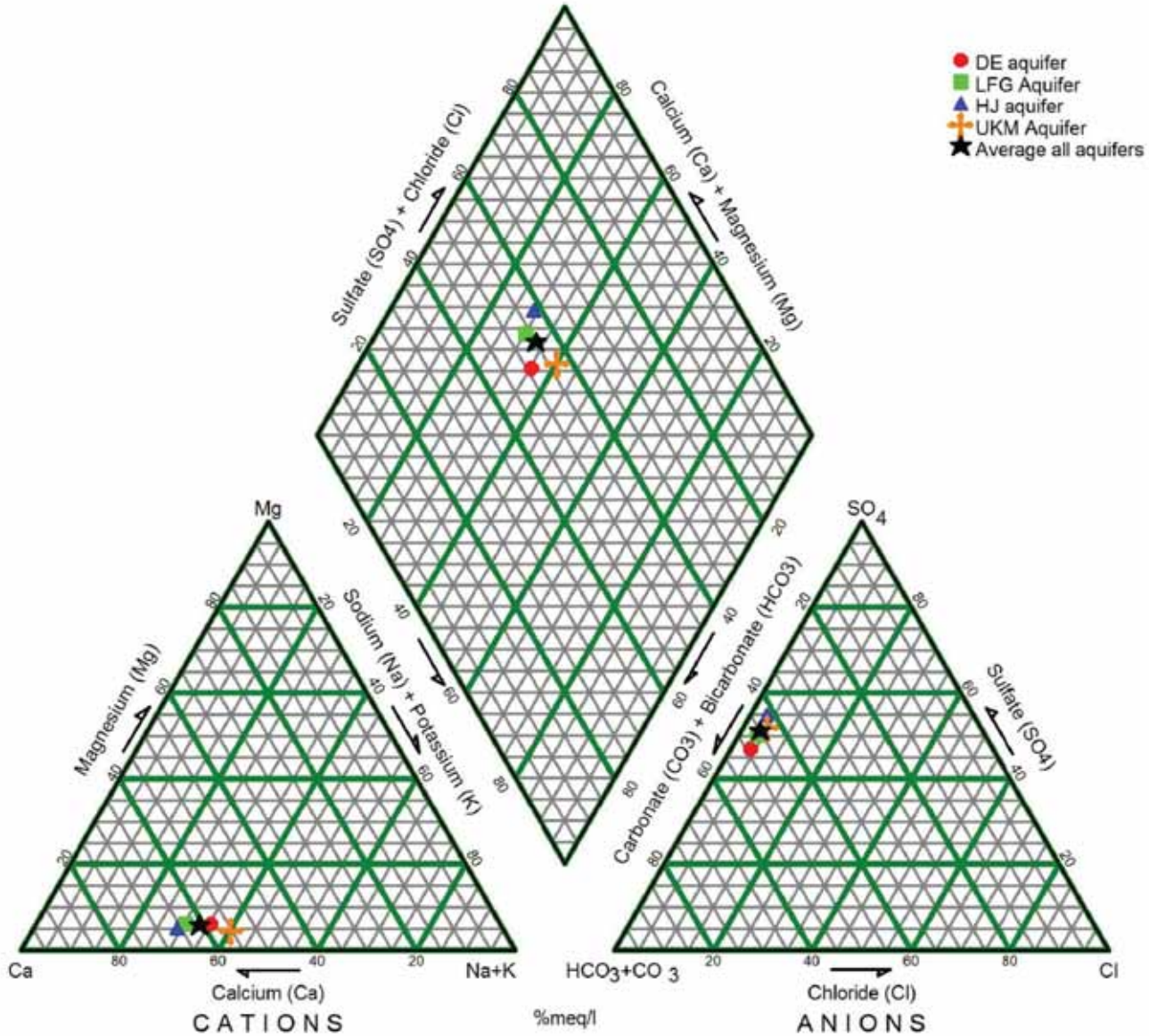


Lost Creek Uranium *In-Situ* Recovery Project

Sweetwater County, WY

Figure 3.6-21
Piper Diagram – Average Water Quality at Individual Monitor Wells

No warranty is made by the BLM for use of the data for purposes not intended by BLM

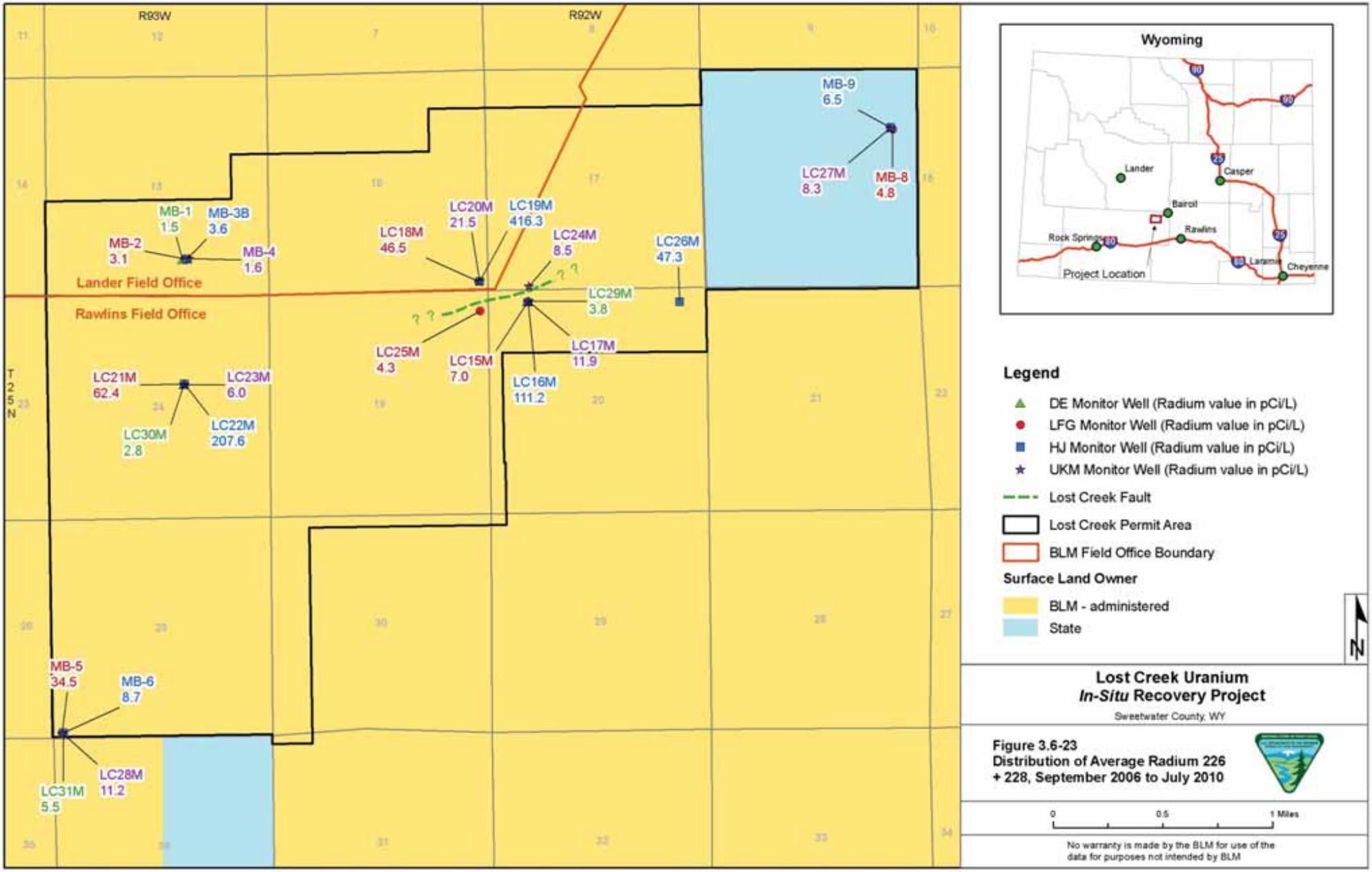


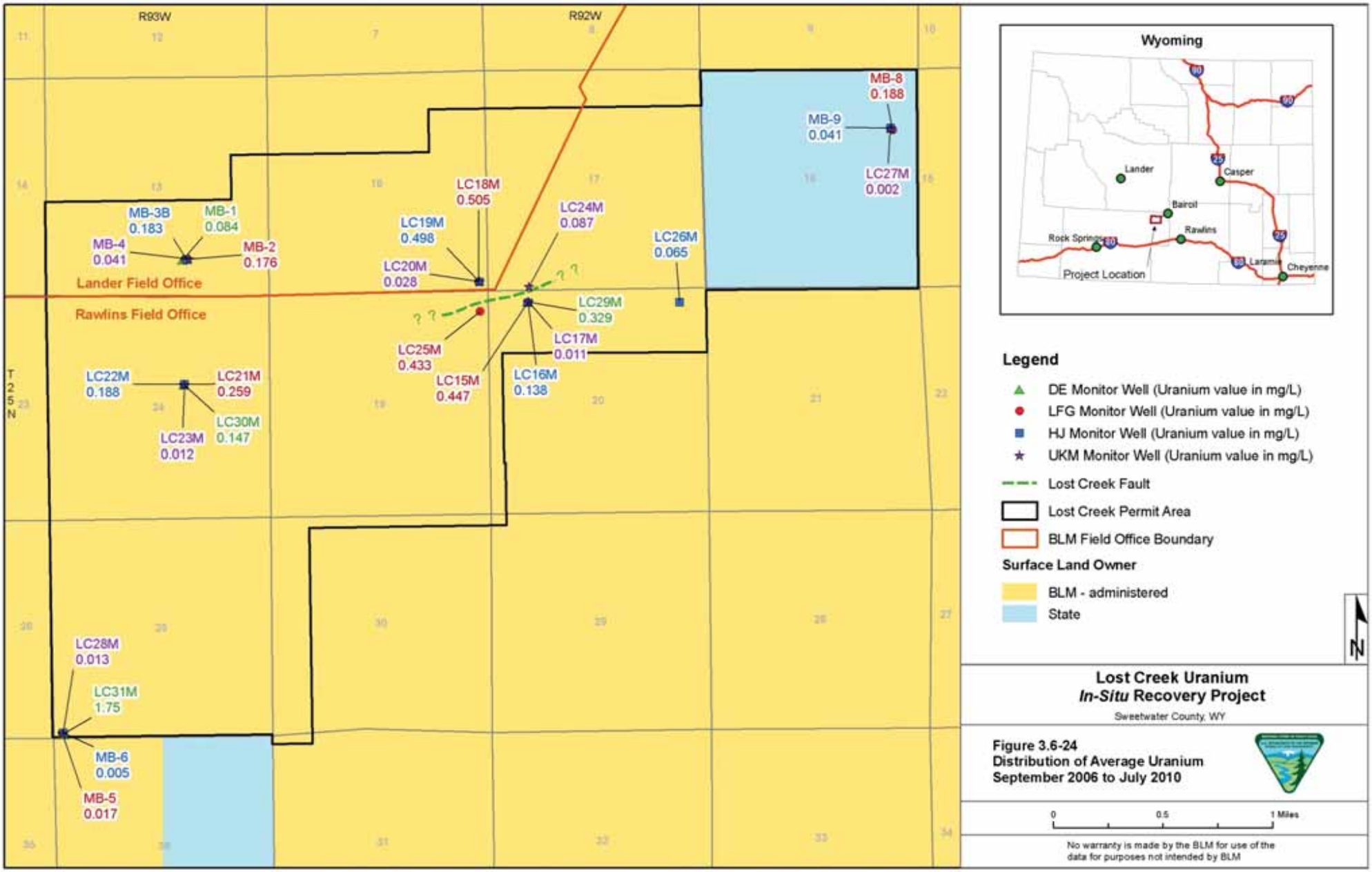
Lost Creek Uranium *In-Situ* Recovery Project

Sweetwater County, WY

Figure 3.6-22
Piper Diagram – Average Water Quality in Aquifer of Interest

No warranty is made by the BLM for use of the data for purposes not intended by BLM


R93W
R92W
T 25 N
Lander Field Office
Rawlins Field Office
MB-1 1.5
MB-3B 3.6
MB-2 3.1
MB-4 1.6
LC18M 46.5
LC20M 21.5
LC19M 416.3
LC24M 8.5
LC26M 47.3
MB-9 6.5
LC27M 8.3
MB-8 4.8
LC29M 3.8
LC25M 4.3
LC15M 7.0
LC16M 111.2
LC17M 11.9
LC21M 62.4
LC23M 6.0
LC30M 2.8
LC22M 207.6
MB-5 34.5
MB-6 8.7
LC28M 11.2
LC31M 5.5
Wyoming
Lander
Casper
Bairoil
Rawlins
Rock Springs
Laramie
Cheyenne
Project Location
Legend
DE Monitor Well (Radium value in pCi/L)
LFG Monitor Well (Radium value in pCi/L)
HJ Monitor Well (Radium value in pCi/L)
UKM Monitor Well (Radium value in pCi/L)
Lost Creek Fault
Lost Creek Permit Area
BLM Field Office Boundary
Surface Land Owner
BLM - administered
State
N
Lost Creek Uranium
In-Situ Recovery Project
Sweetwater County, WY
Figure 3.6-23
Distribution of Average Radium 226 + 228, September 2006 to July 2010
0
0.5
1 Miles
No warranty is made by the BLM for use of the data for purposes not intended by BLM


R93W
R92W
T25N
Lander Field Office
Rawlins Field Office
MB-8
0.188
MB-9
0.041
LC27M
0.002
LC18M
0.505
LC24M
0.087
LC19M
0.498
LC20M
0.028
LC26M
0.065
MB-3B
0.183
MB-1
0.084
MB-4
0.041
MB-2
0.176
LC29M
0.329
LC17M
0.011
LC25M
0.433
LC15M
0.447
LC16M
0.138
LC22M
0.188
LC21M
0.259
LC30M
0.147
LC23M
0.012
LC28M
0.013
LC31M
1.75
MB-6
0.005
MB-5
0.017
Wyoming
Lander
Casper
Bairoil
Rawlins
Rock Springs
Laramie
Cheyenne
Project Location
Legend
DE Monitor Well (Uranium value in mg/L)
LFG Monitor Well (Uranium value in mg/L)
HJ Monitor Well (Uranium value in mg/L)
UKM Monitor Well (Uranium value in mg/L)
Lost Creek Fault
Lost Creek Permit Area
BLM Field Office Boundary
Surface Land Owner
BLM - administered
State
N
Lost Creek Uranium
In-Situ Recovery Project
Sweetwater County, WY
Figure 3.6-24
Distribution of Average Uranium
September 2006 to July 2010
0
0.5
1 Miles
No warranty is made by the BLM for use of the data for purposes not intended by BLM

A summary of the water quality for each of the four hydrostratigraphic units of interest (DE, LFG, HJ and UKM) is presented below. All metal concentrations are reported as dissolved.

DE Sand

Six wells completed in the DE Sand were included in the baseline sampling program (LC29M, LC30M, LC31M, MB-1, MB-7, and MB-10). Both MB-7 and MB-10 had insufficient water to sample and therefore were not included in the analyses. Sample results from the existing baseline monitor wells are included in **Table 3.6-9**.

Results of the baseline sampling indicate that three of the DE monitor wells (LC29M, LC30M, and MB-1) are calcium bicarbonate water, whereas well LC31M is a calcium sulfate type. Both sulfate and TDS levels in LC31M exceed the WDEQ Class I Standards (250 mg/L and 500 mg/L, respectively). Chloride levels in all four wells are low (12 mg/L or less).

Manganese exceeded the WDEQ Class I Standard (0.05 mg/L) in seven of the 16 samples collected from DE monitor wells. The average detectable manganese value was 0.10 mg/L for the DE monitor wells. The average selenium concentration at well LC31M was 0.172 mg/L, exceeding the WDEQ Class I Standard of 0.05 mg/L.

Iron exceeded the WDEQ Class I Standard (0.3 mg/L) in two of the four samples from LC29M and one of the four samples from MB-1. The average values for the four samples from LC29M and MB-1 were below the standard. Similarly, the average ammonia concentration was below the WDEQ Class I Standard (0.5 mg/L) at well LC29M, although two of the four samples exceeded the standard.

Uranium levels exceeded the EPA MCL in every sample collected from the DE monitor wells except one MB-1 sample collected in August 2009. The average uranium concentration for the 16 samples collected was 0.577 mg/L. Ra-226 exceeded the EPA Radium 226+228 MCL of 5.0 pCi/L in two samples. Combined radium 226+228 exceeded the standard in four of the samples. However, the average radium 226+228 activity for each of the DE monitor wells was below the WDEQ Class I Standard.

LFG Sand

Seven wells completed in the LFG Sand were included in the baseline sampling program (LC15M, LC18M, LC21M, LC25M, MB-2, MB-5, and MB-8). Sample results from the existing baseline monitor wells are included in **Table 3.6-9**.

Results of the baseline sampling indicate that the LFG monitor wells are calcium-bicarbonate to calcium-sulfate water. TDS and sulfate levels are below the

WDEQ Class I Standards (500 mg/L and 250 mg/L, respectively) and chloride levels in all seven wells are low (10 mg/L or less).

Manganese and selenium were below the respective WDEQ Class I Standards in all the LFG samples. Iron exceeded the WDEQ Class I Standard in three out of four samples at LC18M, one out of four samples at LC25M, and in one sample at MB-8 for total iron.

Uranium levels exceeded the EPA MCL in every sample collected from the LFG monitor wells except for samples taken at MB-5. The average uranium concentration for the LFG samples was 0.289 mg/L. Radium levels were widely distributed. At least one sample from all LFG wells exceeded the WDEQ Class I Standard for radium 226+228 except for MB-2.

HJ Horizon

Seven wells completed in the HJ Horizon were included in the baseline sampling program (LC16M, LC19M, LC22M, LC26M, MB-3B, MB-6, and MB-9). Sample results from the existing baseline monitor wells are included in **Table 3.6-9**.

Results of the baseline sampling indicate that the HJ monitor wells are calcium-bicarbonate to calcium-sulfate water. Both sulfate and TDS levels in LC26M exceed the WDEQ Class I Standards (250 mg/L and 500 mg/L, respectively). Chloride levels in all four wells are low (11 mg/L or less).

Manganese and selenium were below the respective WDEQ Class I Standards in all the HJ samples.

Uranium levels exceeded the EPA MCL in every sample collected from the LC16M, LC19M, LC22M, LC26M, and MB-3B monitor wells. Only one sample from MB-9 and no samples from MB-6 exceeded the EPA MCL. The average uranium concentration for the HJ samples was 0.160 mg/L.

UKM Sand

Seven wells completed in the UKM Sand were included in the baseline sampling program (LC17M, LC20M, LC23M, LC24M, LC27M, LC28M, and MB-4). Two of the wells were originally thought to be completed in the HJ Horizon (LC27M and LC28M) but were later reinterpreted as UKM completions. Sample results from the existing baseline monitor wells are included in **Table 3.6-9**.

Results of the baseline sampling indicate that the UKM monitor wells are calcium-bicarbonate to calcium-sulfate water. TDS and sulfate levels are below the WDEQ Class I Standards (500 mg/L and 250 mg/L, respectively) in all but one sample and chloride levels in all seven wells are low (32 mg/L or less).

Manganese and selenium were below the respective WDEQ Class I Standards in all the UKM samples.

Uranium levels exceeded the EPA MCL in some samples collected at LC20M, LC24M, and MB-4. LC17M, LC23M, LC27M, and LC28M did not have any samples that exceeded the uranium EPA MCL. The average uranium concentration for the UKM samples was 0.028 mg/L.

Average radium 226+228 levels exceeded the WDEQ Class I Standard in at least one sample for each of the UKM monitor wells except MB-4.

3.6.4.3 MU1 Groundwater Quality, Ore-Bearing and Associated Aquifers

LCI conducted pre-operational sampling in MU1 in 2009 and 2010. The monitor well locations include the monitor well ring and locations within the pattern area (**Section 2.1.3.2**). During Mine Unit Production, these wells are used to monitor for excursions, i.e., conditions that indicate the production and injection is out of balance, and during Mine Unit Restoration, these wells are used to monitor restoration success. The monitor ring wells are completed in the same sand as the ore zone, and the wells within the pattern area are completed in overlying and underlying aquifers. The locations of the monitor wells are shown on **Figure 3.6-5**.

Per WDEQ-LQD requirements, at least four samples were collected, with at least two weeks between each sampling. The sampling results and associated calculation of Upper Control Limits are included in Attachments MU1 4-1 and 4-2 of the WDEQ-LQD MU1 documents (LCI, 2011b), and the results are analyzed in detail in Section 4.2.2 of the WDEQ-LQD MU1 documents (LCI, 2011b). None of the results indicate that conditions in MU1 are different than what would be anticipated from the site-wide baseline sampling.

3.6.4.4 Site Groundwater Quality, Deeper Formations Evaluated for UIC Class I Wells

Information on the water quality in the deeper formations that were evaluated for UIC Class I wells was obtained by a variety of methods, including sampling and evaluation of geophysical logs. In addition, the Wyoming Oil and Gas Conservation Commission website and USGS Produced Waters Database were reviewed for pertinent information. The results are summarized below and are described in more detail in the WDEQ-WQD application for the UIC Class I wells, which is included as Attachment ADJ-2 to the WDEQ-LQD Permit to Mine (LCI, 2011b).

In the target formation, the Fort Union Formation, samples were collected at multiple intervals in the test well, which is the deep well in the southwest corner

of the Permit Area (**Figure 1.2-2**). The samples were collected by cased-hole formation sampling at discrete intervals within the Fort Union Formation, and after casing perforation, samples of water produced from the well were collected, which are representative of the composite fluid from the perforated intervals. The sample results indicated an average TDS concentration just under 14,000 mg/L; concentrations of several inorganic parameters (mercury, manganese, barium, lead, arsenic, and iron) exceeded groundwater quality standards; and gross alpha and radium-226+228 concentrations exceeded groundwater quality standards. Volatile organic compounds were also detected, which was not unexpected as there is hydrocarbon production from this formation elsewhere in the Basin.

Information from the databases was limited in the vicinity of the Permit Area. Most of the data were from distant parts of the Basin, e.g., from areas proximate to oil and gas production or from the Basin margins, representing a wide range of formation depths and hydrogeologic conditions. Therefore, the water quality in the deeper formations was estimated using data from geophysical logs from two wells within about four miles of the Permit Area. These estimates are included in **Table 3.6-10**.

Table 3.6-10 Summary of Stratigraphy and Water Quality

Summary of Stratigraphy and Water Quality – Lost Creek Permit Area (Based on Lost Creek Test Well No. 1, Stratton 1-21 Well, and Federal 32-22 Well)		
Formation	***Depth (feet)***	***Estimated Water Quality***
Wasatch / Battle Spring Formation[1]	GS – 6,158	300 mg/L (shallow) – 4,000 mg/L TDS
Fort Union Formation[1]	6,158 – 11,000 (estimated)	13,945 mg/L TDS (average from testing at TW1)
Lance Formation[2]	9,150 – 11,960	6,700 – 60,000 ppm NaCl[3]
Fox Hills Sandstone[2]	11,960 – 12,635	12,100 – 12,800 ppm NaCl
Lewis Shale[2]	12,635 – 14,010	10,000 – 36,000 ppm NaCl
Mesaverde Formation[2]	14,010 – 16,000 (estimated)	15,500 – 42,000 ppm NaCl

Notes:
[1] – Formation depths from logging data at TW1; water quality from cased-hole formation testing conducted at TW1.
[2] – Formation depths from Stratton 1-21 well, located 4 miles southwest of Lost Creek, where stratigraphic section is approximately 2,000 feet shallower. Water quality data represents range of water quality calculations (as ppm NaCl) from resistivity and porosity data in sand intervals from Stratton 1-21 Well and Federal 32-22 Well.
[3] – Presence of gas observed in sand intervals in the Lance which results in lower calculated NaCl concentrations.