WATER QUALITY MEMORANDUM

Utah Coal Regulatory Program

August 9, 2006

TO: Internal File

THRU: D. Wayne Hedberg, Permit Supervisor

FROM: Dana Dean, P.E., Senior Reclamation Hydrologist

RE: 2005 Fourth Quarter Water Monitoring, Canyon Fuel Company, LLC, Skyline Mine, C/007/0005-WQ-05-4, Task #2414

The Skyline Mine is an operating longwall mine. Current operations are in the North Lease area of the mine. Many mined-out areas of the mine have been sealed-off. Water monitoring requirements can be found in Section 2, especially pages 2-36, 2-36a, 2-36b, 2-37, 2-37a, and 2-39aa of the MRP.

1. Was data submitted for all of the MRP required sites? YES ☒ NO ☐

Springs

The MRP requires fall sampling at 25 springs (S10-1, S12-1, S13-2, S13-7, S14-4, S15-3, S17-2, S22-5, S22-11, S23-4, S24-1, S24-12, S26-13, S34-12, S35-8, S36-12, 2-413, 3-290, 8-253, WQ1-39, WQ3-6, WQ3-26, WQ3-41, WQ3-43, and WQ4-12).

The Permittee submitted all required samples for the spring sites.

Streams

The MRP requires fall sampling at 43 stream-sites (CS-1, CS-3, CS-4, CS-6, CS-7, CS-8, CS-9, CS-10, CS-11, CS-12, CS-13, CS-14, CS-15, CS-16, CS-17, CS-18, CS-19, CS-20, CS-21, CS-22, CS-23, MD-1, SRD-1, F-9, F-10, UP&L-10, VC-6, VC-9, VC-10, VC-11, VC-12, MC-1, MC-2, MC-3, MC-4, MC-5, MC-6, WRDS-1, WRDS-2, WRDS-3, WRDS-4, EL-1, and EL-2).

The Permittee submitted all required samples for the stream sites.

Wells

The MRP requires fall sampling at 18 wells (JC-1, JC-3, ELD-1, W79-10-1-B, W79-14-2A, W79-26-1, W79-35-1A, W79-35-1B, W2-1, W20-4-1, W20-4-2, W99-4-1, W99-21-1, W99-28-1, W20-28-1, 91-26-1, W91-35-1, and 92-91-03).

The Permittee submitted all required samples for the well sites.

UPDES

The UPDES Permit/MRP require weekly monitoring of 3 outfalls: 001, Sedimentation Pond Discharge to Eccles Creek at the Portal; 002, Sedimentation Pond Discharge to Eccles Creek at the Loadout; and 003, the Sedimentation Discharge at the Waste Rock Disposal Site. Well JC-3 is permitted as a UPDES point, but PacifiCorp is the Permittee, and JC-3 has not discharged since July of 2004.

The Permittee submitted all required samples for the UPDES sites. Only outfall 001 reported flow.

2. Were all required parameters reported for each site? YES ☐ NO ☒

The Permittee failed to report several parameters, as listed on the attached sheets. These omissions were included in N06-39-3-1 (April 25, 2006). The Permittee indicated in a letter dated April 26, 2006 that they did not believe they had any of these missing parameters, and therefore would not be able to submit them.

3. Were any irregularities found in the data? YES ☒ NO ☐

Several parameters fell outside of two standard deviations from the mean encountered at the respective sites. They were:

Site	Parameter	Value	Standard Deviations from Mean	Mean
CS-1	Air Temperature	-7 °C	2.97	12.76 °C
CS-3	Dissolved Calcium	100 mg/L	2.33	75.49 mg/L
CS-3	Chloride	65 mg/L	3.06	14.61 mg/L
CS-3	Total Hardness	330 mg/L	2.00	270.50 mg/L
CS-3	Total Dissolved Solids	384 mg/L	2.13	269.34 mg/L
CS-3	Cation/Anion Balance	3.4 %	2.19	1.19 %
CS-3	Air Temperature	-3 °C	2.44	12.61 °C
CS-6	Dissolved Potassium	11.4 mg/L	2.21	5.20 mg/L
CS-6	Sulfate	407 mg/L	2.79	128.75 mg/L
CS-9	Air Temperature	-4 °C	2.36	13.17 °C
CS-10	Air Temperature	0 °C	2.03	14.35 °C
CS-11	Turbidity	27.8 NTU	2.52	8.77 NTU
CS-11	Cation/Anion Balance	3.1 %	2.05	1.23 %
CS-12	Specific Conductivity	2900 µmhos/cm	3.55	1026.63 µmhos/cm
CS-12	Dissolved Calcium	236 mg/L	2.71	93.34 mg/L
CS-12	Dissolved Magnesium	150 mg/L	2.61	55.57 mg/L
CS-12	Dissolved Potassium	27.4 mg/L	2.86	9.83 mg/L
CS-12	Sulfate	1174 mg/L	3.47	369.61 mg/L

CS-12	Total Hardness	1207 mg/L	2.91	461.71 mg/L
CS-12	Total Dissolved Solids	2167 mg/L	3.16	824.89 mg/L
CS-12	Total Cations	33.3 meq/L	2.29	17.57 meq/L
CS-12	Total Anions	36.1 meq/L	2.23	18.56 meq/L
CS-14	Cation/Anion Balance	4.5 %	2.05	1.50 %
CS-18	Specific Conductivity	210 µmhos/cm	2.10	287.5 µmhos/cm
CS-20	Cation/Anion Balance	4.0%	2.15	1.26 %
VC-6	Cation/Anion Balance	4.6 %	2.33	1.38
VC-9	Sulfate	396 mg/L	2.61	130.76 mg/L
MC-2	Dissolved Oxygen	8.38 mg/L	2.31	7.32 mg/L
MC-3	Dissolved Oxygen	9.64 mg/L	5.87	7.23 mg/L
MC-4	Dissolved Oxygen	9.04 mg/L	3.00	7.44 mg/l
MC-5	Dissolved Oxygen	9.79 mg/L	2.50	7.87 mg/L
S10-1	Total Dissolved Solids	184 mg/L	2.52	103.43 mg/L
S13-2	Air Temperature	-3 °C	3.15	14.12 °C
S17-2	Air Temperature	-2 °C	2.66	15.36 °C
S24-12	Air Temperature	-7 °C	2.69	12.63 °C
2-413	Specific Conductivity	307 µmhos/cm	2.09	369.85 µmhos/cm
WQ3-41	Dissolved Magnesium	31.9 mg/L	2.34	27.08 mg/L
92-91-03	Cation/Anion Balance	4.6 %	2.06	1.31 %
JC-1	Water Temperature	7.9 °C	13.2	13.48 °C
JC-1	Specific Conductivity	303 µmhos/cm	3.02	348.5 µmhos/cm
W20-4-2	Depth	1099.18 feet	3.58	1145.78 feet
W99-28-1	Depth	964.57 feet	2.35	993.68 feet
UT0023540-001, 12/21	Total Iron	2.37 mg/L	2.97	0.42 mg/L

Air and water temperature are very flux parameters that not surprisingly have values outside of two standard deviations at some sites. This winter was a bit colder than some of the more recent ones and therefore some colder than usual temperatures were recorded.

The cation/anion balance at SW-1, SW-2A, GW-9B, and GW-15B is both outside 2 standard deviations, and above the 5% attention value. It is not clear why it is so high at so many sites, but as discussed below, it is something that the Permittee should be able to explain.

There is a fairly strong upward trend in chloride at CS-3 ($R^2 = 0.627$), with no real correlation to flow. The drinking water criterion for chloride is 250 mg/L. The criteria for protection of aquatic life are 600 mg/L for short-term exposure, and 1200 mg/L for long-term exposure. The levels of chloride recorded at CS-3 are well below any of these levels, and regardless of the origin, they are not of concern at this time.

The water elevation was higher than usual at W20-4-2 and W99-28-1. There is a fairly strong overall upward trend at W20-4-2 (R^2= 0.494, 0.926 since southwest mine workings allowed to flood), and a slight overall upward trend at W99-28-1 (R^2= 0.181,

0.971 since southwest mine workings allowed to flood). The Permittee suggests that it is possibly due to recovery of the Storr's Sandstone after the mine was flooded. Both wells have only been monitored since 2002. The initial level at W20-4-2 was 8420.53 feet, and at W99-28-1 it was 8377.3 feet. This quarter's elevations are 8454.82 feet, and 8386.43 feet, respectively. This is a positive sign for the hydrologic balance in the area.

The dissolved calcium has a somewhat strong upward trend at CS-12 (R^2= 0.334), and no real trend at CS-3 (R^2 = 0.072). There is a weak positive correlation to flow at CS-12, and no real correlation to flow at CS-3. This is the highest reading ever at both sites. There are no criteria for this metal, but it does contribute to water hardness. The Permittee has not always sampled for hardness, so the Division had to use calculated hardness for some samples. The hardness at these sites has always fallen into the hard (150-300 mg/l) to very hard (>300 mg/l) classifications. It is not completely clear why the calcium level has been increasing, but this does not represent a degradation of water quality.

The dissolved magnesium has a fairly strong upward trend at CS-12, and WQ3-41 (R^2= 0.454, and 0.475). There is a weak positive correlation to flow at both sites. This is the highest value ever recorded at both sites. There are no criteria for this metal, but it does contribute to water hardness. The Permittee has not always sampled for hardness, so the Division had to use calculated hardness for some samples. The hardness at these sites has always fallen into the hard (150-300 mg/l) to very hard (>300 mg/l) classifications. It is not completely clear why the magnesium level has been increasing at these two sites, but this does not represent a degradation of water quality.

The dissolved oxygen was unusually high at MC-2, 3, 4, and 5. None of the readings is outside of acceptable levels, and therefore are not of a concern at this time.

There is a fairly strong upward trend in the dissolved potassium at CS-12 and CS-6 (R^2= 0.526, 0.425). There is a very weak positive correlation to flow at CS-12 and none at CS-6. This is the highest reading ever at CS-12. There are no standards for this metal, and 27.4 mg/L, and 11.4 mg/L are still relatively low numbers. This does not represent degradation of water quality.

There is a strong to fairly strong upward trend in the specific conductivity at CS-12 (R^2= 0.375), with no real correlation to flow. There is a weaker downward trend in the specific conductivity at CS-18 (R^2= 0.239), with no real correlation to flow. At 2-413, and JC-1 there is no real trend in the specific conductivity (R^2= 0.082, 0.079), but at JC-1 there is a fairly strong positive correlation to flow. There is no standard for specific conductivity, but it is closely related to total dissolved solids (TDS). Where the readings are below the average recorded at the site (CS-18, 2-413, and JC-1), the number of samples is low, and a lower number of TDS is an improvement in water quality. The TDS at CS-12 will be discussed in the next paragraph.

There is a strong to fairly strong upward trend in TDS at CS-12 (R^2= 0.436), with no real correlation to flow. There is a weak upward trend in TDS at CS-3, and S10-1

(R^2= 0.102, 0.229), with no real correlation to flow at CS-3, but a weak negative correlation to flow at S10-1. The TDS at CS-12 has almost always been above the secondary drinking water standard of 500 mg/L (75% of the 154 samples), and periods of high TDS have generally been followed by periods of low TDS. At CS-3, and S10-1 the values have always been, and remain below 500 mg/L.

There is a strong upward trend in total cations and total anions at CS-12. These directly relate to the amount of total dissolved solids.

There is a weak upward trend in sulfate at VC-9, CS-6, and CS-12 (R^2= 0.297, 0.353 and 0.259). There is no real correlation to flow for any of the sites. Though the sulfate readings are rather high, there is no indication of acid mine drainage (AMD), since the pH has remained at or above 7, there is alkalinity (>243 mg/L), and the levels of iron, manganese and aluminum have remained low. Sulfate is not toxic to plants or animals (even at very high concentration), but has a cathartic effect on humans in concentrations over 500 mg/L. For this reason, the EPA has set the secondary standard as 250 mg/L. The sulfate at CS-6 has been greater than 250 mg/L in just 12% of the samples, mostly since 1991. At VC-9 it has been greater than 250 mg/L in just 14% of the samples, scattered throughout the sampling period. At CS-12 it has been greater than 250 mg/L in 66% of the samples, many dating to the beginning of the sampling period. The sulfate tends to dilute when introduced into Eccles Creek and by the time it gets to CS-6 is about 30% of the value at CS-12, while the alkalinity remains at about 61% of the CS-12 value. The Division will continue to closely monitor the trend of this parameter.

There is a fairly strong upward trend in total hardness at CS-12 (R^2 = 0.441), with no real correlation to flow. There is no real trend in the hardness at CS-3 (R^2 = 0.008), with a weak positive correlation to flow. The Permittee has not always sampled for hardness, so the Division had to use calculated hardness for some samples. The hardness at these two sites has always fallen into the hard (150-300 mg/l) to very hard (>300 mg/l) classifications.

There is no trend in the turbidity readings at CS-11. There is no water quality standard for turbidity, but it closely relates to the amount of solids in the water, particularly TSS. The TSS at CS-11 was within acceptable ranges this quarter.

Several routine Reliability Checks were outside of standard values. They were:

Site	Reliability Check	Value Should Be...	Value is...
CS-1	TDS/Conductivity	>0.55 & <0.75	0.95
CS-1	Conductivity/Cations	>90 & < 110	53
CS-1	K/(Na + K)	< 20%	23%
CS-3	Conductivity/Cations	>90 & < 110	72
CS-3	Na/(Na + Cl)	> 50%	25%
CS-4	Na/(Na + Cl)	> 50%	43%

CS-6	TDS/Conductivity	>0.55 & <0.75	0.76
CS-6	Conductivity/Cations	>90 & < 110	88
CS-6	Mg/(Ca + Mg)	< 40 %	55%
CS-6	Ca/ (Ca + SO4)	> 50 %	34%
CS-9	TDS/Conductivity	>0.55 & <0.75	84
CS-9	Conductivity/Cations	>90 & < 110	64
CS-11	Conductivity/Cations	>90 & < 110	76
CS-11	Na/(Na + Cl)	> 50%	48%
CS-12	Conductivity/Cations	>90 & < 110	87
CS-12	Mg/(Ca + Mg)	< 40 %	51%
CS-12	Ca/ (Ca + SO4)	> 50 %	33%
CS-13	Na/(Na + Cl)	> 50%	47%
CS-14	Mg/(Ca + Mg)	< 40 %	48%
CS-14	Ca/ (Ca + SO4)	> 50 %	42%
CS-19	Cation/Anion Balance	< 5%	5.6%
CS-19	Conductivity/Cations	>90 & < 110	78
CS-20	Conductivity/Cations	>90 & < 110	73
CS-20	K/(Na + K)	< 20%	20%
CS-21	Conductivity/Cations	>90 & < 110	76
MD-1 10/26	Mg/(Ca + Mg)	< 40 %	50%
MD-1 10/26	Ca/ (Ca + SO4)	> 50 %	38%
F-10 10/18	Conductivity/Cations	>90 & < 110	85
F-10 10/18	K/(Na + K)	< 20%	26%
UPL-10	Conductivity/Cations	>90 & < 110	82
UPL-10	Na/(Na + Cl)	> 50%	32%
VC-6	Mg/(Ca + Mg)	< 40 %	52%
VC-6	Ca/ (Ca + SO4)	> 50 %	36%
VC-9	Conductivity/Cations	>90 & < 110	86
VC-9	Mg/(Ca + Mg)	< 40 %	52%
VC-9	Ca/ (Ca + SO4)	> 50 %	37%
VC-10	Conductivity/Cations	>90 & < 110	77
VC-10	K/(Na + K)	< 20%	22%
MC-1	TDS/Conductivity	>0.55 & <0.75	0.77
MC-3	TDS/Conductivity	>0.55 & <0.75	0.77
MC-4	TDS/Conductivity	>0.55 & <0.75	0.75
S10-1	TDS/Conductivity	>0.55 & <0.75	0.88
S10-1	Conductivity/Cations	>90 & < 110	70
S10-1	K/(Na + K)	< 20%	39%
S10-1	Na/(Na + Cl)	> 50%	44%
S13-7	Conductivity/Cations	>90 & < 110	70
S13-7	K/(Na + K)	< 20%	22%
S17-2	Conductivity/Cations	>90 & < 110	84
S17-2	Mg/(Ca + Mg)	< 40 %	41%
S17-2	Na/(Na + Cl)	> 50%	46%

Parameters missing from the Skyline Mine water monitoring data (for fourth quarter, 2005) as of the end of business on 4/14/06.

See MRP pages 2-36, incorporated Dec. 2, 2005; 2-36a, and 2-36b incorporated August 29, 2005; pages 2-37, and 2-37a incorporated January 6, 2005; and page 2-39-aa incorporated April 24, 2001 for protocols and requirements.

CS-4 dissolved iron dissolved manganese turbidity	Protocol **A 1, 2, 6, 7** **1** requires "water quality field and operational laboratory measurements" Table 2.3.7-2 incorporated Jan. 6, 2005 includes both dissolved iron and dissolved manganese as laboratory parameters for Oct.-Nov. sampling
CS-3 dissolved manganese	Protocol **A 1, 2, 6, 7**
CS-9 dissolved manganese	Protocol **A 1, 2, 6, 7**
CS-11 dissolved manganese	Protocol **A 1, 2, 6, 7**
CS-7 turbidity	Protocol **A 12** **12** requires "Field parameters only" Table 2.3.7-2 incorporated Jan. 6, 2005 includes turbidity as a required field parameter for Oct.-Nov. sampling
CS-8 turbidity	Protocol **A 12**
CS-10 turbidity	Protocol **A 12**
S15-3 turbidity	Protocol **A 12, G 13**
S24-12 turbidity	Protocol **A 12**
S26-13 turbidity	Protocol **A 12**
S34-12 turbidity	Protocol **A 12**

S35-8 turbidity	Protocol **A 12**
S36-12 turbidity	Protocol **A 12**
CS-16 turbidity	Protocol **A 12**
CS-17 turbidity	Protocol **A 12**
CS-18 turbidity	Protocol **A 12**
S13-2 turbidity	Protocol **A 12**
S14-4 turbidity	Protocol **A 12**
S22-5 turbidity	Protocol **A 12**
S22-11 turbidity	Protocol **A 12**
S23-4 turbidity	Protocol **A 12**
F-10 dissolved iron dissolved manganese	Protocol **A 1, 2, C** **1** requires "water quality field and operational laboratory measurements" Table 2.3.7-2 incorporated Jan. 6, 2005 includes both dissolved iron and dissolved manganese as laboratory parameters for Oct.-Nov. sampling
JC-1 total suspended solids **carbon-14** **oxygen-18** **deuterium** **tritium**	Protocol **A 5, B** **5** requires "Seasonal flow, TDS, TSS, and total phosphorous, C14, tritium, and stable isotopes deuterium and oxygen 18" **(lab is behind on processing ^{14}C, ^{18}O, ^{2}H, ^{3}H – not necessarily in Permittee's control)**

CS-6 dissolved manganese	Protocol **A' 1, 2, 3, 6, 7, 10** **1** requires "water quality field and operational laboratory measurements" Table 2.3.7-2 incorporated Jan. 6, 2005 includes dissolved manganese as a laboratory parameter for Oct.-Nov. sampling
CS-12 dissolved manganese	Protocol **A' 1, 2, 3, 6, 7**
CS-13 dissolved iron dissolved manganese	Protocol **A' 1, 2, 3, 6, 7**
CS-14 dissolved manganese	Protocol **A' 1, 2, 3, 6, 7**
UP&L-10 dissolved iron dissolved manganese	Protocol **A 1, 2** **1** requires "water quality field and operational laboratory measurements" Table 2.3.7-2 incorporated Jan. 6, 2005 includes both dissolved iron and dissolved manganese as laboratory parameters for Oct.-Nov. sampling
S10-1 dissolved iron dissolved manganese turbidity	Protocol **A 1, 2** Table 2.3.7-2 incorporated Jan. 6, 2005 also includes turbidity as a field parameter for Oct.-Nov. sampling
S13-7 dissolved iron dissolved manganese	Protocol **A 1, 2**
WQ1-39 dissolved iron dissolved manganese turbidity	Protocol **A 1, 2**
WQ3-26 dissolved iron dissolved manganese turbidity	Protocol **A 1, 2**
WQ3-41 dissolved iron	Protocol **A 1, 2**

dissolved manganese
turbidity

WQ3-43 Protocol **A 1, 2**
dissolved iron
dissolved manganese

WQ3-6 Protocol **A 1, 2**
dissolved iron
dissolved manganese

WQ4-12 Protocol **A 1, 2**
dissolved iron
dissolved manganese

CS-19 Protocol **A 1, 2**
dissolved iron
dissolved manganese

CS-20 Protocol **A 1, 2**
dissolved iron
dissolved manganese

CS-21 Protocol **A 1, 2**
dissolved iron
dissolved manganese

VC-9 Protocol **A' 1, 2, 3, 6, 7, 8, 9**
dissolved manganese **1** requires "water quality field and operational laboratory
total phosphorous measurements" Table 2.3.7-2 incorporated Jan. 6, 2005
includes dissolved manganese as a laboratory parameter for
Oct.-Nov. sampling
8 requires "Also total phosphorous"

VC-6 Protocol **A' 1, 2, 3, 6, 7, 9**
dissolved manganese **1** requires "water quality field and operational laboratory
measurements" Table 2.3.7-2 incorporated Jan. 6, 2005
includes dissolved manganese as a laboratory parameter for
Oct.-Nov. sampling

2-413 Protocol **A 12, 13**
turbidity **12** requires "Field parameters only"
Table 2.3.7-2 incorporated Jan. 6, 2005 includes turbidity
as a required field parameter for Oct.-Nov. sampling

F-9 (October) turbidity	Protocol **C 12** **12** requires "Field parameters only" Table 2.3.7-2 incorporated Jan. 6, 2005 includes turbidity as a required field parameter for Oct.-Nov. sampling
S24-1 dissolved iron dissolved manganese tritium	Protocol **A 1, 2, 13** **1** requires "water quality field and operational laboratory measurements" Table 2.3.7-2 incorporated Jan. 6, 2005 includes both dissolved iron and dissolved manganese as laboratory parameters for Oct.-Nov. sampling **13** requires tritium (lab may be behind on processing, but CFC has not indicated that, nor asked for additional time on this one)
MC-1 flow	Protocol **A' 4** **4** requires "seasonal flow, TDS, TSS, and total phosphorous"
MC-2 flow	Protocol **A' 4**
MC-3 flow	Protocol **A' 4**
MC-4 flow	Protocol **A' 4**
MC-5 flow	Protocol **A' 4**
MC-6 flow	Protocol **A' 4**
92-91-03 air temp. lab sp. cond.	Protocol listed in Table 2.3.7-5, air temp. required as a field parameter specific conductivity required as a lab measurement in addition to the field measurement