WATER QUALITY MEMORANDUM

Utah Coal Regulatory Program

September 12, 2007

TO: Internal File

THRU: Pamela Grubaugh-Littig, Permit Supervisor

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

RE: 2006 Second Quarter Water Monitoring, Nevada Electric Investment Corporation, Wellington Preparation Plant, C/007/0012-WQ-06-2, Task ID #2595

The Wellington Preparation Plant is currently idle. No mining or coal processing activities currently take place there, nor is the site in active reclamation.

Pertinent water monitoring requirement information is in the MRP in Sections 7.23, and 7.31.2-22, and tables 7.24-2, and 7.24-5.

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

Springs –

The Permittee is not required to monitor any springs at the Wellington Preparation Plant.

Streams –

The Permittee is required to sample SW-1, SW-2A, SW-3, SW-4, SW-5, SW-6, SW-7, and SW-8 for flow, and the laboratory parameters outlined in Table 7.24-5 each quarter. They are to sample SW-2 for flow-only each quarter.

The Permittee monitored and reported the essential data for all streams as required during this quarter.

Wells–

The Permittee is required to sample GW-1, GW-3, GW-4, GW-6, GW-7, GW-8. GW-9, GW-9B, GW-10, GW-12, GW-13, GW-14, GW-15A, GW-15B, GW-16, and GW-17 for depth, and the laboratory parameters outlined in Table 7.24-2 each quarter. They are to sample GW-2 for depth-only each quarter.

The Permittee monitored and reported the essential data for all wells as required during this quarter.

UPDES–

There are six active UPDES sites at the Wellington Preparation Plant. They are all under the permit #UTG040010, and include outfalls 003, 004, 005, 006, 007, and 008. The Permittee is required to monitor each UPDES site monthly.

The Permittee monitored and reported the essential data for all UPDES sites as required during this quarter. None of the UPDES sites recorded any flow during the period.

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

There was not enough water at GW-3, GW-13, or GW-17 to properly purge/sample. For this reason, the Permittee was unable to sample the water, and only recorded depth information.

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

Several parameters fell outside of 2 standard deviations from the mean encountered at the respective sites. They were:

Site	Parameter	Value	Standard Deviations from Mean	Mean
SW-1	Dissolved Potassium	2.16 mg/L	2.00	6.41 mg/L
GW-9B	Dissolved Potassium	13.2 mg/L	2.52	7.83 mg/L
GW-9B	Total Cations	172.2 meq/L	2.02	143.55 meq/L
GW-9B	Total Anions	181.1 meq/L	2.06	143.82 meq/L
GW-12	Dissolved Potassium	20.7 mg/L	2.12	12.49 mg/L
GW-15B	Dissolved Calcium	539 mg/L	4.34	384.63 mg/L
GW-15B	Dissolved Magnesium	198 mg/L	4.79	150.11 mg/L
GW-15B	Dissolved Potassium	7.85 mg/L	2.12	5.77 mg/L
GW-15B	Dissolved Sodium	308 mg/L	2.48	273.67 mg/L
GW-15B	Chloride	88 mg/L	3.6	61.87 mg/L
GW-15B	Sulfate	2208 mg/L	3.51	1658.18 mg/L
GW-15B	Total Hardness	2161 mg/L	4.73	1577.96 mg/L
GW-15B	Lab Specific Conductivity	4410 mg/L	3.43	3485.18 mg/L
GW-15B	Total Cations	56.8 meq/L	4.94	43.6 meq/L
GW-15B	Total Anions	57.5 meq/L	3.61	45.9 meq/L
GW-16	Dissolved Calcium	359 mg/L	2.15	317.71 mg/L
GW-16	Dissolved Potassium	7 mg/L	2.30	5.40 mg/L

Many of the parameters that are unusually high or low in concentration this quarter were measured at well GW-15B. Many of these parameters have at least a weak negative correlation to water elevation, and the water level has a strong downward trend ($R^2 = 0.8293$), with ups and downs mostly consistent with the Palmer Hydrologic Drought Index. In fact, this quarter the water level was just 6.1 inches above the all time low reading (obtained 11/17/05). The water quality at GW-15B has never been particularly good, and the increased solute concentrations are not of concern at this time, since they are more than likely related to the low water level in the well. The salinity at GW-15B, which is affected by several parameters (Cl, Na, Mg, SO_4, Ca, K, HCO_3, etc.) has always been in the "brackish" category (500-30000 mg/L NaCl equivalent), with only 1 reading of 27 below 2000 mg/L NaCl equivalent.

Chloride has a weak upward trend at GW-15B ($R^2 = 0.0212$), and a weak negative correlation to water levels ($R^2 = 0.1300$). This is the highest concentration of chloride ever recorded at this site, but a level of 88 mg/L is well below any water quality limits, and the range of values for chloride is quite small (52-88 mg/L).

There is a weak upward trend in dissolved calcium at GW-15B ($R^2 = 0.4786$), and GW-16 ($R^2 = 0.4881$). Each has a weak negative correlation to water levels ($R^2 = 0.4578$, and 0.1187. respectively). There are no criteria for this metal, but it does contribute to water hardness. The hardness at these sites has always fallen into the very hard (>300 mg/l) classification; the lowest hardness on record for GW-15B is 1424 mg/L, and 1626 for GW-16.

Dissolved magnesium has a weak upward trend overall at GW-15B ($R^2 = 0.1661$), with a very strong upward trend since March of 2005 ($R^2 = 0.951$). This metal has a weak negative correlation to water level, stronger since March of 2005 ($R^2 = 0.23$ overall, 0.42 since 3-2005). There are no criteria for this metal, but it contributes to water hardness. The hardness at this site has always fallen into the very hard (>300 mg/l) classification; the lowest hardness on record is 1424 mg/L.

The dissolved potassium was unusually low at SW-1, and unusually high at GW-9B, GW-12, GW-15B, and GW-16. Overall, there is no real trend in potassium at SW-1 ($R^2 = 0.0103$-downward), a very weak upward trend at GW-16 ($R^2 = 0.1211$), and weak upward trend at GW-9B ($R^2 = 0.5546$), GW-12 ($R^2 = 0.2831$) and GW-15B ($R^2 = 0.2658$). There is a fairly strong negative correlation between potassium levels and flow at SW-1, a weak negative correlation between potassium and water level at GW-15B and no good correlation at the other sites. There are no water quality standards for potassium and all readings are below 21 mg/L, so there is no concern about potassium levels at this time.

The value for sodium (308 mg/L) is the largest ever recorded at GW-15B, and there is a strong upward trend in sodium over the past year ($R^2 = 0.9537$), with a weak negative correlation to water level. Overall, there is actually a very slight downward trend in dissolved sodium at GW-15B ($R^2 = 0.07$), with a weak positive correlation to water elevation. There is no water quality standard for sodium.

The laboratory measured specific conductivity at GW-15B (4410) is the highest ever recorded at that site. There is an overall weak upward trend ($R^2 = 0.3547$), but the upward trend has been very strong ($R^2 = 0.9815$) since August of 2004. The field measurements for specific conductivity do not correlate well with the laboratory measurements ($R^2 = 0.02$). The field measurements have only a very weak upward trend overall ($R^2 = 0.083$), and a weak upward trend since August of 2004 ($R^2 = 0.377$). There are no water quality standards for specific conductivity, but it is closely related to total dissolved solids (TDS). There is a weak correlation between lab specific conductivity and TDS ($R^2 = 0.22$), but it is even weaker for field conductivity ($R^2 = 0.05$). The TDS at GW-15B was within two standard deviations from the mean.

Sulfate has a fair upward overall trend at GW-15B ($R^2 = 0.5447$), with a weak negative correlation to water elevation. Since November of 2004, the upward trend is very strong ($R^2 = 0.9806$), with a fair negative correlation to water elevation. 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 GW-15B has always been above 1380 mg/L, and this is not a drinking water source. There is no indication of acid mine drainage (AMD), since the pH has remained at or above 6.7, the alkalinity is fairly high (454 mg/L), and the levels of iron, manganese and aluminum have remained low.

The number of cations and anions counted at GW-9B, and GW-15B is unusually high. For each there is a weak negative correlation to water level, and a weak positive correlation to TDS. The cation/anion balance is within the 5% recommended limit at these sites. The number of cations and anions relate to the total dissolved solids in the water sample, which fell within two standard deviations from the mean.

The total hardness at GW-15B has a weak general upward trend ($R^2 = 0.3566$), with a much sharper upward trend ($R^2 = 0.9485$) since March of 2005, the last four quarters recording the highest concentrations ever at this site. Because all recorded values of hardness at this site are greater than 1400 mg/L, and therefore in the very hard range (>300 mg/l), the increased values do not represent a degradation of water quality.

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

Site	Reliability Check	Value Should Be...	Value is...
SW-1	Conductivity/Cations	> 90 & < 110	89
SW-1	Mg/(Ca + Mg)	< 40 %	45 %
SW-2A	Mg/(Ca + Mg)	< 40 %	45 %
GW-1	TDS/Conductivity	>0.55 & <0.75	0.99

GW-1	Conductivity/Cations	> 90 & < 110	73
GW-1	Mg/(Ca + Mg)	< 40 %	47 %
GW-1	Ca/ (Ca + SO4)	> 50 %	28 %
GW-4	TDS/Conductivity	>0.55 & <0.75	0.94
GW-4	Conductivity/Cations	> 90 & < 110	77
GW-4	Mg/(Ca + Mg)	< 40 %	53 %
GW-4	Ca/ (Ca + SO4)	> 50 %	26 %
GW-6	TDS/Conductivity	>0.55 & <0.75	0.90
GW-6	Conductivity/Cations	> 90 & < 110	80
GW-6	Mg/(Ca + Mg)	< 40 %	56 %
GW-6	Ca/ (Ca + SO4)	> 50 %	26 %
GW-7	TDS/Conductivity	>0.55 & <0.75	0.78
GW-7	Conductivity/Cations	> 90 & < 110	88
GW-7	Mg/(Ca + Mg)	< 40 %	60 %
GW-7	Ca/ (Ca + SO4)	> 50 %	21 %
GW-8	TDS/Conductivity	>0.55 & <0.75	1.00
GW-8	Conductivity/Cations	> 90 & < 110	69
GW-8	Mg/(Ca + Mg)	< 40 %	76 %
GW-8	Ca/ (Ca + SO4)	> 50 %	12 %
GW-9	TDS/Conductivity	>0.55 & <0.75	1.36
GW-9	Conductivity/Cations	> 90 & < 110	54
GW-9	Mg/(Ca + Mg)	< 40 %	69 %
GW-9	Ca/ (Ca + SO4)	> 50 %	11 %
GW-9B	TDS/Conductivity	>0.55 & <0.75	1.20
GW-9B	Conductivity/Cations	> 90 & < 110	60
GW-9B	Mg/(Ca + Mg)	< 40 %	69 %
GW-9B	Ca/ (Ca + SO4)	> 50 %	17 %
GW-10	TDS/Conductivity	>0.55 & <0.75	1.05
GW-10	Conductivity/Cations	> 90 & < 110	69
GW-10	Mg/(Ca + Mg)	< 40 %	67 %
GW-10	Ca/ (Ca + SO4)	> 50 %	17 %
GW-12	TDS/Conductivity	>0.55 & <0.75	1.42
GW-12	Conductivity/Cations	> 90 & < 110	52
GW-12	Mg/(Ca + Mg)	< 40 %	80 %
GW-12	Ca/ (Ca + SO4)	> 50 %	10 %
GW-14	TDS/Conductivity	>0.55 & <0.75	1.16
GW-14	Conductivity/Cations	> 90 & < 110	63
GW-14	Mg/(Ca + Mg)	< 40 %	69 %
GW-14	Ca/ (Ca + SO4)	> 50 %	16 %
GW-15A	TDS/Conductivity	>0.55 & <0.75	0.93
GW-15A	Conductivity/Cations	> 90 & < 110	79

GW-15A	Ca/ (Ca + SO4)	> 50 %	36 %
GW-15B	TDS/Conductivity	>0.55 & <0.75	1.03
GW-15B	Conductivity/Cations	> 90 & < 110	69
GW-15B	Ca/ (Ca + SO4)	> 50 %	37 %
GW-16	TDS/Conductivity	>0.55 & <0.75	0.94
GW-16	Conductivity/Cations	> 90 & < 110	75
GW-16	Mg/(Ca + Mg)	< 40 %	52 %
GW-16	Ca/ (Ca + SO4)	> 50 %	30 %

The Permittee should work with the lab to make sure that samples pass all quality checks so that the reliability of the samples does not come into question. These inconsistencies do not necessarily mean that a sample is wrong, but it does indicate that something is unusual. An analysis and explanation of the inconsistencies by the Permittee would help to increase the Division's confidence in the samples. The Permittee can learn more about these reliability checks and some of the geological and other factors that could influence them by reading Chapter 4 of *Water Quality Data: Analysis and Interpretation* by Arthur W. Hounslow.

4. On what date does the MRP require a five-year re-sampling of baseline water data.

December 10, 2009

5. Based on your review, what further actions, if any, do you recommend?

No further actions are required at this time.

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