0018

WATER QUALITY MEMORANDUM

Utah Coal Regulatory Program

January 5, 2006

TO: Internal File

THRU: D. Wayne Hedberg, Permit Supervisor

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

RE: 2005 First Quarter Water Monitoring, Nevada Electric Investment Corporation, Wellington Preparation Plant, C/007/0012-WQ05-1, Task #2533

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 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 Oxygen	17 mg/L	3.60	8.17 mg/L
SW-1	Dissolved Potassium	2.46 mg/L	2.31	6.75 mg/L
SW-2A	Dissolved Oxygen	17 mg/L	2.11	9.09 mg/L
SW-2A	Dissolved Potassium	2.68 mg/L	2.05	6.67 mg/L
GW-1	Dissolved Magnesium	220 mg/L	2.52	254 mg/L
GW-1	Dissolved Potassium	3.13 mg/L	3.42	5.47 mg/L
GW-1	Dissolved Sodium	557 mg/L	2.33	634.95 mg/L
GW-1	Total Hardness	1,947 mg/L	2.29	2132.6 mg/L
GW-1	Total Dissolved Solids	4,639 mg/L	2.50	4936.25 mg/L
GW-1	Total Cations	63.2 meq/L	3.32	70.36 meq/L
GW-4	Dissolved Potassium	5.43 mg/L	2.22	7.5 mg/L
GW-6	Dissolved Magnesium	238 mg/L	2.35	263.94 mg/L
GW-6	Dissolved Potassium	4.29 mg/L	2.99	7.06 mg/L
GW-7	Dissolved Potassium	4.65 mg/L	2.24	7.18 mg/L
GW-8	Dissolved Potassium	4.01 mg/L	3.71	11.18 mg/L
GW-9B	Dissolved Calcium	528 mg/L	3.49	386.84 mg/L
GW-9B	Total Selenium	30 mg/L	2.92	14.29 mg/L
GW-10	Dissolved Calcium	197 mg/L	2.19	494.15 mg/L
GW-12	Dissolved Calcium	467 mg/L	2.69	326.14 mg/L
GW-12	Dissolved Potassium	4.79 mg/L	2.78	10.70 mg/L

GW-12	Chloride	793 mg/L	2.01	305.70 mg/L
GW-12	Sulfate	10,090 mg/L	2.14	4,038.22 mg/L
GW-13	Dissolved Sodium	3,460 mg/L	2.36	3,911.88 mg/L
GW-15A	Dissolved Calcium	455 mg/L	4.56	383.82 mg/L
GW-15A	Dissolved Potassium	3.5 mg/L	2.45	4.78 mg/L
GW-15A	Sulfate	2,228 mg/L	2.78	1,766 mg/L
GW-15A	Total Alkalinity	576 mg/L	3.75	518.94 mg/L
GW-15A	Total Hardness	1,947 mg/L	2.76	1,653.83 mg/L
GW-15A	Lab Specific Conductivity	4,610 µmhos/cm	3.12	3,684.17 µmhos/cm
GW-15A	Total Dissolved Solids	3,865 mg/L	2.47	3,258.22 mg/L
GW-15A	Total Cations	54.8 meq/L	2.06	46.94 meq/L
GW-15A	Total Anions	60.3 meq/L	2.77	49.32 meq/L
GW-15A	Total Iron	22.4 mg/L	2.79	4.07 mg/L
GW-15B	Dissolved Potassium	3.47 mg/L	2.63	5.71 mg/L
GW-15B	Dissolved Sodium	249 mg/L	2.42	275.64 mg/L
GW-15B	Total Alkalinity	462 mg/L	2.43	486.78 mg/L
GW-16	Dissolved Potassium	3.05 mg/L	4.99	5.24 mg/L
GW-16	Total Iron	12.9 mg/L	2.67	3.20 mg/L
GW-17	Dissolved Sodium	267 mg/L	2.08	457.67 mg/L
GW-17	Sulfate	193 mg/L	2.18	420.69 mg/L
GW-17	Total Dissolved Solids	1,032 mg/L	2.26	1,621.81 mg/L

There is a strong upward trend in chloride at GW-12, with no correlation to water level. 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 GW-12 have almost always been above these limits, and levels of other constituents (sodium, sulfate) have always limited the usability of the water, so this rise in chloride is not of concern at this time.

The dissolved calcium levels have an overall upward trend at each of the listed sites. There is a weak correlation to water level for each of the sites; positive at GW-9B and GW-12 ($R^2 = 0.0977$; 0.1929), and negative at GW-10 and GW-15A ($R^2 = 0.3524$; 0.2534). This quarter's value at GW-10 has actually dropped well below the average value, but is in-line with values recorded in 1986 and 1998. There are no criteria for this metal, but it does contribute to water hardness. The hardness at each of these sites has always fallen into the hard (150-300 mg/l) to very hard (>300 mg/l) classifications, with most samples over 1000 mg/l (99% of all samples over 300 mg/L, 88% over 1000 mg/L). It is not clear why the calcium level has been changing, but this does not represent a degradation of water quality.

Dissolved magnesium has a downward trend at both GW-1 and GW-6. There is a strong correlation to water level at GW-1 ($R^2 = 0.57$), but none at GW-6. There are no criteria for this metal, but it contributes to water hardness, which also has an overall downward trend at these sites. A drop in magnesium and hardness levels is a positive change in water quality.

Dissolved oxygen has an upward trend at SW-1 and SW-2A, with no correlation to flow or temperature. These are unusually high numbers, but the numbers seem to have dropped to close to average in the second and third quarter of 2005.

The dissolved potassium was lower than average at several sites. There is a weak downward trend in the potassium level at GW-4 and GW-7 (R^2= 0.238, and 0.363). There is a weak upward trend in potassium at GW-12, GW-15A, GW-8, and GW-15B (R^2= 0.207, 0.162, 0.151, and 0.117). There is a very weak upward trend in potassium at GW-1, SW-2A, and GW-16 (R^2= 0.070, .047, and .026). There is no real trend in potassium at SW-1 ($R^2 = 5 \times 10^{-6}$). There is a fairly strong negative correlation between potassium levels and flow/well elevation at SW-1, SW-2A, and GW-15A. There are no water quality standards for potassium and this lowering of the potassium level does not hurt the water quality.

The dissolved sodium was lower than average at GW-1, GW-13, GW-15B, and GW-17. There is also a downward trend in sodium levels at each of these sites. There is a fairly strong negative correlation to well elevation at GW-13, a weak positive correlation to well elevation at GW-15B, and no real correlation to flow at the other two sites. There is no water quality standard for sodium, but it does increase the salinity of water. High salinity in irrigation water can decrease yields, depending on the crop. The reduction in sodium is a positive trend.

There is a fairly strong upward trend in sulfate at GW-12, and GW-15A (R2= 0.769, and 0.573); and a strong downward trend in sulfate at GW-17 (R2= 0.727). There are no strong correlations between sulfate and well elevation at these sites. Though the sulfate readings at GW-12, and GW-15A are quite high, there is no indication of acid mine drainage (AMD), since the pH has remained at or above 6.8 (except for one reading of 4.65 at GW-12 in 1992), and the total alkalinity of the water is quite high. 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-12 has been greater than 250 mg/L in 94% of the samples, and greater than 1000 mg/L in 79% of the samples. The sulfate at GW-15A has always been at or above 1460 mg/L.

There is a weak upward trend in the total alkalinity at GW-15A (R2=0.295), and a fairly strong downward trend at GW-15B (R2= 0.500). The upward trend at GW-15A is welcome, since it means the water is better able to buffer any acids it may encounter. Though the downward trend at GW-15B is not desirable, it has just dropped from 508 mg/L at the highest to 462 mg/L at the lowest, which is still quite a high number. In addition the pH at GW-15B has only been below 6.9 once (in 1998) and the pH actually has a very weak *upward* trend at this site. Alkalinity is an important measure of buffering capacity (ability to absorb acids without lowering pH), and the Division will continue to monitor the trend of this parameter.

There is a strong upward trend in the total dissolved solids (TDS) at GW-15A, with a strong negative correlation to water level. The water level at GW-15A has been steadily trending downward since the Permittee began monitoring (R^2=0.74), however the overall pattern follows the PHDI for the area quite closely. In any case, the TDS at GW-15A has only been below 3000 mg/L once (2720 mg/L, well above the EPA's secondary standard of 500 mg/L for drinking water) and therefore the reading of 3,865 mg/L is not alarming. This does not represent a degradation of the water quality. There is a strong downward trend in TDS at GW-17, and a fairly strong downward trend in TDS at GW-1. There is no correlation to water level at GW-17, but there is a fairly strong positive correlation to water level at GW-1. Though it is not clear why the TDS numbers are going down at these two sites, a reduction in total dissolved solids is an improvement to water quality, and not a concern at this time.

There is a fairly strong upward trend in the total hardness at GW-15A, with a fairly strong negative correlation to water level. The water level at GW-15A has been steadily trending downward since the Permittee began monitoring (R^2=0.74), however the overall pattern follows the PHDI for the area quite closely. In any case, the hardness at GW-15A has never been below 1500 mg/L, which is well into the very hard (>300 mg/L) range. This does not represent a degradation of the water quality. There is a fairly strong downward trend in hardness at GW-1, with a strong positive correlation to flow. Though it is not clear why the hardness is going down at this site, a reduction in hardness is an improvement to water quality, and not a concern at this time.

There is a fairly strong upward trend in the total iron at GW-15A and a somewhat weaker upward trend at GW-16. There is a fairly strong negative correlation to water level at GW-15A, and a weak negative correlation to water level at GW-16. The secondary water quality standard for iron (based on taste and appearance only) is 0.3 mg/l, and for industrial use, the limit is 0.2 mg/l. The aquatic life standard (warm water fisheries) is 1.0 mg/l. Since the groundwater at the Wellington Preparation Plant does not support aquatic life, and has usually been above 0.2 mg/l, the rise in total iron does not represent a degradation of water quality.

There is a very slight upward trend in total selenium at GW-9B (R^2 = 0.082), with a weak negative correlation to flow. The drinking water quality standard for selenium is 0.05 mg/L, the fresh-water aquatic life standard is 0.005 mg/L, and the human-life standard is 170 mg/L. The selenium at GW-9B has always been above the drinking water quality standard and the aquatic life standard. It is still well below the human-life standard. This water is not used as a fishery or for drinking water, and this change in selenium does 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	Mg/(Ca + Mg)	< 40 %	52%
SW-1	Ca/ (Ca + SO4)	> 50 %	37%

SW-2A	Mg/(Ca + Mg)	< 40 %	52%
SW-2A	Ca/ (Ca + SO4)	> 50 %	36%
GW-1	Cation/Anion Balance	<5%	6.0%
GW-1	TDS/Conductivity	>0.55 & <0.75	1.19
GW-1	Conductivity/Cations	> 90 & < 110	62
GW-1	Mg/(Ca + Mg)	< 40 %	47%
GW-1	Ca/ (Ca + SO4)	> 50 %	26%
GW-4	TDS/Conductivity	>0.55 & <0.75	1.17
GW-4	Conductivity/Cations	> 90 & < 110	62
GW-4	Mg/(Ca + Mg)	< 40 %	52%
GW-4	Ca/ (Ca + SO4)	> 50 %	26%
GW-6	Cation/Anion Balance	<5%	6.6%
GW-6	TDS/Conductivity	>0.55 & <0.75	1.15
GW-6	Conductivity/Cations	> 90 & < 110	65
GW-6	Mg/(Ca + Mg)	< 40 %	55%
GW-6	Ca/ (Ca + SO4)	> 50 %	24%
GW-7	Cation/Anion Balance	<5%	5.8%
GW-7	TDS/Conductivity	>0.55 & <0.75	0.87
GW-7	Conductivity/Cations	> 90 & < 110	81
GW-7	Mg/(Ca + Mg)	< 40 %	58%
GW-7	Ca/ (Ca + SO4)	> 50 %	19%
GW-8	Cation/Anion Balance	<5%	6.2%
GW-8	TDS/Conductivity	>0.55 & <0.75	1.65
GW-8	Conductivity/Cations	> 90 & < 110	44
GW-8	Mg/(Ca + Mg)	< 40 %	76%
GW-8	Ca/ (Ca + SO4)	> 50 %	11%
GW-9B	TDS/Conductivity	>0.55 & <0.75	1.18
GW-9B	Conductivity/Cations	> 90 & < 110	40
GW-9B	Mg/(Ca + Mg)	< 40 %	67%
GW-9B	Ca/ (Ca + SO4)	> 50 %	16%
GW-10	TDS/Conductivity	>0.55 & <0.75	1.30
GW-10	Conductivity/Cations	> 90 & < 110	58
GW-10	Mg/(Ca + Mg)	< 40 %	74%
GW-10	Ca/ (Ca + SO4)	> 50 %	13%
GW-12	TDS/Conductivity	>0.55 & <0.75	2.31
GW-12	Conductivity/Cations	> 90 & < 110	32
GW-12	Mg/(Ca + Mg)	< 40 %	79%
GW-12	Ca/ (Ca + SO4)	> 50 %	10%
GW-13	TDS/Conductivity	>0.55 & <0.75	1.89
GW-13	Conductivity/Cations	> 90 & < 110	39
GW-13	Mg/(Ca + Mg)	< 40 %	68%

GW-13	Ca/ (Ca + SO4)	> 50 %	9%
GW-14	Cation/Anion Balance	<5%	5.7%
GW-14	TDS/Conductivity	>0.55 & <0.75	1.57
GW-14	Conductivity/Cations	> 90 & < 110	47
GW-14	Mg/(Ca + Mg)	< 40 %	70%
GW-14	Ca/ (Ca + SO4)	> 50 %	15%
GW-15A	TDS/Conductivity	>0.55 & <0.75	1.10
GW-15A	Conductivity/Cations	> 90 & < 110	64
GW-15A	Mg/(Ca + Mg)	< 40 %	42%
GW-15A	Ca/ (Ca + SO4)	> 50 %	33%
GW-15B	Cation/Anion Balance	<5%	5.6%
GW-15B	TDS/Conductivity	>0.55 & <0.75	0.99
GW-15B	Conductivity/Cations	> 90 & < 110	74
GW-15B	Ca/ (Ca + SO4)	> 50 %	35%
GW-16	Cation/Anion Balance	<5%	5.5%
GW-16	TDS/Conductivity	>0.55 & <0.75	1.12
GW-16	Conductivity/Cations	> 90 & < 110	66
GW-16	Mg/(Ca + Mg)	< 40 %	53%
GW-16	Ca/ (Ca + SO4)	> 50 %	26%
GW-17	Mg/(Ca + Mg)	< 40 %	58%
GW-17	Ca/ (Ca + SO4)	> 50 %	42%

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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