CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

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This chapter presents the potential direct and indirect effects of the Proposed Action and alternatives. This chapter also identifies irreversible and irretrievable commitments of resources and residual adverse effects. Mitigation measures that have been developed to reduce or eliminate potential impacts are also described. The alternatives for which effects are presented are described in **Chapter 2**. These alternatives address the issues and indicators identified during the scoping process and are presented at the beginning of each resource section of this impact assessment.

Effects are described in terms of context (site-specific, local, or regional effects), duration (short- or long-term), and intensity (negligible, minor, moderate, or major).

Duration of effects is defined as:

- Short-term - Short-term effects are defined as those effects that would not last longer than the life of the project, including initial reclamation.
- Long-term - Long-term effects are effects that would remain following completion of the project.

The thresholds of change for the intensity of an impact are defined as:

- **Negligible** - the impact is at the lowest levels of detection.
- **Minor** - the impact is slight, but detectable.
- **Moderate** - the impact is readily apparent.
- **Major** - the impact is a severe or adverse impact or of exceptional benefit.

Analysis of the Proposed Action and alternatives was limited to the Study Area as defined in **Chapter 1**. Some discussions may address a larger analysis area that includes adjacent areas to establish a broader context.

This chapter is organized to inform the understanding of direct and indirect effects. Alternatives are divided into their individual elements, which are each presented separately. The effects of the alternative elements are presented to provide the Agencies with flexibility in selecting elements out of the alternatives.

In addition, the effects of each element and alternative are presented in two ways. First, the actual impact of each element or alternative is compared to the baseline condition. In most cases, this is the same as the comparison of the impact with the No Action Alternative. Second, the impacts of each element or alternative are compared with the Proposed Action to inform the reader how the element or alternative would differ from the Proposed Action. The Agency-Preferred Alternative, identified in **Section 2.7**, is the Rasmussen Collaborative Alternative (the RCA).

4.1 GEOLOGY, MINERALS, AND PALEONTOLOGY

Issue: How does apparent geotechnical instability of portions of the Study Area affect the stability of the proposed external overburden piles, growth medium stockpiles, haul roads, and other mine facilities?

Indicators:

- Quantifiable geotechnical stability safety factors or equivalent stability analysis for overburden piles
- Predicted slope stability
- Delineation of areas of unstable landforms and soil map units containing unstable landforms

Issue: How would slope stability be affected in areas outside the proposed external overburden piles?

Indicators:

- Predicted slope stability
- Delineation of areas of unstable landforms and soil map units containing unstable landforms

Issue: What are the potential effects on paleontological resources?

Indicators:

- Disturbance of significant fossil-producing deposits or covering of potential fossil-bearing areas, removing them from access for research

4.1.1 Direct and Indirect Impacts

4.1.1.1 Proposed Action

4.1.1.1.1 Geotechnical

Residual Pit Wall Stability

Residual pit walls would remain on the central and northern portions of the pit after backfill and reclamation is completed for the Proposed Action. The stability of the pit wall is controlled by several factors including the type and strength of rock, degree of rock alteration, steepness of the final pit wall slope, presence of any groundwater, spacing and orientation of fractures and faults, and blasting practices (BLM and USFS 2007).

For the same rock type, less fractured and altered rock would produce more stable pit walls compared to altered or fractured rock. Geotechnical boring data indicate that rock formations underlying the mine pit are highly fractured (CNI 2011). Rocks are generally considered to have very poor integrity because of fractures if the rock quality designation (RQD) is less than 25 percent. The rock formations at Rasmussen Valley are highly fractured with mean RQD values typically less than 10 percent. In the north end, where the residual pit walls will be, RQD values are approximately zero, while in the central portions, the pit wall is less fractured, with RQD values of approximately 10 to 20 percent. Because portions of the pit wall would remain exposed in the North End after reclamation, RQD data and the presence of faults in that area indicate that natural rock fracturing would likely contribute to instability in the North End following reclamation. Areas of exposed pit wall in the northern pit are less fractured and would have lower potential instability; however, fracturing and instability hazards would increase to the south along the northern pit.

Pit wall instability can also be promoted by groundwater discharges from the pit wall. Given the relatively small pit wall exposures, and the expected overall permeability of the fractured rock reducing the risk of pore pressure build-up, large-scale slope instability is not expected to occur. The pit wall slopes may occasionally slough material, but the effect on resources would be minimal. These areas are not expected to affect post-reclamation pit wall instability. Surface water (runon) draining down the west flank of Rasmussen Ridge over the pit crest may infiltrate existing fractures and contribute to minor amounts of post-reclamation pit wall instability during freeze-thaw cycles.

Other Mine Facilities

Geotechnical factors may also affect the stability of mine features other than remaining pit high walls. Mine features that add material to an area or excavate material leaving steeper slopes can potentially induce geotechnical instability in accordance with topography of the surface underlying the pile; stress, such as shock loading or overloading; slope heights; reduction of material strength by introduction of water; and the scheduling of reclamation contouring (BLM and USFS 2007). In particular, overburden piles or growth medium (GM) stockpile slopes were identified during project scoping as facilities with potential geotechnical instability.

A geotechnical engineering evaluation of the conditions in the Study Area was completed (STRATA 2013). Factors of safety (FOS) were calculated and compared to design factors of safety (**Table 4.1-1**) to evaluate whether certain project facilities (e.g., piles and haul roads) are likely to be stable (**Table 4.1-1**). FOS for short-term (life-of-mine), long-term (post-reclamation), and seismically induced (earthquake) conditions were calculated. Calculated FOS were greater than design FOS for most stockpiles and fill features; therefore, those facilities are expected to exhibit suitable slope stability. The exceptions were the calculated FOS for the South Main and North Overburden Piles over the short term and long term. Shallow groundwater near the toe of these two facilities is expected to contribute to their instability. The calculations predict that instability would be increased by surcharge loading during construction, resulting in increased pore pressure and a decrease in effective shear strength and stability.

The presence of landslide deposits currently exhibiting movement near the toe of the North Overburden Pile are also indicative of the conditions that could cause instability of that facility (STRATA 2013). The boundary of this landslide is consistent with the boundary of soil map unit HPM and extends south of the North Overburden Pile footprint. The HPM soil unit consists of old slips and slumps and commonly has seep and pond areas (AECOM 2012). Soil unit HPM is also present beneath the western portion of the North Overburden Pile and near the western edge of the South Main Overburden Pile. STRATA (2013) concluded that the South Main and North Overburden Piles would require engineering controls to provide an adequate FOS. Without engineering controls, these two features are anticipated to exhibit moderate to major impacts as a result of geotechnical instability, which would potentially result in overburden material sliding outside of the designed footprint, covering water management features and potentially resulting in adverse effects on surface water and groundwater quality.

Haul roads and monitoring well roads constructed in soil map units HAX, PCM, and RDX are likely to experience minor cut slope (cutbank) failures similar to those observed in existing exploratory roads within the Study Area (AECOM 2012). The number and types of slope failures associated with existing exploratory roads have not been documented. Minor cut slope failures can generally be remedied by removal of debris and loose material by standard mining or construction equipment and are anticipated to have negligible to minor adverse effects on mine features. Under the Proposed Action, haul roads would occupy approximately 17.8 acres of map unit HAX

and 12.8 acres of map unit PCM. Proposed monitoring well roads would use existing infrastructure and would not create new disturbances that would be prone to slope failure. Calculated FOS for haul road cut slopes are greater than design factors of safety (**Table 4.1-1**), indicating that, although cut slope failures may occur, such failures are likely to be minor. Overall potential effects of slope and pit wall instability under the Proposed Action would be short-term and minor.

Table 4.1-1 Geotechnical Stability Factors of Safety

Proposed Project Facility	Short-Term Factor of Safety	Long-Term Factor of Safety	Seismically Induced Factor of Safety
Design Factor of Safety	**1.3**	**1.5**	**1.1**
Access North GM Stockpile	1.856	1.963	NA
Access South GM Stockpile	1.346	1.575	NA
North GM Stockpile	1.393	1.581	NA
North Overburden Pile	1.011	1.211	0.667
Ore Stockpile	2.042	2.070	NA
Pit Backfill and South External Overfill Pile	2.584	2.584	1.491
Sediment Retention Basin 4	1.646	1.717*	1.114
South Main Overburden Pile	0.923	1.271	NA
South-South Overburden Pile	1.536	2.645	1.196
Haul Road Design Factor of Safety	1.6	NA	1.1
Haul Road Cut Slope	1.633	NA	1.109

Notes:
NA = Not Assessed
* Runoff Event FOS, not Long-Term FOS. Design FOS is 1.5 for this scenario.
Source: STRATA 2013

4.1.1.1.2 Geochemistry

Percolation of meteoric water through the proposed overburden disposal facilities and optional ore stockpile would generate seepage with elevated concentrations of metals and other constituents of potential concern (COPCs) that could be released into groundwater or surface water. The expected chemistry of this seepage was evaluated using synthetic precipitant leaching procedure (SPLP) and column leaching tests (Whetstone 2015a). SPLP tests are screening-level analyses performed by leaching rock and soil samples in a solution of weakly acidified deionized water. The testing method was developed by the U.S. Environmental Protection Agency (USEPA 1994) to evaluate the mobility of readily soluble constituents in acid rain. Although SPLP tests can be used to evaluate which constituents would be easily dissolved in seepage, they cannot be used to predict the effects of longer-term generation of COPCs, such as sulfide mineral reactions, that would release previously insoluble constituents over time as overburden and ore are weathered by exposure to oxygen in near surface storage and disposal facilities. The time-dependent release of constituents in seepage by weathering is better evaluated by the column leaching tests which were performed in accordance with Bureau of Land Management (BLM) and U.S. Forest Service (USFS) guidelines for the Southeast Idaho Phosphate District (Whetstone 2013). The concentrations of COPCs revealed by the column leaching tests is used to determine an appropriate COPC source term inputs for the Proposed Action fate-and-transport model discussed later.

SPLP Tests

One hundred and fifty samples of overburden and ore were submitted for SPLP testing as part of the Baseline Geochemistry Study Report (Whetstone 2015a). The tests were performed in

accordance with USEPA method 1312 (USEPA 1994) and consisted of tumbling the samples in a solution of weakly acidified deionized water for 18 hours at a solution to rock ratio of 20:1. The resultant leachates were filtered and analyzed for an extensive suite of major ions, nutrients, and trace metals whose concentrations were compared to the numerical water quality standards in **Table 3.3-2** and **Table 3.3-15**. The results of the comparison indicated that 16 constituents are likely to be mobile in seepage from the overburden and ore storage facilities at levels of regulatory concern. The mobile constituents include aluminum, antimony, arsenic, cadmium, chromium, copper, fluoride, iron, lead, manganese, nickel, selenium, sulfate, total dissolved solids (TDS), thallium, and zinc. Summary statistics for the SPLP tests are presented in **Table 4.1-2**. Complete data and a discussion of the SPLP testing results are presented in the Baseline Geochemistry Study Report (Whetstone 2015a).

Table 4.1-2 Summary Statistics for Mobile Constituents in SPLP Leachates

			Aluminum[2] mg/L	Antimony[3] mg/L	Arsenic[3] mg/L	Cadmium[4] mg/L	Chromium[5] mg/L	Copper[4] mg/L	Fluoride[5] mg/L	Iron[2] mg/L
Unit[1]	**Number of Samples**	**Lowest Standard**	**0.2**	**0.0056**	**0.010**	**0.0006**	**0.1**	**0.011**	**4**	**0.3**
ALV	17	Average	0.45	0.0005	0.002	0.0008	0.0101	0.0035	0.50	0.34
		Min.	<0.03	<0.0004	0.0006	<0.0001	<0.0005	<0.0005	0.11	<0.02
		Max.	1.70	0.0011	0.003	0.0027	0.0503	0.0070	0.97	1.10
		Std. Dev.	0.49	0.0003	0.001	0.0009	0.0138	0.0019	0.27	0.34
BST	6	Average	0.50	0.0004	0.0009	<0.0001	0.0005	0.0019	0.21	0.28
		Min.	0.28	<0.0004	0.0004	<0.0001	<0.0005	0.0010	<0.10	0.15
		Max.	0.82	0.0005	0.0022	<0.0001	0.001	0.0026	0.35	0.54
		Std. Dev.	0.18	0.0001	0.0007	0	0.0003	0.0006	0.09	0.14
DCS	14	Average	0.69	0.0005	0.0013	0.0004	0.0132	0.0083	0.36	0.64
		Min.	<0.03	<0.0004	0.0004	<0.0001	<0.0005	0.0019	<0.2	<0.02
		Max.	1.53	0.0010	0.0026	0.0035	0.0332	0.0328	0.71	1.52
		Std. Dev.	0.49	0.0002	0.0006	0.0009	0.0107	0.0089	0.18	0.51
REX	16	Average	0.51	0.0006	0.0010	0.0007	0.0105	0.004	0.20	0.44
		Min.	0.18	0.0004	0.0003	0.0001	0.0005	0.0013	0.10	0.12
		Max.	1.04	0.0015	0.0028	0.0060	0.0263	0.0070	0.395	0.82
		Std. Dev.	0.26	0.0003	0.0007	0.0015	0.0072	0.002	0.1	0.23
HWM	13	Average	0.75	0.0014	0.0015	0.0434	0.005	0.0115	1.14	0.74
		Min.	<0.03	<0.0004	<0.0002	<0.0001	<0.0005	<0.0005	<0.5	<0.02
		Max.	4.63	0.0039	0.0038	0.3160	0.024	0.0586	4.43	4.28
		Std. Dev.	1.35	0.0009	0.0010	0.0937	0.007	0.0186	1.11	1.31
UO	6	Average	0.57	0.0035	0.0051	0.0046	0.0543	0.0064	1.25	0.32
		Min.	<0.03	0.0015	0.0028	0.0002	0.0013	0.0011	0.87	<0.02
		Max.	1.34	0.0067	0.0087	0.0097	0.1496	0.0130	1.68	0.58
		Std. Dev.	0.49	0.0019	0.0027	0.0034	0.0569	0.0045	0.34	0.24
UOP	6	Average	0.54	0.0016	0.0048	0.0014	0.0196	0.0035	1.44	0.33
		Min.	0.06	0.0007	0.0025	<0.0001	0.0014	0.0016	0.93	0.02
		Max.	0.95	0.0041	0.0075	0.0022	0.0295	0.0056	2.24	0.80
		Std. Dev.	0.39	0.0013	0.0020	0.0007	0.0121	0.0015	0.45	0.27
CW	22	Average	0.14	0.0053	0.0029	0.0103	0.0029	0.0098	1.24	0.09
		Min.	<0.03	0.0008	0.0007	0.0001	<0.0005	<0.0005	0.47	<0.02
		Max.	2.76	0.0221	0.0114	0.1219	0.0129	0.0863	3.96	1.38
		Std. Dev.	0.59	0.0045	0.0024	0.0274	0.0029	0.0234	0.87	0.30
LO	9	Average	0.08	0.0039	0.0078	0.0070	0.0286	0.0053	0.91	0.22
		Min.	<0.03	0.0016	0.0029	0.0004	0.0018	0.0006	0.43	<0.02
		Max.	0.49	0.0088	0.0136	0.0240	0.0933	0.0140	1.40	0.68

Table 4.1-2 Summary Statistics for Mobile Constituents in SPLP Leachates

		Std. Dev.	0.32	0.0023	0.0037	0.0069	0.0380	0.0050	0.30	0.30
LOP	9	Average	0.07	0.0019	0.0043	0.0015	0.0065	0.0029	0.68	0.04
		Min.	<0.03	0.0005	0.002	<0.0001	0.0032	0.0008	0.35	<0.02
		Max.	0.21	0.0040	0.0068	0.0037	0.0176	0.0056	1.07	0.25
		Std. Dev.	0.06	0.0013	0.0018	0.0012	0.0046	0.0015	0.24	0.08
FWM	8	Average	0.12	0.0033	0.0047	0.0044	0.0057	0.0022	0.54	0.09
		Min.	<0.03	0.0004	0.0023	0.0004	0.0017	0.0009	<0.20	<0.02
		Max.	0.21	0.0089	0.0072	0.0129	0.0124	0.0034	0.98	0.17
		Std. Dev.	0.07	0.0030	0.0017	0.0041	0.0040	0.0011	0.23	0.06
GDT	18	Average	<0.03	0.0004	0.0015	0.0001	0.0010	0.0007	0.20	0.02
		Min.	<0.03	<0.0004	0.0006	<0.0001	<0.0005	<0.0005	0.11	<0.02
		Max.	<0.03	0.0012	0.0033	0.0003	0.0025	0.0013	0.46	0.04
		Std. Dev.	0	0.0003	0.0007	0.0000	0.0005	0.0002	0.09	0.00
WEL	6	Average	0.06	0.0007	0.0011	0.0001	0.0006	0.0010	0.27	<0.02
		Min.	<0.03	<0.0004	0.0005	<0.0001	<0.0005	0.0009	<0.10	<0.02
		Max.	0.12	0.0017	0.0026	0.0002	0.0008	0.0013	0.75	<0.02
		Std. Dev.	0.03	0.0005	0.0008	0.0000	0.0001	0.0002	0.23	0.00
			Lead[4] mg/L	**Manganese[2] mg/L**	**Nickel[4] mg/L**	**Selenium[6] mg/L**	**Sulfate[2] mg/L**	**TDS[2] mg/L**	**Thallium[3] mg/L**	**Zinc[4] mg/L**
Unit	**Number of Samples**	**Lowest Standard**	**0.0025**	**0.05**	**0.0520**	**0.005**	**250**	**500**	**0.00024**	**0.120**
ALV	17	Average	0.0002	0.0069	<0.01	0.009	3.61	67	0.0001	0.016
		Min.	<0.0001	<0.0005	<0.01	0.0001	<0.5	40	<0.0001	0.005
		Max.	0.0005	0.0245	<0.01	0.076	26.8	110	0.0002	0.041
		Std. Dev.	0.0001	0.0071	0.00	0.020	7.5	18	0.0000	0.011
BST	6	Average	0.0002	0.0097	<0.01	0.009	6.27	40	<0.0001	0.02
		Min.	<0.0001	0.0035	<0.01	0.0002	<0.5	20	<0.0001	0.012
		Max.	0.0003	0.0207	<0.01	0.0295	9.41	50	<0.0001	0.03
		Std. Dev.	0.0001	0.0081	0.00	0.011	2.06	11	0	0.01
DCS	14	Average	0.0003	0.0539	0.08	0.0276	29	82	<0.0001	0.23
		Min.	<0.0001	0.0023	<0.01	0.0014	<1.0	30	<0.0001	0.013
		Max.	0.0007	0.347	0.60	0.0894	162	240	<0.0001	2.04
		Std. Dev.	0.0002	0.0966	0.16	0.0285	48.1	55	0	0.54
REX	16	Average	0.0003	0.0211	0.04	0.0135	6.54	44	<0.0001	0.08
		Min.	0.0001	0.0011	0.01	0.0025	0.74	20	<0.0001	0.01
		Max.	0.0009	0.0823	0.18	0.0280	43.2	65	<0.0001	0.40
		Std. Dev.	0.0002	0.0230	0.05	0.0087	10.5	14	0	0.13
HWM	13	Average	0.0001	0.2174	0.49	0.0813	69.1	133	0.0002	1.81
		Min.	<0.0001	0.0029	0.01	0.0015	1.09	30	<0.0001	0.01
		Max.	0.0006	0.593	1.70	0.3615	197	320	0.0007	8.77
		Std. Dev.	0.0002	0.2133	0.66	0.0906	64.8	89	0.0002	3.05
UO	6	Average	0.0005	0.0067	0.01	0.0278	7.5	53	0.0006	0.099
		Min.	<0.0001	0.0020	<0.01	0.0014	<0.5	30	0.0002	0.031
		Max.	0.0008	0.0171	0.02	0.0850	32.8	80	0.0009	0.2
		Std. Dev.	0.0047	0.0060	0.01	0.0319	11.5	20	0.0003	0.060
UOP	6	Average	0.0003	0.0102	0.01	0.0287	13.0	45	0.0006	0.052
		Min.	0.0001	0.0050	<0.01	0.0015	0.76	20	0.0002	0.017
		Max.	0.0005	0.0260	0.02	0.1133	42.6	70	0.0012	0.084
		Std. Dev.	0.0002	0.0081	0.01	0.0426	17.5	22	0.0004	0.024
CW	22	Average	0.0004	0.1531	0.34	0.1663	85.7	180	0.0003	1.139
		Min.	<0.0001	0.0014	<0.01	0.0060	1.28	60	<0.0001	0.011

Table 4.1-2 Summary Statistics for Mobile Constituents in SPLP Leachates

		Max.	0.0068	1.55	2.93	0.5448	358	540	0.002	13.6
		Std. Dev.	0.0014	0.3893	0.79	0.1540	86.8	120	0.0004	3.296
LO	9	Average	0.0004	0.0042	0.03	0.0830	33.9	81	0.0007	0.136
		Min.	<0.0001	0.0011	0.02	0.0064	0.87	30	0.0003	0.011
		Max.	0.0014	0.0054	0.08	0.1962	166	250	0.0014	0.37
		Std. Dev.	0.0004	0.0014	0.02	0.0592	49.3	68	0.0004	0.109
LOP	9	Average	0.0002	0.0018	0.01	0.1008	9.9	59	0.0004	0.042
		Min.	<0.0001	0.0009	<0.01	0.0021	<0.5	40	0.0001	0.009
		Max.	0.0003	0.0045	0.02	0.586	49.5	110	0.0012	0.076
		Std. Dev.	0.0001	0.0012	0.01	0.1940	15.5	21	0.0003	0.026
FWM	8	Average	0.0003	0.0053	0.02	0.1095	24.5	101	0.0015	0.076
		Min.	<0.0001	0.0008	<0.01	0.0003	1.55	70	0.0009	0.014
		Max.	0.0005	0.0226	0.06	0.3387	74.1	170	0.0029	0.166
		Std. Dev.	0.0002	0.0078	0.02	0.1211	29.2	41	0.0007	0.053
GDT	18	Average	0.0001	0.0005	<0.01	0.0073	1.24	42	0.0001	0.002
		Min.	<0.0001	<0.0005	<0.01	0.0004	<0.5	30	<0.0001	<0.002
		Max.	0.0002	0.0008	<0.01	0.0378	6.04	50	0.0005	0.009
		Std. Dev.	0.0001	0.0001	0.00	0.0115	1.85	8	0.0001	0.002
WEL	6	Average	0.0001	0.0010	<0.01	0.0098	10.8	68	0.0002	0.008
		Min.	<0.0001	<0.0005	<0.01	0.0002	1.52	50	<0.0001	0.006
		Max.	0.0002	0.0032	<0.01	0.0288	26.7	90	0.0009	0.012
		Std. Dev.	0.00004	0.0011	0.00	0.0113	10.4	17	0.0003	0.002

Notes:

1 Abbreviations: ALV = alluvium, BST = basalt, DCS = Cherty Shale, REX = Rex Chert, HWM = hanging wall mud, UO = upper ore, UOP = upper ore partings, CWS = center waste, LO = lower ore, LOP = lower ore partings, FWM = footwall mud, GTD = Grandeur Tongue, WEL = Wells Formation

2 Lowest numerical standard is the Idaho secondary groundwater standard

3 Lowest numerical standard is the Idaho aquatic standard for consumption of water and organisms

4 Lowest numerical standard is the Idaho cold water biota criterion continuous concentration (CCC) based on a hardness of 100 mg/L total harness and a water effect ratio of 1

5 Lowest numerical standard is the Idaho primary groundwater standard

6 Lowest numerical standard is the Idaho cold water biota criterion continuous concentration (CCC)

Column Leaching Tests

Fourteen columns were constructed to evaluate the time-dependent leaching characteristics of exploration drill hole cuttings and cores representative of the overburden and ore that would be produced from the proposed mining operation (Whetstone 2015a). The columns were prepared and operated according to BLM and USFS guidelines for column leaching tests in the Southeast Idaho Phosphate District (Whetstone 2013). The results of the column leaching tests were used to specify input concentrations (source terms) for numerical modeling of contaminant fate and transport from the proposed overburden disposal facilities and optional ore stockpile (**Section 4.3**). A summary of columns that were prepared for the proposed Rasmussen Valley Mine is presented in (**Table 4.1-3**).

Agency guidelines for column testing recommend that monolithologic (single rock type) columns be prepared for each rock type that represents more than 5.0 percent by weight of the overburden material balance (Whetstone 2013). The planned percentages of Cherty Shale (13.2 percent), Rex Chert (15.5 percent), hanging wall mud (7.0 percent), center waste (34.9 percent), combined ore partings (6.7 percent), and Grandeur Tongue (14.4 percent) for the Proposed Action exceed this threshold and were evaluated using the unsaturated column testing protocol. The remaining overburden geochemical testing units including basalt (0.7 percent), alluvium (3.8 percent),

footwall mud (1.4 percent), and Wells Formation (2.5 percent) would each form less than 5.0 percent of the material balance and were not tested as monolithologic columns. Column testing guidelines also recommend that mixed lithology columns, again using rock types that represent more than 5.0 percent of overburden material, be prepared to model the run-of-mine composition of overburden and ore storage facilities (Whetstone 2013). Columns were operated in a water-saturated or water-unsaturated state to represent overburden or backfill that would be below or above the water table, respectively. Although it has been demonstrated that microbial activity can play a role in reducing the concentrations of selenium released in leachate from phosphate mine overburden materials, no columns were sterilized nor inoculated in response to agency concerns regarding the feasibility of culturing bacteria populations that are representative of field conditions. Columns BROM-U1 and BROM-S1 were prepared to represent the average composition of the pit backfill. BROM-U1 represents backfill overburden material that would be placed above the water table and was operated using the unsaturated column testing protocol. BROM-S1 represents backfill overburden material that would be placed below the water table and was operated using the saturated column testing protocol. Column OROM-U1 was prepared to represent the average composition of overburden material that would be placed in the North and South-South Overburden Piles and was operated under unsaturated conditions because it was planned to be above the water table. ORE-U1 represents material that would be placed in the ore stockpile and was operated under unsaturated conditions, again, because it was planned to be above the water table. Mixed lithology columns were not prepared for the South Main Overburden Pile or the North and South Temporary Overburden Piles because the material in these facilities would be re-handled into the pit backfill.

Table 4.1-3 Column Summary

Column Designation	Tested Material	Leaching Condition	Comment
Monolithologic Columns			
CS-U1	Cherty Shale	Unsaturated	13.2 percent[2] of the overburden material balance
REX-U1	Rex Chert	Unsaturated	15.5 percent[2] of the overburden material balance
HWM-U1	Hanging wall mud	Unsaturated	7.0 percent[2] of the overburden material balance
CW-U1	Center waste	Unsaturated	34.9 percent[2] of the overburden material balance
COP-U1	Combined ore partings[1]	Unsaturated	6.7 percent[2] of the overburden material balance
GDT-U1	Grandeur tongue	Unsaturated	14.4 percent[2] of the overburden material balance
Mixed Lithology Columns			
BROM-U1	Run-of-mine overburden	Unsaturated	Average composition of pit backfill for the Proposed Action
BROM-S1	Run-of-mine overburden	Saturated	Average composition of pit backfill for the Proposed Action
OROM-U1	Run-of-mine non-Meade peak overburden	Unsaturated	Average composition of proposed North and South-South Overburden Piles
ORE-U1	Combined upper and lower ore	Unsaturated	Average composition of the proposed ore stockpile
QC Columns			
BROM-U2	Run-of-mine overburden	Unsaturated	Replicate column for BROM-U1
BROM-S2	Run-of-mine overburden	Saturated	Replicate column for BROM-S1
CON-U1	Glass packing beads	Unsaturated	Control column
CON-S1	Glass packing beads	Saturated	Control column

Notes:

1 Combined ore partings include material from the upper ore partings (82 percent) and the lower ore partings (18 percent). This column is included with the monolithologic columns to differentiate it from mixed lithology columns that were used to directly model mine facilities.

2 Percent by weight

Four columns were also prepared to provide quality control for the column leaching study. Columns BROM-U2 and BROM-S2 were replicates of BROM-U1 and BROM-S1, respectively and were packed and operated identically to their replicates. The replicate columns were used to evaluate reproducibility of the experimental results under unsaturated and saturated conditions. Columns CON-U1 and CON-S1 were control columns packed with glass beads. The control columns were used to monitor potential contamination from the column testing equipment under unsaturated and saturated conditions.

Unsaturated Column Construction and Testing Method

Unsaturated columns were packed with 20 kilograms (kg) of material representing the expected compositions of the various rock types that would be placed in the proposed mine facilities. The samples were placed in 1- to 2-inch-thick random lifts that were gently settled (compacted) by tapping on the sides of the columns with a rubber mallet. A layer of acid-washed glass beads (3 to 4 inches) was placed at the top and bottom of each column as packing material.

With the exception of column REX-U1, the unsaturated columns were operated for eight leaching cycles. Column REX-U1 was operated for four additional cycles (12 total) to evaluate a trend of decreasing pH observed in the leachates from the column. Each leaching cycle required 19 days to complete and included a solution application period (14 days), a drain-down period (2 days), and an aeration period (3 days). The head solution (distilled water from a common reservoir) was applied to the tops of the columns using metering pumps at a rate of about 15 milliliters per hour (mL/hr). The columns were allowed to drain freely, and the leachates were collected at the bottom. Approximately 5 liters of solution were applied to each column per cycle (0.25:1 solution to sample weight ratio). At the end of the application period, the columns were allowed to drain for 48 hours before circulating dry air (up-flow) through the material at a flow rate of about 1 liter per minute.

The unsaturated columns were inspected daily through the clear column tube for ponding and channelized flow. Neither condition was observed during the operation of the columns. The columns were also inspected for bio-films that might interfere with a representative leaching process. No evidence of bio-film formation was noted during the leaching tests. Leachates from the unsaturated columns were analyzed for an extensive suite of 65 water quality parameters for Cycles 1 through 8 and Cycle 11. A limited suite of parameters (pH, electrical conductivity [EC], alkalinity, TDS, total and dissolved iron) was also evaluated for cycles 9, 10, and 12 (column REX-U1 only).

Saturated Column Construction and Testing Method

The saturated column (BROM-S1), representing run-of-mine backfill that would be placed below the water table, was packed with 20 kg of material using the same method for both the material percentages and stacking order as for the corresponding unsaturated run-of-mine backfill column (BROM-U1). The column was operated for a total of eight cycles. Each leaching cycle was 19 days long and included a 14-day solution application and collection period followed by a 5-day rest period. The saturated column was operated under up-flow conditions, and the head solution (distilled water from the same source as the unsaturated columns) was applied to the bottom of the column at a rate of 15 mL/hr. Approximately 5 liters of solution were applied per cycle after the initial saturation of the column. Leachates from the saturated column were analyzed for the same set of 65 parameters as the unsaturated columns.

Column Results

Data from the column tests indicate that many constituents exhibit markedly different mobility

depending on whether the material is leached under saturated or unsaturated conditions. In general, analyses for the identically packed run-of-mine backfill columns (BROM-S1 and BROM-S2) showed an initial flushing effect in which leachates for the first one to three cycles yielded higher concentrations of TDS, sulfate, and metals than leachates from subsequent cycles **Figure 4.1-1**. For identical materials, with the exceptions of iron and manganese, metals under saturated column conditions (BROM-S1) were less leachable and less mobile than metals in the unsaturated column (BROM-U1). Iron and manganese were more leachable under saturated conditions. The lower mobility of selenium, sulfate, and some metals under saturated conditions (**Figure 4.1-1**) is interpreted to be a function of bacterial reduction (Whetstone 2015a). This interpretation is consistent with work by Bithell-Kirk (2011), which identified a number of bacteria in phosphate mine overburden, including *dechloromonas* and *stenotrophomonas*, that can rapidly reduce soluble selenium to insoluble minerals.

Results from monolithologic columns indicate that, for the rock types in overburden, the Meade Peak rocks (especially center waste shale and hanging wall mud) are likely to contribute the highest seepage COPC concentrations.

The column leachates were typically moderately to well buffered solutions with calcium-sulfate compositions and alkaline to near-neutral pH. The Rex Chert column (REX-U1) was an exception to this generalization and produced leachates with lower pH and total alkalinity values during the later leaching cycles (**Figure 4.1-1**). The major ion composition of column leachates evolved from calcium-sulfate composition toward calcium-bicarbonate composition during subsequent leaching cycles.

Thirteen constituents in the column leachates exceeded one or more of the numerical water quality standards in **Table 3.3–2** and **Table 3.3–15**. These constituents included TDS, sulfate, aluminum, antimony, cadmium, copper, iron, manganese, nickel, selenium, thallium, uranium, and zinc (**Figure 4.1-1**). Concentrations of the mobile constituents were typically highest in leachates from columns that contained Meade Peak rocks, especially center waste shale and hanging wall mud. In general, concentrations decreased rapidly during the first several leaching cycles before becoming asymptotic in later cycles. Cadmium was the primary exception to this trend, with concentrations remaining relatively stable or increasing in most columns. In addition, leachates from several columns yielded concentrations that increased toward the end of testing for TDS, thallium, uranium, and zinc.

Leachates from the Rex Chert column (REX-U1) displayed somewhat different behavior with respect to pH and alkalinity than the other unsaturated columns (**Figure 4.1-1**). Alkalinity and pH continued to decrease through Cycle 11, with alkalinity falling below the detection limit (2 milligrams calcium carbonate per liter [mg $CaCO_3$/L]) by Cycle 9, and pH falling as low as 5.0 s.u. at the time of collection of Cycle 12. These observations are consistent with the results of acid-base account (ABA) testing (**Section 3.1.3.3.2**), which indicate the Rex Chert has weak potential to generate acidic leachate. Many metals are more mobile with decreasing pH, and a corresponding increase is observed in concentrations of aluminum, cadmium, copper, manganese, nickel, uranium, and zinc in leachates from later cycles of the Rex Chert column.

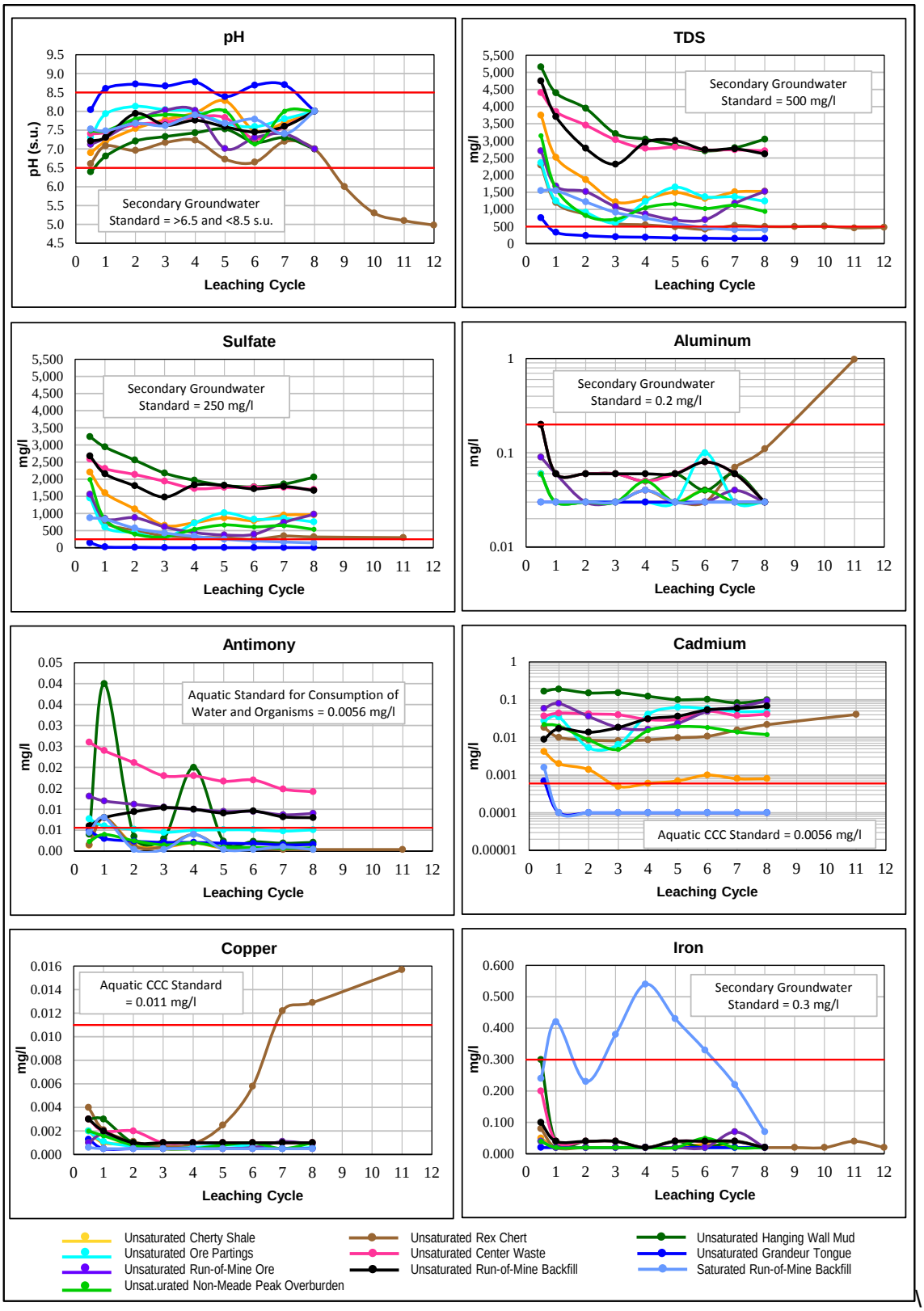

Figure 4.1-1 Concentrations Plots for Constituents Mobile in Column Leachates above Numerical Water Quality Standards

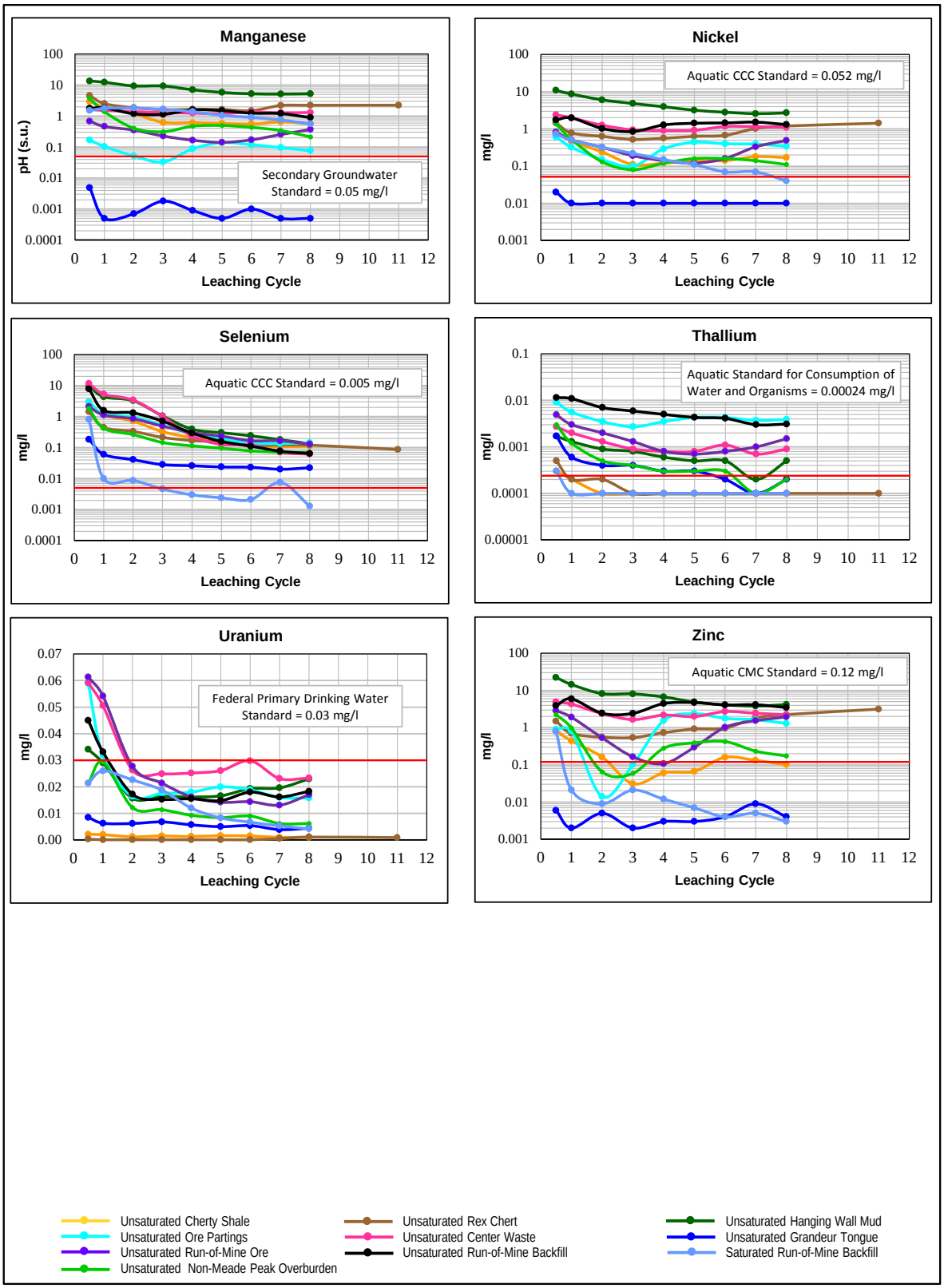

Figure 4.1-1 Concentration Plots for Constituents Mobile in Column Leachates above Numerical Water Quality Standards *(continued)*

4.1.1.1.3 Paleontology

Excavation of the pit and construction of facilities could directly affect paleontological resources if fossils are excavated without detection or their contextual geologic setting if the fossils are found in the excavated overburden, if these resources actually exist in the pit area or at the locations of the facilities. Effects cannot be fully determined until excavation and construction expose rock strata that may contain scientifically significant fossils. For example, construction could disturb about 60 acres of the Meade Peak Member of the Phosphoria Formation, which has a very high potential to contain scientifically significant fossils (Potential Fossil Yield Classification [PFYC] Class 5a; **Table 3.1–5**). In addition, excavation of the pit would produce approximately 57.1 million tons of overburden consisting of PFYC Class 5a formations (Brown and Caldwell [BC] 2014b).

In addition, construction of facilities could disturb approximately 25 acres of the Dinwoody and Wells Formations, which are considered to have moderate potential to contain scientifically significant fossils within the analysis area (PFYC Class 3a). In general, paleontological resources contained in these formations are invertebrate fossils not generally considered to be important or restricted to the analysis area, and are likely to be found throughout the outcrop areas of these formations in southeastern Idaho and adjacent areas. Early Triassic invertebrates from the Dinwoody Formation of the Aspen Range west of the analysis area, however, are rare, scientifically significant and may occur within the analysis area (Smith 1914). Negligible volumes of PFYC Class 3b formations would be excavated as overburden (BC 2014b).

Overall, the Proposed Action carries a moderate to high potential for the beneficial effect of encountering and documenting paleontological resources that would not otherwise have been encountered. The Proposed Action also carries a moderate to high potential of adverse effect on scientifically significant but regionally common invertebrate paleontological resources associated with damaging or destroying important paleontological resources. The Agencies have identified a number of requirements that would be implemented to mitigate the potential for adverse effects as described in **Section 4.1.4.2**.

In contrast to the potential direct effects, development of the Proposed Action is not expected to increase indirect effects, notably because roads already provide access to the mine site and development of the mine would not increase public access. In addition, the area lacks the unvegetated outcrops preferred for prospecting and collecting fossils. Consequently, fossil collection is not expected to increase, and indirect effects from prospecting on scientifically significant fossils would be negligible. Overall effects to paleontology under the Proposed Action would be long-term and minor.

4.1.1.2 Rasmussen Collaborative Alternative

4.1.1.2.1 Geotechnical

Residual pit walls under the Rasmussen Collaborative Alternative (RCA) would be similar in nature to those included in the Proposed Action; therefore, slope stability concerns would be the same.

Elimination of the North Permanent, North Temporary, and South Main Temporary and South-South Permanent Overburden Piles under the RCA is expected to eliminate the potential for problems related to geotechnical overburden pile stability when compared to the Proposed Action. Under the RCA, only a portion of these same areas would be used to borrow and store GM and alluvium for use in cap and cover construction and overall reclamation. The maximum GM and alluvium material needed for the cap and cover and other reclamation and the GM and alluvium to be handled would only be 8 to 20 percent of the volume proposed for the overburden piles in the Proposed Action, for which a geotechnical analysis was performed. The volumes of the GM

and alluvium piles are not even expected to be that much because, to avoid re-handling, the GM and alluvium would typically be excavated and used as it was needed rather than stockpiling all of it at once. Thus, the potential for and effects of slope and pile geotechnical failures is greatly mitigated.

Stability of Overfill Piles 1, 2, and 3 was not assessed quantitatively. However, similar material type, slope angle, and topographic position indicate that FOS would likely be similar to those calculated for the Pit Backfill and the South External Overfill Pile in the Proposed Action (**Table 4.1-1**). The FOS of the overfill piles would be enhanced because the downhill toes of the overfill piles would be buttressed by the pit backfill, which in turn, would be buttressed by the southwest pit walls.

HR-5 traverses steeper side slopes than the Proposed Action Haul Road and would carry a higher potential for minor cut slope failures. Under the RCA, haul roads would occupy approximately 19.3 acres of map unit HAX and 11.7 acres of map unit PCM. If additional monitoring well roads are needed, they would carry a minimal potential for minor cut slope failures during mining, and would be reclaimed by backfilling the road prism which would eliminate the exposed cut slope and the corresponding potential of failure. The RCA would not have permanent external overburden piles downslope of the mine thus eliminating the potential of overburden pile stability failure. Overall potential effects of slope and pit wall instability under the RCA would be negligible.

4.1.1.2.2 Geochemistry

The geochemical characteristics of each rock type and ore that would be produced from the open pit under the RCA would be the same as for the Proposed Action, but the volumes and percentages of each rock type produced placed in various mine facilities would change due to the change in pit configuration, location, and depth. The volumes and percentages of each rock type placed in various mine facilities would also change. These changes affect the predicted source concentrations seeping from the overburden that are applied to the fate and transport modeling. The overburden and ore material balances for the RCA are compared to the Proposed Action in **Table 4.1-4**.

4.1.1.2.3 Paleontology

Overall, the RCA carries a moderate to high potential beneficial effect of encountering and documenting paleontological resources that would not otherwise have been encountered. The RCA also carries a moderate to high potential adverse effect on scientifically significant but regionally common invertebrate paleontological resources associated with damaging or destroying important paleontological resources.

Under the RCA, the mine pit would be expanded north and a higher volume of PFYC Class 5 geologic units would be disturbed by excavations than under the Proposed Action. Surface disturbances in areas of the Meade Peak Member of the Phosphoria Formation would affect approximately 67 acres, 7 acres more than under the Proposed Action. Surface disturbances would affect approximately 65 acres of the Dinwoody and Wells Formations, 40 acres more than under the Proposed Action. As a result, the potential for permanent impacts to paleontological resources would also be marginally higher. The RCA could have a beneficial effect for paleontology through the discovery and documentation of previously undocumented paleontological resources. The Agencies have identified a number of requirements that would be implemented to mitigate the potential for adverse effects as described in **Section 4.1.4.2**. With implementation of these measures, effects to paleontological resources under the RCA would be long-term and minor.

Table 4.1-4 Material Balance Comparison for the Proposed Action and RCA

Mine Facility		Million Tons of Material[4]		Material Balance[3] (%)									
		Fullest Extent[1]	Permanent[2]	BST	ALV	DCS	REX	HWM	CWS	COP	FWM	GTD	WEL
North Overburden Pile	PA[3]	3.44	1.13	4.4	6.8	41.5	26.5	---	---	---	---	20.1	0.8
	RCA	0	0	---	---	---	---	---	---	---	---	---	---
South-South Overburden Pile	PA	4.61	4.61	5.4	6.3	47.1	25.8	---	---	---	---	15.2	0.2
	RCA	0	0	---	---	---	---	---	---	---	---	---	---
South Main Overburden Pile	PA	6.20	0	---	---	---	---	13.8	67.5	16.2	2.6	---	---
	RCA	0	0	---	---	---	---	---	---	---	---	---	---
North/Central and South Temporary Overburden Piles	PA	0.85	0	---	---	---	---	13.8	67.5	16.2	2.6	---	---
	RCA	7.33	0	---	6.5	1.4	9.5	4.9	33.8	8.9	2.7	18.5	13.7
Total Rasmussen Valley Mine Pit Backfill	PA	56.55	56.55	0.2	3.9	10.3	15.9	7.2	35.8	6.4	1.5	15.7	3.0
	RCA	70.39	70.39	1.0	4.5	6.0	18.6	5.3	29.8	7.4	1.6	15.5	10.2
Total P4 South Rasmussen Mine Pit Backfill	PA	0	0	---	---	---	---	---	---	---	---	---	---
	RCA	13.17	13.17	---	8.0	4.1	16.0	7.8	29.3	6.9	1.9	8.8	17.1
Final Reclaimed Total	PA[5]	---	62.29	0.7	3.8	13.2	15.5	7.0	34.9	6.7	1.4	14.4	2.4
	RCA	---	83.57	0.8	5.1	5.7	18.2	5.7	29.7	7.3	1.6	14.4	11.3

Notes:

1 Difference between fullest extent and permanent is material that would be re-handled into pit backfill at the end of mining

2 Million tons of material at final reclamation

3 Abbreviations: PA = Proposed Action, ALV = alluvium, BST = basalt, DCS = Cherty Shale, REX = Rex Chert, HWM = hanging wall mud, COP = combined ore partings CWS = center waste, FWM = footwall mud, GTD = Grandeur Tongue, WEL = Wells Formation

4 May range from .57 to .71 loose cubic yards per ton (or million loose cubic yards [MLCY] per million tons) depending on what kind of material.

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4.1.1.3 No Action Alternative

Current geologic, mineral, and paleontological resource trends within the analysis area would continue under the No Action Alternative. No direct or indirect impacts to geologic or mineral resources would occur as a result of implementation of the No Action Alternative.

4.1.2 Irreversible and Irretrievable Commitment of Resources

Under the Proposed Action or alternatives, removal of phosphate ore from the Rasmussen Valley Mine would represent an irreversible and irretrievable commitment of resources. Similarly, removal of alluvial and associated materials for cover system construction under the RCA and removal, combination, and alteration of separate and intact geologic rock types as overburden would be irreversible. Impacted mineral resources represent a small percentage of resources available for future use in southeastern Idaho.

Any loss of paleontological resources that occurred under the Proposed Action or the RCA would be irreversible and irretrievable. Paleontological resources discovered, documented, salvaged, and curated by the Agencies or surface owners during operations would not be lost.

4.1.3 Unavoidable Residual Adverse Effects

Local geologic and mineral resources would be unavoidably impacted. Ore within the tract would be depleted by the excavation and removal of ore and overburden and, to a lesser extent, by the excavation and relocation of geologic material for the construction of support facilities under the Proposed Action and the RCA. Residual adverse effects to the availability of phosphate ore and other mineral and geological resources would be negligible in a regional (southeast Idaho) context.

Excavation and curation of any significant fossils encountered during construction or operation under the Proposed Action and the RCA would decrease the potential for adverse impacts to scientifically significant paleontological resources, but cannot guarantee that all adverse impacts would be avoided.

Unavoidable adverse impacts of the RCA would be expected to be greater than those associated with the Proposed Action due to the greater amount excavated under the RCA, and greater than those under the No Action Alternative.

4.1.4 Mitigation Measures

4.1.4.1 Geotechnical

4.1.4.2 Proposed Action

Mine designs (such as overall slope and catch bench width) would be adapted as needed to respond to any indications of pit wall instability.

A geotechnical engineering evaluation of the conditions in the Study Area was completed (STRATA 2013) which focused on the Proposed Action. This study identified the proposed locations of the South Main and North Overburden Piles as areas that did not exhibit satisfactory slope stability. Three types of engineering mitigation measures were discussed in order to address slope instability: structural stabilization, dewatering, and earthwork. Overburden pile reconfiguration was mentioned, but dismissed without discussion.

Structural stabilization could be achieved by installing structural features such as retaining structures, drilled shafts, or driven piles. However, these are generally used to stabilize existing landslides, not to provide a stable base for new material piles. In addition, structural stabilization for storage piles of the sizes proposed for these overburden piles would be cost-prohibitive.

The FOS for the foundation and piles could be increased by dewatering the foundation soil or by providing subsurface drainage control to reduce subsurface pore water pressure buildup. Dewatering can be implemented before pile construction and can be monitored for effectiveness. Because of insufficient permeability of soils in the foundation analysis area, horizontal dewatering drains would provide the most effective form of foundation drainage control.

In addition to dewatering, a portion of the existing near surface foundation soil could be excavated and replaced with soil that exhibits more favorable engineering characteristics. Considering the large volume of material to be generated by mining and the proposed extent of external overburden storage piles, replacement of a portion of the existing soil below the storage piles with compacted mine material may be feasible. Replacement of a portion of the near surface subgrade with compacted mine material would reduce the pile size and surcharge loading, and would reduce the estimated settlement and pile deformation.

4.1.4.3 Rasmussen Collaborative Alternative

Mine designs (such as overall slope and catch bench width) for the RCA would be adapted as needed to respond to any indications of pit wall instability.

The overburden piles could be reconfigured to reduce pile height and pile slope or eliminated altogether. This would improve pile stability and reduce surcharge loading or eliminate the issue entirely. This option was not evaluated. Greatly reduced pile volumes were chosen for the RCA to reduce or eliminate the potential for pile instability.

4.1.4.3.1 Paleontology

Discovery of vertebrate macro fossils or unusual invertebrate fossils that may be scientifically significant would result in suspension of operations in that affected area until the appropriate BLM Authorized Officer (AO) is notified. The BLM or a BLM-designated paleontologist would evaluate the discovery and identify what course of action should be taken.

4.2 AIR RESOURCES, CLIMATE, AND NOISE

Issue: What is the potential for emission of air pollutants, including those associated with particulate matter from mining operations and mine traffic on haul roads and access roads?

Indicators:

- Increased emissions of fugitive dust from proposed mining activities

Issue: What is the potential to increase emissions from construction and operation and release greenhouse gas (GHG) emissions, which have been implicated in climate change?

Indicators:

- Levels of carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4) emissions from proposed mining activities; predicted cumulative effects

Issue: What is the potential for noise impacts at sensitive receptors as a result of mine operations, mine traffic on haul and access roads, and blasting?

Indicators:

- Predicted noise levels from mining that are 1) experienced at sensitive receptors, 2) higher than the USEPA guideline of 55 A-weighted decibels (dBA) for residences, or 3) higher than the USEPA guideline of 55 dBA at outdoor areas where people spend widely varying amounts of time
- Estimated noise levels from mining operations, haul truck traffic related to mining, and access road traffic

4.2.1 Direct and Indirect Impacts

4.2.1.1 Proposed Action

4.2.1.1.1 Air Resources

Air resource impacts for the Proposed Action include fugitive dust and gaseous emissions that would occur during drilling, blasting, excavation, materials handling, vehicle operations, ore screening, haul road usage, ore transportation, wind erosion, a boiler, and other generators. The equipment used for the Proposed Action would be obtained from the Rasmussen Ridge Mines as operations there gradually conclude. Generators at the Rasmussen Ridge Mine shop would continue to operate for the life of proposed mining activities. The difference would be that the location of the emissions would move approximately six miles to the southeast, and differences in terrain and haul distances would affect the emission levels. Generally, the air resource impacts generated during the normal operations from the Rasmussen Ridge Mines would represent similar levels of noise and emissions for the Proposed Action. The Proposed Action and the Rasmussen Ridge Mines operate at similar levels and would use the same operating equipment; therefore, the emissions would be comparable.

The majority of impacts to air quality result from fugitive dust and emissions generated from both mobile and stationary equipment. Emissions from these types of operations are controlled by a fugitive dust control plan and equipment manufacturers' emission control standards.

<u>Proposed Action Emissions</u>

Mining operations would produce fugitive dust emissions. Particulate matter with a particle diameter of 10 microns and smaller (PM_{10}) size range is the measure of dust particulates that are considered respirable. The Proposed Action would include implementing several measures to control fugitive dust emissions that result from mining operations. These measures include use of water sprays at the screening operations; use of water sprays or chemical dust suppressants to minimize dust generation from vehicle and equipment traffic on roadways and exposed areas; and implementation of a phased mining approach such that excavation, haulage of ore and overburden, placement of materials in overburden piles, backfilling of pits, and capping of overburden and backfill would be timed to minimize the amount of acreage and material exposed to wind erosion.

Table 4.2-1 presents estimated worst-case annual controlled emissions for the Proposed Action. Emission estimates were developed using published USEPA air pollutant emission factors know as AP-42 (USEPA 2009), and stationary combustion emissions are referenced from the

Rasmussen Ridge Mines air permit application (Agrium 2014). The Rasmussen Ridge Mines air permit application included emission estimates produced by the same fleet of stationary combustion sources to be relocated and used for the Proposed Action. The hours of operations and equipment fleet for both the Rasmussen Ridge Mines and Proposed Action are nearly identical; therefore, the emissions estimates are assumed to be comparable. AP-42 emissions factors were used to estimated fugitive emissions based on the Proposed Action mining operations.

Point-source emissions used in the emission estimates are referenced from the North Rasmussen Ridge Mine air permit application because the same equipment would be used for the Rasmussen Valley Mine. The emissions were calculated using AP-42 emission factors and engine emission certificates where applicable. The North Rasmussen Ridge Mine equipment would be reassigned to the Proposed Action; therefore, the impacts from stationary combustion sources would generally remain the same but would relocate approximately 6 miles southeast of the North Rasmussen Ridge Mine.

Mobile tailpipe emission estimates were calculated using USEPA NONROAD engine modeling emission factors (USEPA 2010). Emission sources for the Proposed Action include the mobile equipment fleet for loaders, dozers, excavators, graders, water trucks, welding trucks, backhoes, school busses, blasting trucks, fuel trucks, service trucks, and other vehicles.

Mining operation emissions for the Proposed Action include blasting and explosives, drilling, screening, hauling, material handling, and wind erosion. AP-42 emission factors and emission estimating methods were used to calculate mining emissions.

The majority of air emission impacts are produced during mobile transport. Control measures would be applied to mitigate emissions during mobile transport by means of water spray applied to haul roads and by vehicle manufacturer catalytic converters and air fuel controllers. The Proposed Action would impact the existing environment at similar levels compared to the existing Rasmussen Ridge Mines with the exception that the air impacts would shift approximately 6 miles southeast because the equipment fleet and operations from Rasmussen Ridge Mine would essentially be reassigned and used for the Proposed Action. The impacts from the Proposed Action to air resources would be short-term and negligible.

4.2.1.1.2 Climate

Mining involves combustion of diesel and gasoline fuel for operation of mining and support equipment, which contribute GHG emissions to the atmosphere. Projected fuel consumption for the Proposed Action is estimated to be approximately 3.5 million gallons annually (BC 2014c).

In accordance with 40 Code of Federal Regulations (CFR) Part 98, which finalized GHG reporting requirements for regulated sources, facilities must report GHG emissions if they meet the definition of one of the identified industry segments and emit 25,000 metric tons of CO_2 equivalent (CO_2e) or more per year in combined GHG emissions. An estimated air emission inventory for GHGs was performed for the Proposed Action and is estimated to emit approximately 15,000 metric tons per year of CO_2e for the life-of-mine. This value represents the potential to emit CO_2e assuming 8,760 operating hours per year. **Table 4.2-2** presents the estimated CO_2e emissions for the Proposed Action applicable to the GHG reporting requirements. The Proposed Action is not subject to the GHG reporting program because facility emissions are projected to be less than 25,000 metric tons per year.

Table 4.2-1 Potential Controlled Emissions Summary, Rasmussen Valley Mine Proposed Action[1]

Emission Source	PM_{10}		$PM_{2.5}$		SO_2		NO_X		CO		VOC	
	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr
Stationary Fuel Combustion Sources												
Main Generator	0.44	1.9	0.37	1.6	0.44	1.9	4.7	20.4	1.3	5.6	0.14	0.63
Mine Shovel	0.032	0.14	0.032	0.14	0.14	0.60	0.52	2.3	0.55	2.4	0.52	2.26
Support Generator	0.85	3.7	0.85	3.7	0.79	3.5	4.1	18.0	2.2	9.7	4.11	18.0
Well Pump	0.22	1.0	0.22	0.96	0.21	0.90	3.1	13.6	0.67	2.9	0.25	1.1
Seasonal run-off Control Generators	0.082	0.36	0.08	0.36	1.0	4.4	2.7	11.9	0.48	2.1	2.7	11.9
Night Shift Light Plants	0.34	1.5	0.27	1.2	0.56	2.5	3.7	16.4	2.9	12.6	3.2	13.9
Steam Generation/Hot Water Boiler	0.23	1.0	0.011	0.050	0.00036	0.0016	0.23	1.02	0.13	0.59	0.018	0.080
Dust Suppression Generator	0.027	0.12	0.027	0.12	0.20	0.88	0.45	2.0	0.192	0.84	0.47	2.0
Contractor Building Generator	0.059	0.26	0.059	0.26	0.18	0.81	0.69	3.0	0.73	3.2	0.69	3.04
Mine Pit Equipment Generator	0.11	0.50	0.11	0.50	0.11	0.47	1.6	7.1	0.35	1.5	0.13	0.57
Mobile Fuel Combustion Sources												
Mobile Equipment Engines	14.8	64.7	14.8	64.7	15.8	69.1	447.8	1961.3	255.8	1120.5	23.6	103.2
Mining												
Blasting & Explosives	0.0024	0.011	0.00014	0.00061	0.089	0.39	0.75	3.30	2.97	13.0	--	--
Drilling	0.069	0.30	0.069	0.30	--	--	--	--	--	--	--	--
Screening	0.030	0.13	0.0020	0.0088	--	--	--	--	--	--	--	--
Hauling	67.4	295.1	6.7	29.5	--	--	--	--	--	--	--	--
Material Handling	0.074	0.33	0.011	0.049	--	--	--	--	--	--	--	--
Wind Erosion	0.82	3.6	0.12	0.54	--	--	--	--	--	--	--	--
Tanks												
Storage Tanks	--	--	--	--	--	--	--	--	--	--	0.0065	0.028
Project Total	**86**	**375**	**24**	**104**	**19**	**85**	**470**	**2,060**	**268**	**1,175**	**36**	**157**

Notes:

1 Units are pounds per hour (lb/hr) and short tons per year (tons/yr)

Source: Agrium 2013, ARCADIS 2015f

Abbreviations: PM_{10} – particulate matter less than 10 microns in diameter; $PM_{2.5}$ - particulate matter less than 2.5 microns in diameter; SO_2 – sulfur dioxide; NO_x – oxides of nitrogen; CO – carbon monoxide; VOC – volatile organic compound

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Table 4.2-2 Stationary Sources Greenhouse Gas Emissions[1]

Emission Source	CO_2e	
	lb/hr	tons/yr
Main Generator	1,252	5,483
Mine Shovel	77	336
Support Generator	444	1,946
Well Pump	115	502
Seasonal Runoff Control Generators	1,082	2,435
Night Shift Light Plants	1,151	3,781
Steam Generation/Hot Water Boiler	197	862
Dust Suppression Generator	112	491
Contractor Building Generator	114	498
Mine Pit Equipment Generator	60	261
Project Total	**4,603**	**16,595**
	15,054 metric tons/yr	

Notes:
1 Units are pounds per hour (lb/hr) and short tons per year (tons/yr)
Source: ARCADIS 2015f

The assessment of GHG emissions and their relationship to climate change is in its formative phase; therefore, it is not yet possible to know with confidence the net impact to climate from the Proposed Action. The lack of scientific tools designed to predict climate change on regional or local scales limits the ability to quantify potential future impacts with a strong degree of certainty. The Proposed Action anticipates nearly identical GHG-emitting stationary sources to the Rasmussen Ridge Mines during the active mining period of 3.9 years. There is an addition of approximately 1 year prior to and 1 year subsequent to the active mining period to account for infrastructure development and final reclamation, respectively. During these periods, there would be less equipment operating and therefore less GHG emissions. Conclusions demonstrate that the emissions from the Proposed Action would not increase the annual GHG emissions but only extend the duration of impacts by approximately 5.8 years. Effects of the Proposed Action on GHG emissions and climate change would not be different from existing conditions and would not continue after the mine is closed. The effects of the Proposed Action on climate change would be short-term and negligible.

4.2.1.1.3 Noise Resources

Noise from equipment operation, vehicle use (both on site and on the area road system), and blasting can affect the environment for humans and wildlife, including the quality of the recreational user's experience on a given property, potentially diminishing the quality of that site for a particular endeavor.

Noise from activity during the operations of the Proposed Action would primarily be generated by site equipment, blasting, drilling, and traffic to and from the site.

Noise may also affect wildlife usage of the property. Chronic or episodic noise-related disturbance may result in wildlife movement away from the source of disturbance, as well as the quality of wildlife-based recreation for hunting, trapping, and nature study.

The USEPA identifies outdoor noise limits to protect against effects on public health and welfare by an equivalent sound level (L_{eq}), which is an A-weighted average measure over a given time. Outdoor limits of 55 A-weighted decibels (dBA) L_{eq} have been identified as desirable to protect

against speech interference and sleep disturbance for residential areas and areas with educational and healthcare facilities. Site noise levels are generally acceptable to most people if they are exposed to outdoor noise levels of 65 dBA L_{eq} or less, potentially unacceptable if they are exposed to levels of 65 to 75 dBA L_{eq}, and unacceptable if exposed to levels of 75 dBA L_{eq} or more (USEPA 1981).

Most of the equipment that would be on site at the Proposed Action generates sound levels at or below 90 dBA L_{eq} at 50 feet. **Table 4.2-3** summarizes estimated noise levels at 50 feet generated by intermittent activity at the mine. To calculate the impact of a point source, the noise levels are mathematically propagated using the Inverse Square Law of Noise Propagation (Harris 1991). This formula states that noise decreases by approximately 6 dBA with every doubling of the distance from the source.

Table 4.2-3 Sound Levels for Applicable Noise Sources

Noise Source	Mean Noise Level at 50 Feet Lmax (dBA)
Haul Truck	80
Blasting	94
Front End Loader	80
Generators	82
Excavator	85
Blast Hole Drill	85

Source: Federal Highway Administration Construction Noise Handbook (2006).

Noise levels drop progressively with distance from the source. There are few sensitive receptors in the vicinity. The nearest residence or area of human activity is a seasonal residence approximately 0.5 mile south of the Study Area. Current mine activities cause only minor noise impacts on any off-site human receptors because the distances to the nearest occupied areas are sufficient to attenuate the noise of the heavy equipment to near background levels. Intermittent blasting can be audible but is at low enough volume and frequency to be considered minor.

An L_{eq} for blasting is not typically used as a measurement. Instead, a maximum sound level (L_{max}) was used to determine a noise estimate. This estimate does not account for natural attenuation of noise when blasting is occurring below grade in the pit or additional attenuation of noise as a result of natural topography and vegetation. Topographic and vegetative features would further decrease noise levels.

Noise levels at other operating phosphate mines in the area would represent typical noise levels for the Proposed Action. The effect of multiple noise sources is not a simple addition, but rather a logarithm. For example, if two identical and adjacent sources each produce a noise level of 65 dBA at 50 feet from the source, the total noise produced by both sources would be 68 dBA at 50 feet.

Based on doubling distances of the L_{eq}, sensitive noise receptors would not be impacted by noise generated at the mine. Even without attenuation of noise by natural and man-made barriers, noise levels would be lower than the USEPA guideline of 55 dBA for each source at a distance less than 0.5 mile. The L_{eq} for most noise sources are below 85 dBA at 50 feet; therefore, based on the Inverse Square Law of Noise Propagation, the noise would disseminate below the USEPA guideline of 55 dBA for acceptable environmental noise at 0.3 mile. The noise effects from the Proposed Action would be short-term and negligible or minor at the closest residence as a result of the distance from the mine.

4.2.1.2 Rasmussen Collaborative Alternative

4.2.1.2.1 Air Resources

Annual air emission impacts for the RCA are similar to those associated with the Proposed Action for gaseous emissions but would produce higher particulate emissions. The mining equipment and operating hours for the RCA would remain the same as those for the Proposed Action; therefore, the tailpipe and stationary air emission impacts are estimated to be the same. The RCA includes reducing overburden and ore stockpiles, reducing total disturbance area, and increasing ore hauling distance. Generally, the only difference in impacts between the RCA and the Proposed Action would be those from particulate emissions from mining operations such as hauling, material handling, and wind erosion. **Table 4.2-4** summarizes the estimated potential emissions for the RCA.

The RCA includes direct placement of Rasmussen Valley Mine overburden in the South Rasmussen Mine backfill area, thus eliminating the need for stockpiles downslope of the pit. This reduces the overburden pile area and reduces the frequency of overburden pile disturbance, resulting in reduced particulate emissions compared to the Proposed Action.

The total project-related surface disturbance of the RCA is approximately 40 acres less than that calculated for the Proposed Action; therefore, particulate emissions generated from surface wind erosion are estimated to be lower for the RCA. In addition, the disturbance from the project under the RCA would be spread over an additional 1.3 years (7.1 years in comparison to 5.8 years for the Proposed Action).

The RCA haul route extends approximately 3 miles longer than the Proposed Action route. Compared to the Proposed Action, an additional 6 vehicle miles of hauling emissions from the mine pit to the Wooley Valley Tipple Area are associated with the RCA. Particulate emissions from haul trucks would increase as a result of this haul route change.

Although potential particulate air impacts from wind erosion are reduced from the Proposed Action impacts, the overall annual potential particulate air emissions for the RCA would be higher as a result of the increase in total vehicle miles traveled for hauling material under the RCA plan.

The impacts from the RCA to air resources would be short-term and negligible.

4.2.1.2.2 Climate

The RCA anticipates nearly identical GHG emitting stationary sources to the Rasmussen Ridge Mine during the active mining period of 4.8 years. There is an addition of approximately 1 year prior to and 1 year subsequent to the active mining period to account for infrastructure development and final reclamation, respectively. During these periods, there would be less equipment operating and therefore less GHG emissions. Therefore, we concluded that the emissions from the RCA would not increase the annual GHG emissions but only extend the duration of impacts by approximately 7 years beyond those of the North Rasmussen Mine. The estimated contribution to climate change for the RCA would not change from the current levels as described in the Proposed Action impacts. **Table 4.2-2** presents GHG emissions for the Proposed Action, which are representative of the annual RCA impacts. The effects of the RCA on climate change would be short-term and negligible.

4.2.1.2.3 Noise Resources

Although the haul routes have changed in the RCA, there are still very few sensitive receptors in the RCA Study Area that would be noticeably impacted differently from the Proposed Action. As

explained in the Proposed Action, noise is directly related to distance from the source to the receptors. The sensitive receptors would continue to maintain a very similar distance to the RCA noise sources. The noise impacts from the RCA are expected to be short-term and negligible or minor at the closest residence as a result of the distance from the mine.

4.2.1.3 No Action Alternative

Under the No Action Alternative, direct impacts of air emissions and noise from the Proposed Action would not occur; therefore, air, climate, and noise quality would remain at ambient levels.

Under the No Action Alternative, indirect impacts to climate are not expected to change.

Under the No Action Alternative, noise associated with the Proposed Action would not occur, and ambient noise levels would remain unchanged in the analysis area. Under the No Action Alternative, the federal phosphate leases would not be developed; however, this does not preclude future development of the federal phosphate leases under a different mine plan.

4.2.2 Irreversible and Irretrievable Commitment of Resources

The Proposed Action and the RCA would include development of permanent external overburden piles. The potential for dust emissions from the piles would be mitigated by active re-vegetation. Under either the Proposed Action or the RCA, reclamation would restore existing conditions for dust emissions, and there would be no irreversible and irretrievable commitment of resources.

The estimated contribution to climate change for the RCA would not change from the current levels, as described in the Proposed Action impacts. Under either the Proposed Action or the RCA, once the active mining period is completed, existing conditions would be restored and there would be no irreversible and irretrievable commitment of resources.

Noise impacts from the Proposed Action and the RCA are expected to be short-term and unnoticeable or minor at the closest residence to the mine. Under either the Proposed Action or the RCA, once the active mining period is completed, existing conditions would be restored, and there would be no irreversible and irretrievable commitment of resources.

4.2.3 Unavoidable Residual Adverse Effects

For the Proposed Action and the RCA, an unavoidable residual adverse impact to air resources would occur if re-vegetation efforts were not successful, resulting in a greater potential to generate particulate emission caused by wind erosion. The effects of both the Proposed Action and the RCA to climate and noise resources would be short-term and would have no residual adverse effects.

For the Proposed Action and the RCA, an unavoidable residual adverse impact on climate change is not expected to occur because climate change impacts will cease when the active mining period is completed.

For the Proposed Action and the RCA, an unavoidable residual adverse impact on noise is not expected to occur because noise impacts will cease when the active mining period is completed.

Table 4.2-4 Potential Controlled Emissions Summary, Rasmussen Valley Mine under the RCA

Emission Source	PM_{10}		$PM_{2.5}$		SO_2		NO_X		CO		VOC	
	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr
Stationary Fuel Combustion Sources												
Main Generator	0.44	1.9	0.37	1.6	0.44	1.9	4.7	20.4	1.3	5.6	0.14	0.63
Mine Shovel	0.032	0.14	0.032	0.14	0.14	0.60	0.52	2.3	0.55	2.4	0.52	2.26
Support Generator	0.85	3.7	0.85	3.7	0.79	3.5	4.1	18.0	2.2	9.7	4.11	18.0
Well Pump	0.22	1.0	0.22	0.96	0.21	0.90	3.1	13.6	0.67	2.9	0.25	1.1
Seasonal run-off Control Generators	0.082	0.36	0.08	0.36	1.0	4.4	2.7	11.9	0.48	2.1	2.7	11.9
Night Shift Light Plants	0.34	1.5	0.27	1.2	0.56	2.5	3.7	16.4	2.9	12.6	3.2	13.9
Steam Generation/Hot Water Boiler	0.23	1.0	0.011	0.050	0.00036	0.0016	0.23	1.02	0.13	0.59	0.018	0.080
Dust Suppression Generator	0.027	0.12	0.027	0.12	0.20	0.88	0.45	2.0	0.192	0.84	0.47	2.0
Contractor Building Generator	0.059	0.26	0.059	0.26	0.18	0.81	0.69	3.0	0.73	3.2	0.69	3.04
Mine Pit Equipment Generator	0.11	0.50	0.11	0.50	0.11	0.47	1.6	7.1	0.35	1.5	0.13	0.57
Mobile Fuel Combustion Sources												
Mobile Equipment Engines	14.8	64.7	14.8	64.7	15.8	69.1	447.8	1961.3	255.8	1120.5	23.6	103.2
Mining												
Blasting & Explosives	0.0024	0.011	0.00014	0.00061	0.089	0.39	0.75	3.30	2.97	13.0	--	--
Drilling	0.069	0.30	0.069	0.30	--	--	--	--	--	--	--	--
Screening	0.030	0.13	0.0020	0.0088	--	--	--	--	--	--	--	--
Hauling	78.7	344.9	7.9	34.5	--	--	--	--	--	--	--	--
Material Handling	0.071	0.31	0.011	0.047	--	--	--	--	--	--	--	--
Wind Erosion	0.76	3.3	0.11	0.50	--	--	--	--	--	--	--	--
Tanks												
Storage Tanks	--	--	--	--	--	--	--	--	--	--	0.0065	0.028
Project Total	**97**	**424**	**25**	**109**	**19**	**85**	**470**	**2,060**	**268**	**1,175**	**36**	**157**

Source: Agrium 2013; ARCADIS 2015f

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4.2.4 Mitigation Measures

To minimize direct and indirect impacts to air resources, Agrium would mitigate particulate emissions by application of water or supplementary dust suppressants, such as magnesium chloride or calcium chloride, as necessary. Liquid dust suppressants would be used for all blast hole drilling operations (Agrium 2011). No additional mitigation measures would be needed for air resources.

The Mine Reclamation Plan is an element of the Proposed Action and RCA designed to reduce environmental impacts. The Mine Reclamation Plan includes operations for backfill sequence, haul roads, store-and-release cover, re-vegetation, and removal of all mine equipment and facilities. Disturbed areas would be covered with GM, seeded, and fertilized. No mitigation for noise impacts is identified. Air quality, noise, and climate impacting sources would be removed and mitigated to reduce the potential of irreversible long-term adverse effects.

4.3 WATER RESOURCES

Issue: What are the potential impacts to the volume and timing of surface water runoff and flow patterns in the Lanes Creek, Angus Creek, and Blackfoot River drainages?

Indicators:

- Changes to volume of runoff, flow patterns, base and peak flows, recharge rates, or volume to local, intermediate, and regional aquifer systems

Issue: What are the potential impacts to sediment, turbidity, and COPC loading in Lanes Creek, Angus Creek, Blackfoot River, wetlands, ponds, and springs and the impacts of those changes to surface water quality accessed by humans, wildlife, and aquatic organisms or cause non-compliance of the water bodies with applicable water quality standards?

Indicators:

- Predicted changes in sediment loads, turbidity, concentrations of COPCs in springs, wetlands and waters of the U.S. (WOUS), ponds, Lanes Creek, Angus Creek, and Blackfoot River

Issue: What are the potential impacts to groundwater quality accessed by humans and non-compliance of the groundwater with applicable water quality standards resulting from changes in concentrations of COPCs downgradient of the proposed mine facilities?

Indicators:

- Changes in concentrations of COPCs in groundwater

Issue: Would reduction in groundwater discharge to Lanes Creek, Angus Creek, Blackfoot River, ponds, springs, and wetlands cause affects to water availability on humans, wildlife, and aquatic organisms?

Indicators:

- Estimated changes to base flow in streams, pond water levels, spring flows, and wetland areas
- Increased depth to groundwater

4.3.1 Direct and Indirect Impacts

Potential impacts to water resources were evaluated using numerical models to estimate seepage rates from the proposed mine facilities and to simulate the transport of COPCs in groundwater and surface water. The models were based on data and analysis presented in Whetstone (2015a,b) and (BC 2015a,b). Supporting documentation for the numerical models and the water resources impact evaluation are presented in the Groundwater Modeling Report (ARCADIS 2015g), Cap and Cover Report (BC 2015a), and the Source Term Report (Whetstone 2015c).

4.3.1.1 Proposed Action

4.3.1.1.1 Conceptual Hydrologic and Geochemical Models for Mine Facilities

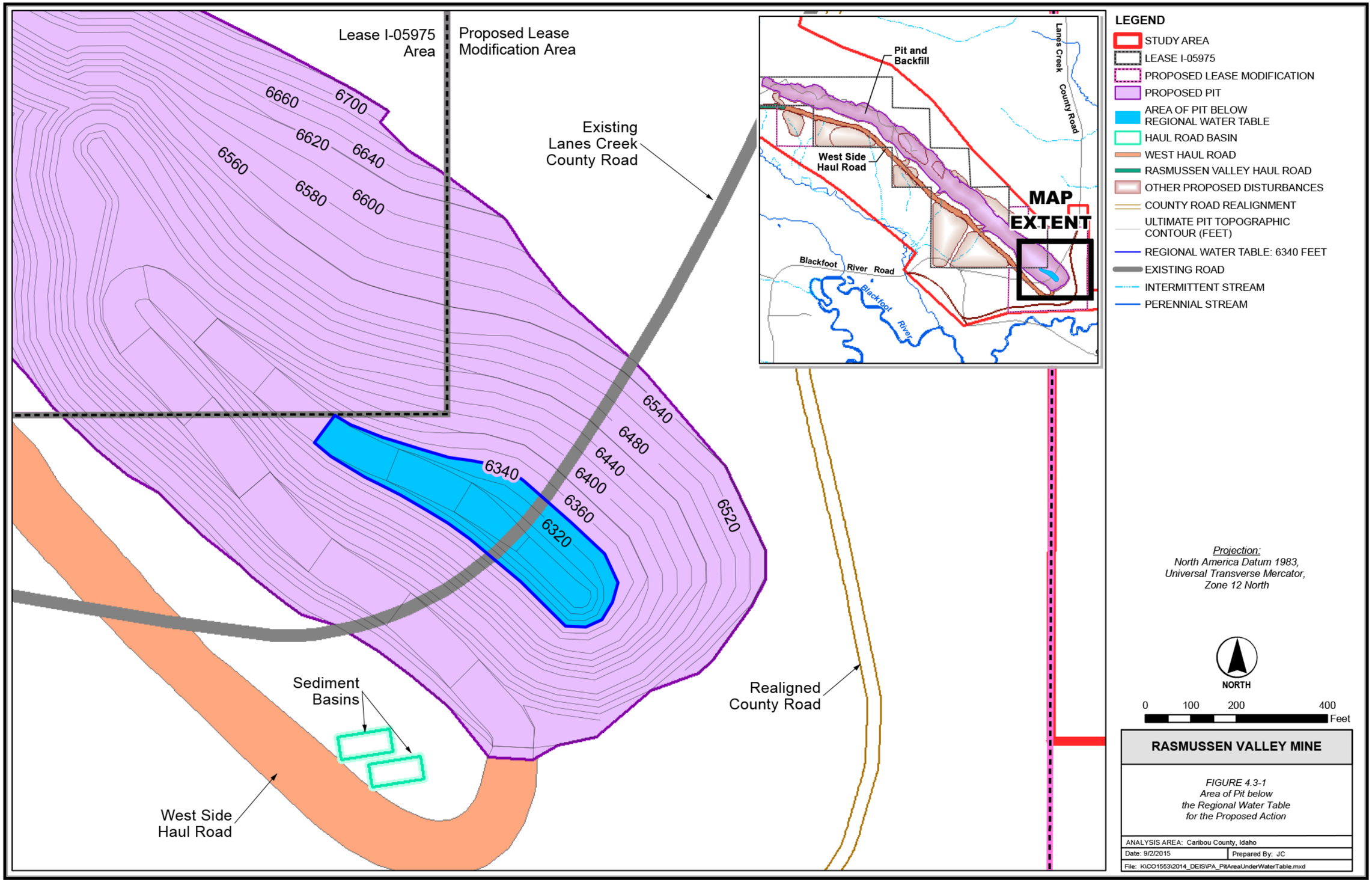
Open Pit and Backfill

The open pit and backfill, including the North and South External Overfill areas, would have a length of approximately 2.4 miles and a footprint of 195.4 acres (**Figure 2.3–2**). Excavation of the pit would progress from southeast to northwest and would be completed in six phases over 3.9 years. The elevation of the pit floor would decrease to the southeast and have a minimum level of about 6,280 feet above mean sea level (amsl).

Mining below 6,340 feet amsl would be below the water table in the Wells Regional Aquifer, and dewatering using an in-pit sump could be required to facilitate excavation of the pit below this level (**Figure 4.3-1**). Numerical modeling by ARCADIS (2015g) indicates that the dewatering discharge rate would need to be approximately 4,300 gallons per minute (gpm) for approximately 7 to 8 months during Phase 1 mining to keep excess water from collecting in the bottom of the pit. Groundwater levels in the Wells Regional Aquifer are projected to rebound to the pre-mining level in about 3 months once pumping stops after the completion of Phase 1 mining.

Limited volumes of groundwater would also be encountered at higher elevations in the pit. This inflow would originate from alluvium, the Rex Chert, and to a lesser extent the Meade Peak. These strata would drain rapidly after being opened, but could generate water intermittently during the spring snowmelt or in response to precipitation events. Agrium's proposal to handle water that accumulates in the pit from runoff, precipitation, or groundwater inflow would be to collect it in a sump at the bottom of the pit. The sump water would then be pumped or hauled to unreclaimed backfill areas, where it would be dispersed and allowed to infiltrate. However, it is noted that, given south to north mining sequence, no areas of backfill would exist to disperse and infiltrate the accumulated water (including pit dewatering) during mining Phase 1.

Backfilling of the pit would start by placing Phase 2 overburden into the Phase 1 pit concurrent with mining of Phase 2. The process of backfilling previous open pits with backfill from newly mined areas of the pit would continue as mining progressed north. Two external overburden overfill areas (North and South External Overfill) would be located on the east side of the pit and would be contiguous with the backfill. A total of about 36.9 million loose cubic yards (MLCY) of material would be placed as backfill and overfill including basalt (0.2 percent), alluvium (3.9 percent), Cherty Shale (10.3 percent), Rex Chert (15.9 percent), Meade Peak (51.0 percent), Grandeur Tongue (15.7 percent), and Wells Formation (3.0 percent). The backfilled pit would be contoured to resemble the surrounding topography, capped with a minimum of 36 inches of non-Meade-Peak-containing material and 24 inches of GM, and re-vegetated. A portion of the northeast pit wall consisting of Grandeur Tongue or Wells Formation would remain exposed after final reclamation.


Lease I-05975 Area
Proposed Lease Modification Area
Existing Lanes Creek County Road
Realigned County Road
Sediment Basins
West Side Haul Road
6660
6700
6620
6640
6560
6580
6600
6540
6480
6440
6400
6360
6340
6320
6520
Pit and Backfill
West Side Haul Road
Lanes Creek County Road
Blackfoot River Road
Blackfoot River
MAP EXTENT
LEGEND
STUDY AREA
LEASE I-05975
PROPOSED LEASE MODIFICATION
PROPOSED PIT
AREA OF PIT BELOW REGIONAL WATER TABLE
HAUL ROAD BASIN
WEST HAUL ROAD
RASMUSSEN VALLEY HAUL ROAD
OTHER PROPOSED DISTURBANCES
COUNTY ROAD REALIGNMENT
ULTIMATE PIT TOPOGRAPHIC CONTOUR (FEET)
REGIONAL WATER TABLE: 6340 FEET
EXISTING ROAD
INTERMITTENT STREAM
PERENNIAL STREAM
Projection:
North America Datum 1983,
Universal Transverse Mercator,
Zone 12 North
NORTH
0 100 200 400
Feet
RASMUSSEN VALLEY MINE
FIGURE 4.3-1
Area of Pit below
the Regional Water Table
for the Proposed Action
ANALYSIS AREA: Caribou County, Idaho
Date: 9/2/2015
Prepared By: JC
File: K:\CO1553\2014_DEIS\PA_PitAreaUnderWaterTable.mxd

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Precipitation falling on the capped backfill and overfill would either run off or evaporate, or infiltrate where it would either be stored in the soil pore space, transpired by vegetation, or continue percolation downward below the cap. The backfill would also receive runoff from a 663-acre slope area on the northeast side of the pit. Runoff from upslope areas would be allowed to enter the open pit during mining, but Agrium would have the option to intercept and divert the flows from drainage areas 3 and 4 and divert the flow to drainage area 20, which drains into Lower Lanes Creek sub-watershed (**Figure 2.3–5**). Runoff from the backfill during construction would be captured in an interceptor ditch on the downslope side of the backfill and would be routed to the pit sump. The interceptor ditch would be located within the footprint of the pit to minimize infiltration to the alluvial aquifer. The final reclamation surface of the backfill would be graded to re-establish natural drainage patterns similar to the pre-mining configuration of the site. The proposed cover system is designed to limit the amount of meteoric water that would infiltrate through the overburden and prevent root uptake of selenium in cover vegetation. Runoff from the reclaimed backfill and overfill areas would have chemical characteristics similar to runoff from undisturbed ground but may have increased turbidity and suspended solids during construction and initial reclamation that would be mitigated through the use of best management practices (BMPs) such as sediment fences, straw wattles, and retention basins.

Meteoric water that percolates through the cover and into the overburden would leach metals and other constituents from the overburden and continue downward to become solutes in the groundwater of the Wells Regional Aquifer, where they would be transported to the northwest by the natural groundwater flow. The regional flow system does not discharge to surface water within the Study Area. A conceptual diagram illustrating the release of solutes from the pit backfill is shown on **Figure 4.3-2**.

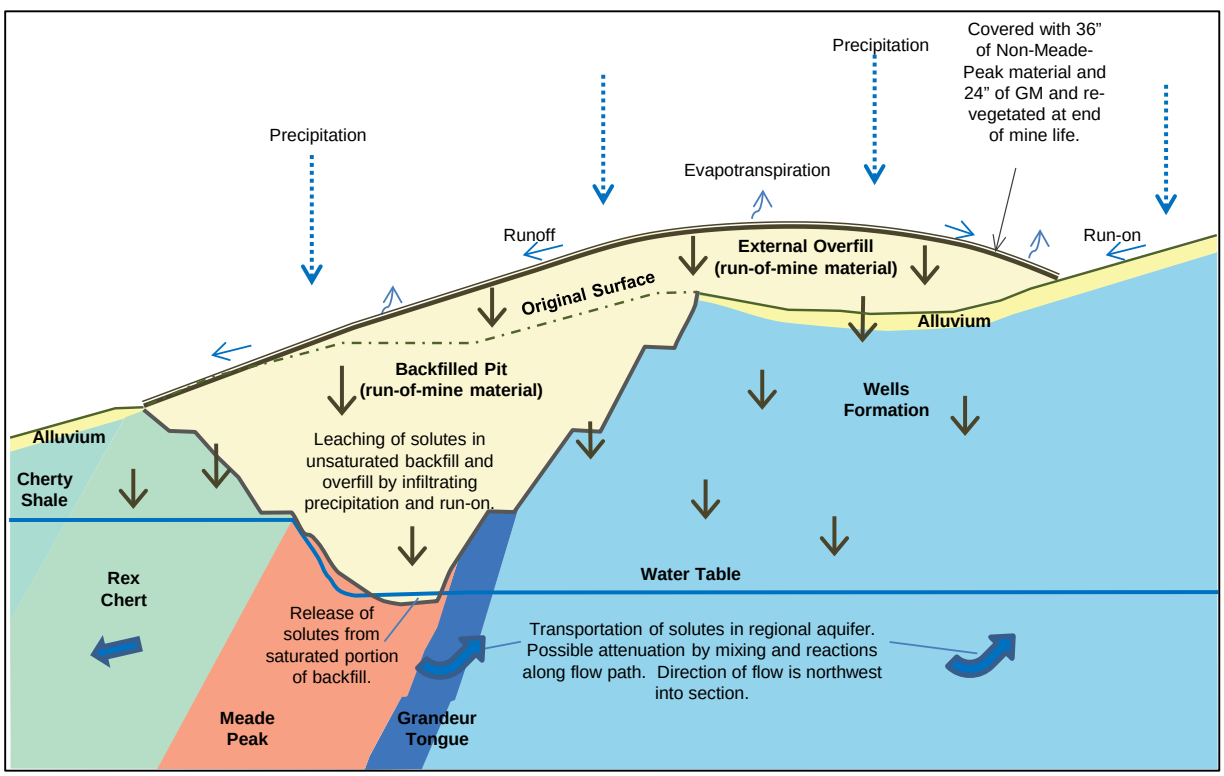


Figure 4.3-2 Conceptual Diagram Showing Runoff, Infiltration, and Solute Transport for Proposed Action Pit Backfill after Reclamation

North Overburden Pile

The North Overburden Pile would be located on the west (downslope) side of the pit near its northern extent (**Figure 2.3–2**). The North Overburden Pile would contain approximately 2.1 MLCY of non-Meade-Peak overburden at its largest extent, including basalt (4.4 percent), alluvium (6.8 percent), Cherty Shale (41.5 percent), Rex Chert (26.5 percent), Grandeur Tongue (20.1 percent), and Wells Formation (0.8 percent). Construction of the North Overburden Pile would start during Phase 1 and continue through Phase 6. The majority of the pile would be re-handled and placed as backfill during Phase 7, resulting in a final material volume of 689,300 LCY. The overburden pile would be reclaimed during Phase 8 with a final slope of 3H:1V and would be covered with no less than 12 inches of GM and re-vegetated. The remaining overburden pile would be a permanent facility that would remain in place after the end of mining.

Precipitation falling on the North Overburden Pile would either run off; evaporate; or infiltrate to be stored in the soil pore space, transpired by vegetation, or continue percolating downward beyond the cap. Runoff from the facility during operation would be captured in a perimeter ditch at the base of the pile and would be routed to sediment basins near the southwest corner of the pile, where it would infiltrate, evaporate, or be transported to other available approved storm water storage and infiltration areas. A ditch would also be located along the upslope edge of the pile to intercept and route run-on to the storm water sediment basins. The ditch and basin locations overlie alluvium and alluvial aquifers such that water that infiltrates from the sediment basins is expected to percolate to the alluvial aquifers, have similar chemical characteristics as seepage from the pile, and be transported west in the shallow alluvial aquifer toward Angus Creek. Storm water management structures would be designed to accommodate runoff from the 100-year, 24-hour storm event and would be reclaimed at the end of mining.

Meteoric water that percolates through the cover and overburden pile would leach metals and other contaminants into the alluvial aquifer, where they would be transported west in groundwater toward Angus Creek. The depth to groundwater below the North Overburden Pile ranges from about 30 to 57 feet (**Table 3.3–12**) depending on location and season. Gain-loss studies (**Table 3.3–5**) and baseline monitoring data indicate that the upper sections of Angus Creek lose flow to groundwater under most flow conditions. The concentrations of metals and other constituents transported in groundwater away from the facility may be attenuated along the flow path by dilution, precipitation, or adsorption (Fuller and Davis 1987; Zachara et al. 1993; Hayes et al. 1987; Balistrieri and Chao 1990; Rajan 1979). A conceptual diagram showing the release of solutes from the North Overburden Pile is shown on **Figure 4.3-3**.

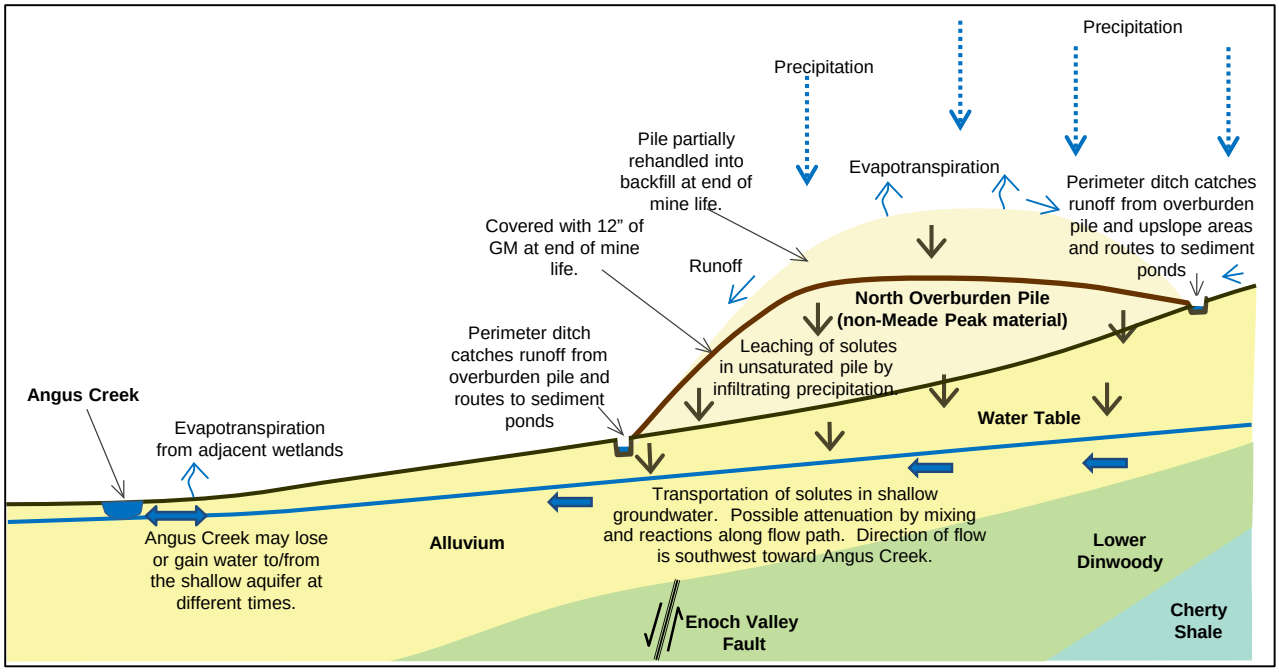


Figure 4.3-3 Conceptual Diagram Showing Runoff, Infiltration, and Solute Transport from the North Overburden Pile of the Proposed Action during Mining and after Reclamation

South-South Overburden Pile

The South-South Overburden Pile would be located on the west side of the pit and haul road, approximately 800 feet to the east of Angus Creek (**Figure 2.3-2**). The facility would contain approximately 2.8 MLCY of non-Meade-Peak overburden and have a footprint of 32.8 acres. The projected material balance for the facility includes basalt (5.4 percent), alluvium (6.3 percent), Cherty Shale (47.1 percent), Rex Chert (25.8 percent), Grandeur Tongue (15.2 percent), and Wells Formation (0.2 percent). Construction of the South-South Overburden Pile would occur during Phase 1, with reclamation starting in Phase 2. The reclaimed pile would be contoured to a 3H:1V slope, covered with 12 inches of GM, and re-vegetated. The South-South Overburden Pile would be a permanent facility that would remain in place after the end of mining.

Precipitation falling on the South-South Overburden Pile would either run off or evaporate or infiltrate where it would be transpired by vegetation, stored in the soil pore space; or continue percolation downward below the cap. Runoff from the facility during operation would be captured in a perimeter ditch at the base of the pile and would be routed to sediment basins near the southwest corner of the pile, where it would infiltrate, evaporate, or be transported to other available approved storm water storage and infiltration areas. A ditch would also be located along the upslope edge of the pile to intercept and route run-on to the sediment basins. The ditch and basin locations overlie alluvium and alluvial aquifers. Water that infiltrates from the sediment basins is expected to percolate to the alluvial aquifers, have chemical characteristics similar to seepage from the pile, and be transported west in the shallow alluvial aquifer toward Angus Creek. Storm water management structures would be designed to accommodate runoff from the 100-year, 24-hour storm event and would be reclaimed at the end of mining.

Meteoric water that percolates into the South-South Overburden Pile would leach metals and other constituents into the underlying alluvial aquifer, where they would be transported west in groundwater toward Angus Creek. The depth to water below the South-South Overburden Pile ranges from approximately 2 to 56 feet (**Table 3.3-12**) depending on location and season. Gain-loss studies (**Table 3.3-5**) and baseline monitoring data indicate that the lower sections of Angus Creek lose flow to groundwater under most flow conditions. The concentrations of metals and other constituents transported in groundwater away from the facility may be attenuated along the flow path by dilution, precipitation, or adsorption (Fuller and Davis 1987; Zachara et al. 1993; Hayes et al. 1987; Balistrieri and Chao 1990; Rajan 1979). A conceptual diagram showing the release of solutes from the South-South Overburden Pile is presented on **Figure 4.3-4**.

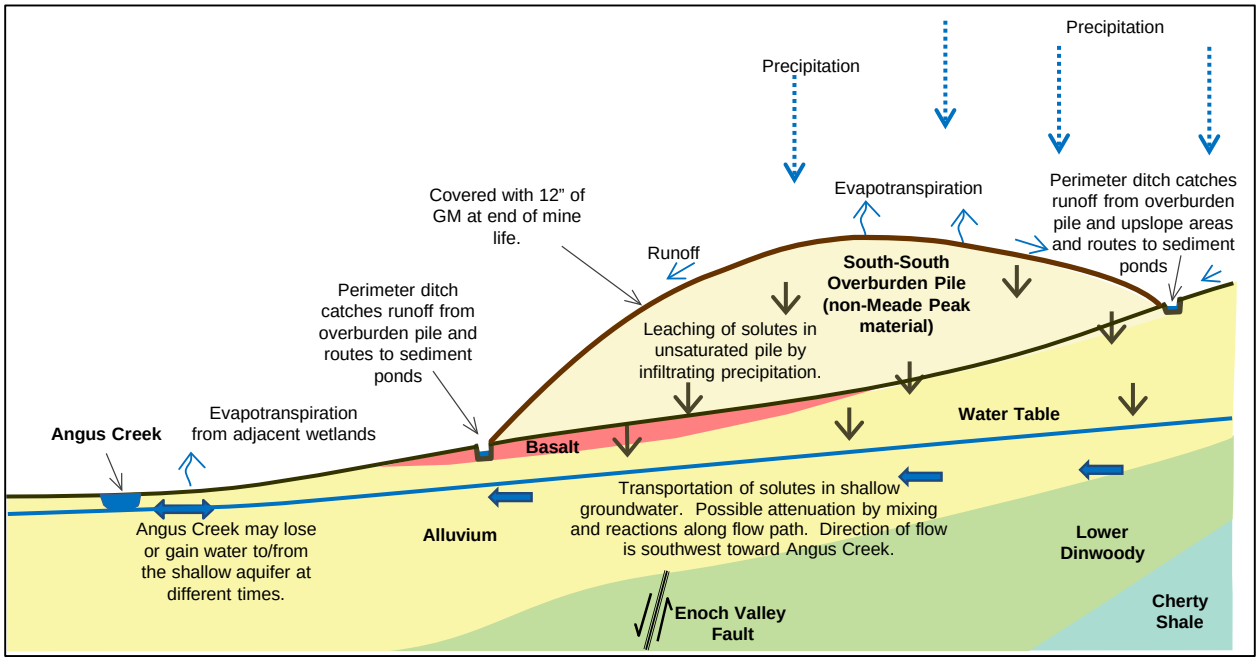


Figure 4.3-4 Conceptual Diagram Showing Runoff, Infiltration, and Solute Transport from the South-South Overburden Pile of the Proposed Action after Reclamation

South Main Overburden Pile

The South Main Overburden Pile would be a temporary facility located on the west side of the pit and haul road, approximately 650 feet east of Angus Creek (**Figure 2.3-2**). The facility would contain approximately 4.1 MLCY of Meade Peak overburden at its maximum extent, and would have a maximum footprint of 37.9 acres. The projected material balance includes hanging wall mud (13.8 percent), center waste (67.5 percent), upper and lower ore partings (16.2 percent), and footwall mud (2.6 percent). Construction of the South Main Overburden Pile would start during Phase 1 and continue through Phase 6. The pile would be removed and placed into the pit as backfill at the end of mining, and the site re-graded, covered with 12 inches of GM, and re-vegetated.

Precipitation falling on the South Main Overburden Pile would either run off, evaporate or would infiltrate where it would be transpired by vegetation, stored in the soil pore space, or continue percolation downward below the cap. Runoff from the facility during operation would be captured in a perimeter ditch at the base of the pile and would be routed to sediment basins near the southwest corner of the facility, where it would infiltrate or evaporate or be transported to other

available approved storm water storage and infiltration areas. A ditch would also be located along the upslope edge of the pile to intercept and route run-on to the sediment basins. The ditch and basin locations overlie alluvium and alluvial aquifers. Water that infiltrates from the sediment basins is expected to percolate to the alluvial aquifers, have chemical characteristics similar to seepage from the pile, and be transported west in the shallow alluvial aquifer toward Angus Creek. Storm water management structures would be designed to accommodate runoff from the 100-year, 24-hour storm event and would be reclaimed at the end of mining.

Meteoric water that percolates into the South Main Overburden Pile would leach metals and other constituents into the alluvial aquifer, where they would be transported southwest in groundwater toward Angus Creek. The depth to water below the South Main Overburden Pile is 2 to 56 feet (**Table 3.3-12**) depending on season and location. Gain-loss studies (**Table 3.3-5**) and baseline monitoring data indicate that the lower sections of Angus Creek lose flow to groundwater under most flow conditions. The concentrations of metals and other constituents that are transported in groundwater away from the facility may be attenuated along the flow path by dilution, precipitation or adsorption (Fuller and Davis 1987; Zachara et al. 1993; Hayes et al. 1987; Balistrieri and Chao 1990; Rajan 1979). A conceptual diagram showing the release of solutes from the South Main Overburden Pile is shown on **Figure 4.3-5**.

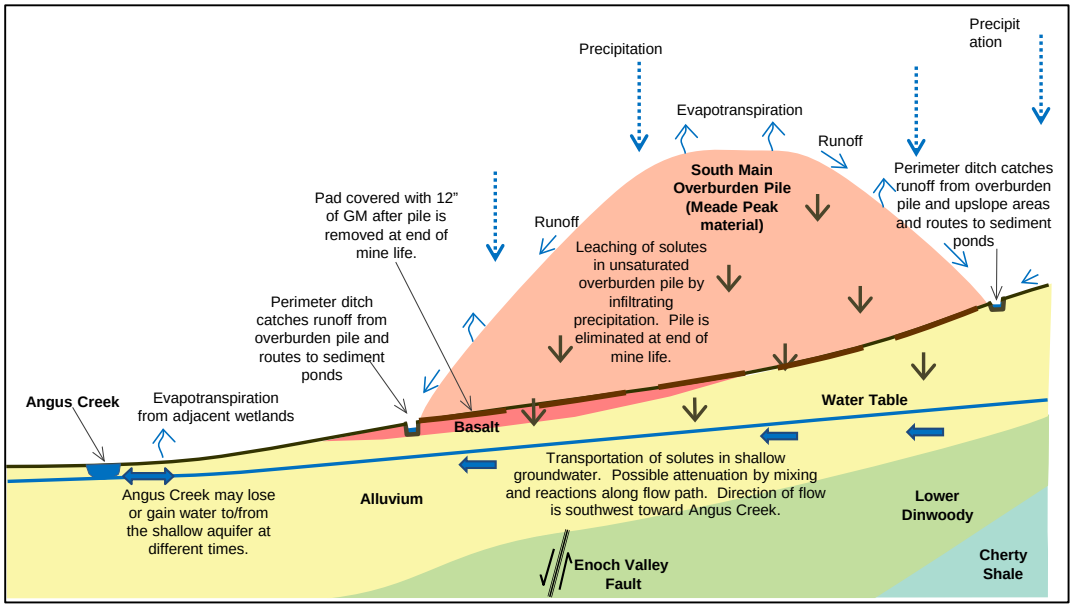


Figure 4.3-5 Conceptual Diagram Showing Runoff, Infiltration, and Solute Transport from the South Main Overburden Pile of the Proposed Action during Mining

Optional Ore Stockpile/Overburden Storage Area

The Optional Ore Stockpile/Overburden Storage Area, if constructed, would be located on the west side of the pit and haul road, between the South Main and North Overburden Piles, about 1,200 feet east Angus Creek (**Figure 2.3-2**). The facility would have a storage capacity of 0.18 MLCY and may be used to store ore or overburden depending on timing of ore transport and available backfill locations. The base of the facility would be constructed using 0.16 MLCY of non-Meade-Peak overburden. The material balance for the Optional Ore Stockpile/Overburden Storage Area has not been determined, but it may contain any rock type that is produced from the mine. All material in the facility would be removed at the end of mining and the site would be re-graded, covered with 12 inches of GM, and re-vegetated.

Precipitation falling on the Optional Ore Stockpile/Overburden Storage Area while it is being used for ore would either run off, evaporate, or infiltrate. Infiltration would either be stored in the ore pore space, or continue percolation downward. No transpiration would occur because the piles would not be vegetated. If the Optional Ore Stockpile/Overburden Storage Area were used to permanently store overburden and was reclaimed, precipitation would either run off, evaporate, or infiltrate. The infiltration would either be stored in the soil pore space, be transpired by the re-vegetation plants, or continue percolation downward in much the same way as the other external overburden stockpiles. Runoff from the facility during operation would be captured in a perimeter ditch at the base of the pile and would be routed to sediment basins near the south corner of the stockpile, where it would infiltrate, evaporate, or be transported to other available approved storm water storage and infiltration areas. A ditch would also be located along the upslope edge of the pile to intercept and route run-on to the sediment basins. The ditch and basin locations overlie alluvium and alluvial aquifers. Water that infiltrates from the sediment basins is expected to percolate to the alluvial aquifers, have chemical characteristics similar to seepage from the pile, and be transported west in the shallow alluvial aquifer toward Angus Creek. Storm water management structures would be designed to accommodate runoff from the 100-year, 24-hour storm event and would be reclaimed at the end of mining.

Meteoric water that percolates into the Optional Ore Stockpile/Overburden Storage Area would leach metals and other constituents into the alluvial aquifer, where they would be transported southwest in groundwater toward Angus Creek. The depth to water below the Optional Ore Stockpile is approximately 22 to 56 feet depending on season and location (**Table 3.3-12**). Gain-loss studies (**Table 3.3-5**) and baseline monitoring data indicate that Angus Creek loses flow to groundwater under most flow conditions. The concentrations of metals and other constituents transported in groundwater away from the facility may be attenuated along the flow path by dilution, precipitation, or adsorption (Fuller and Davis 1987; Zachara et al. 1993; Hayes et al. 1987; Balistrieri and Chao 1990; Rajan 1979). A conceptual diagram illustrating the release of solutes from the Optional Ore Stockpile/Overburden Storage Area is shown on **Figure 4.3-6**.

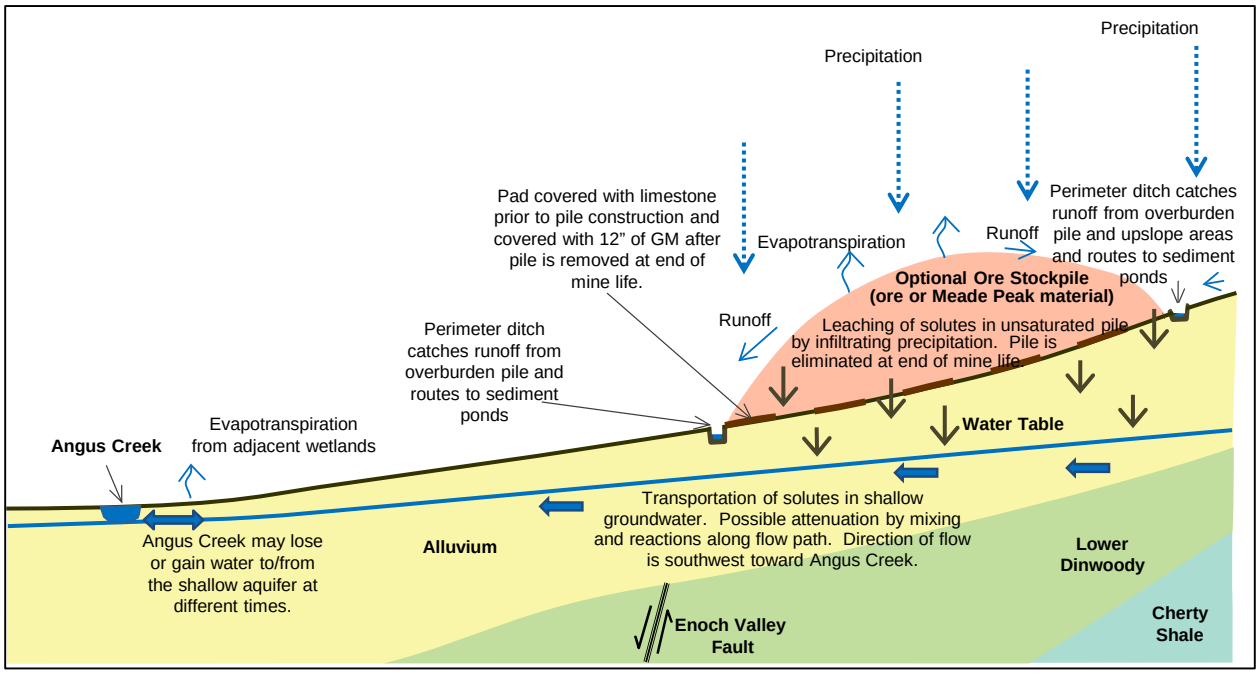


Figure 4.3-6 Conceptual Diagram Showing Runoff, Infiltration, and Solute Transport from the Optional Ore Stockpile of the Proposed Action during Mining

North and South Temporary Overburden Piles

The North and South Temporary Overburden Piles would be located within the footprint of the pit prior to mining that pit (**Figure 2.3-2**). Construction of the temporary overburden piles would start during Phase 1 mining and would continue through Phase 3. Material from the piles would be re-handled into the backfill during mining of Phases 4 and 5. The maximum duration that the piles would be present is approximately 30 months. The temporary overburden piles would contain a combined total of approximately 0.56 MLCY of Meade Peak overburden and have a maximum footprint of 15.1 acres. The projected material balance of the temporary pile includes hanging wall mud (13.8 percent), center waste (67.5 percent), upper and lower ore partings (16.2 percent), and footwall mud (2.6 percent).

Precipitation falling on the North and South Temporary Overburden Piles would either run off, evaporate, or infiltrate where it would either be transpired by vegetation, be stored in the soil pore space; or continue percolation downward below the cap. Runoff from the facilities would be captured in the interceptor ditch on the southwest side of the pit and be routed to a system of sediment basins, where it would infiltrate, evaporate, or be transported to other available approved storm water storage and infiltration areas. A ditch would also be located along the upslope edge of the pile to intercept and route run-on to the sediment basins. The ditch and basin locations overlie alluvium and alluvial aquifers. Water that infiltrates from the sediment basins is expected to percolate to the alluvial aquifers, have chemical characteristics similar to seepage from the pile, and be transported west in the shallow alluvial aquifer toward Angus Creek. Storm water management structures would be designed to accommodate runoff from the 100-year, 24-hour storm event and would be reclaimed at the end of mining.

Meteoric water that percolates into the temporary overburden piles would leach metals and other constituents into unsaturated bedrock. Because these temporary overburden piles are located within the pit footprint, bedrock and associated leachate below the piles would subsequently be mined and placed as backfill during mining of Phases 4 and 5. A conceptual diagram showing the impacts from the North and South Temporary Overburden Piles is shown on **Figure 4.3-7**.

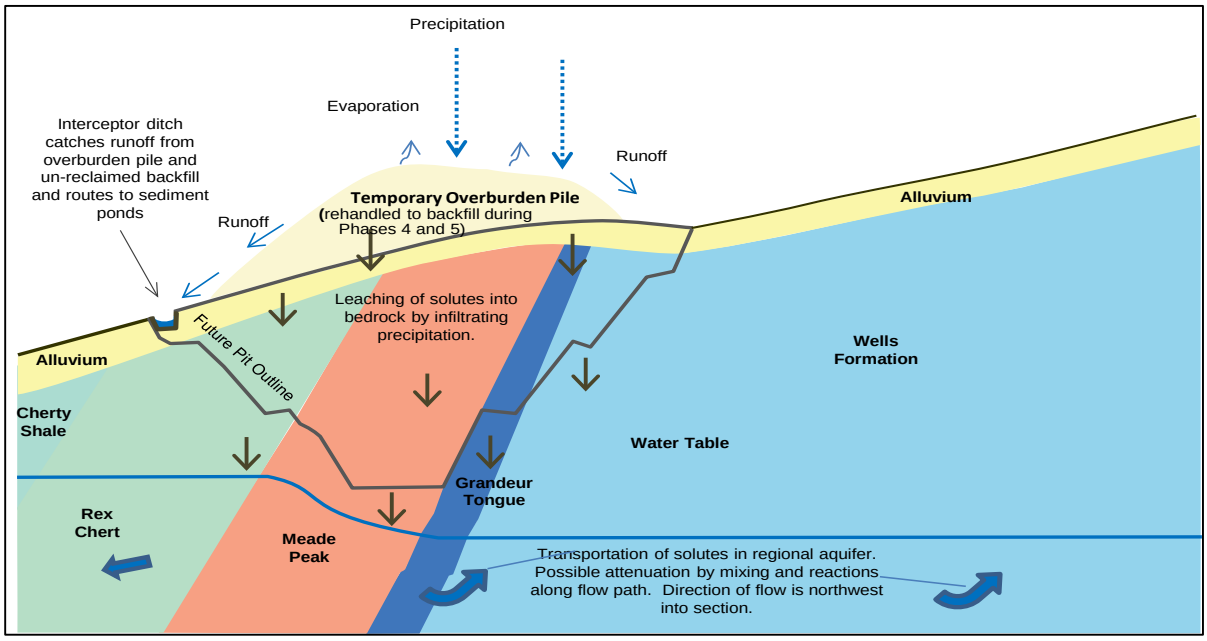


Figure 4.3-7 Conceptual Diagram Showing Runoff, Infiltration, and Solute Transport from the North and South Temporary Overburden Piles of the Proposed Action during Mining

Growth Medium Stockpiles

Three GM Stockpiles (Access North, Access South, and North GM Stockpiles) would be located along the haul road on the southwest side of the pit (**Figure 2.3-2**). The piles would contain soil from mining disturbance areas that is suitable as GM in reclamation activities. It is estimated that a total of approximately 1.7 MLCY of GM would be removed from the disturbed areas over the life-of-mine. The stockpiles would vary in size and volume over time as disturbance areas expand and material is removed for concurrent reclamation. Approximately 990,000 LCY of GM would be required for reclamation of mine facilities. Excess GM in the stockpiles would be distributed along haul roads or other areas that may require in-filling during final reclamation.

Precipitation that falls onto the GM stockpiles would run off, evaporate, or infiltrate and be stored in the soil pore space, be transpired or continue percolation downward. GM leachate is expected to exhibit characteristics similar to undisturbed soils, thus runoff and seepage from the piles are expected to meet applicable water quality standards with the exception of TDS and total suspended solids (TSS), which would be mitigated by the use of BMPs such as sediment fences, straw wattles, and retention basins. A conceptual diagram showing the impacts from the GM Stockpiles is shown on **Figure 4.3-8**.

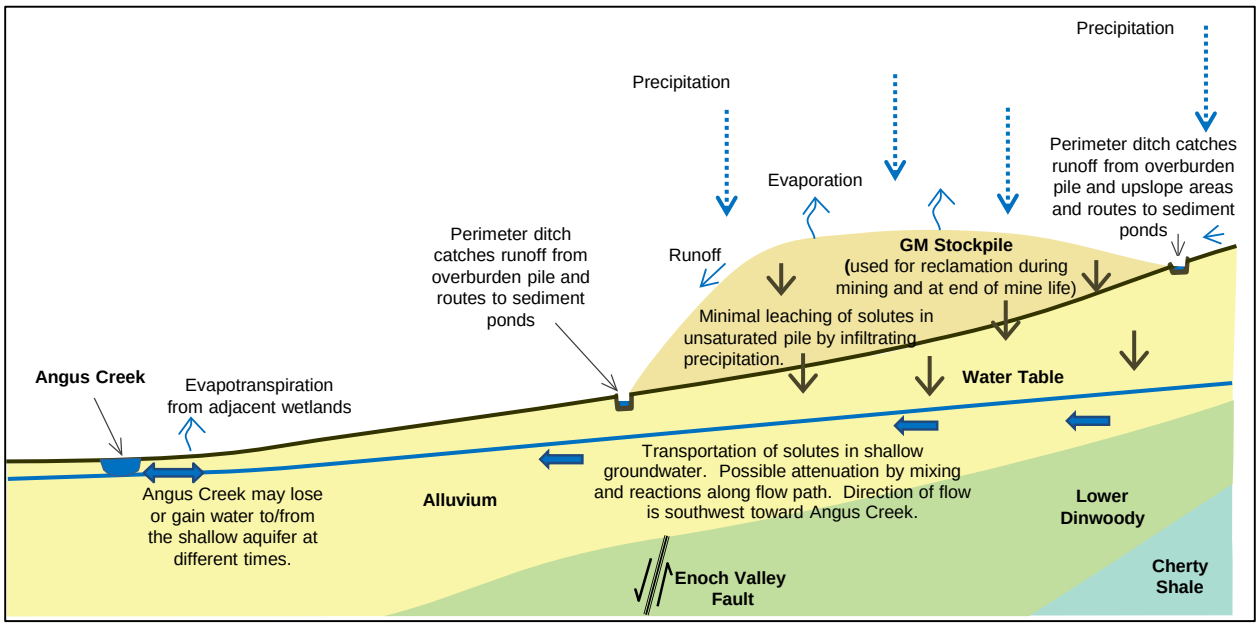


Figure 4.3-8 Conceptual Diagram Showing Runoff, Infiltration, and Solute Transport from GM Stockpiles of the Proposed Action and RCA during Mining

Seepage Chemistry and Constituents of Potential Concern

COPCs in seepage from the proposed mine facilities were determined by comparison of the column leachates (**Section 4.1.1.1.2**) to numerical standards for surface water and groundwater (**Table 3.3–2** and **Table 3.3–15**). In general, concentrations of most COPCs were highest in leachates from columns that contained Meade Peak rocks followed by leachates from columns containing Cherty Shale and Rex Chert. Leaching under unsaturated conditions typically resulted in higher metal mobility than leaching under saturated conditions. Iron and manganese were exceptions to this generalization and were more mobile under saturated leaching conditions. COPCs carried forward in the contaminant fate-and-transport model for the proposed Rasmussen Valley Mine (ARCADIS 2015g) are presented in **Table 4.3-1**.

Table 4.3-1 Constituents of Potential Concern for Surface Water and Groundwater

COPC	Concentration in Column Leachate Exceeded Groundwater Standard[1]	Concentration in Column Leachate Exceeded Lowest Surface Water Standard[2]
Aluminum	x	
Antimony	x	x
Cadmium	x	x
Copper		x
Iron	x	
Manganese	x	
Nickel		x
Selenium	x	x
Sulfate	x	
TDS	x	
Thallium	x	x
Uranium	x[3]	
Zinc	x	x

Notes:
1 Idaho Groundwater Standards (IDAPA 58.01.11); see **Table 3.3-15**
2 Idaho Surface Water Standards (IDAPA 58.01.02); see **Table 3.3-2**
3 Federal primary drinking water standard

4.3.1.1.2 Numerical Models

Numerical models were developed to quantify seepage from the proposed mine facilities and to evaluate the loading and transport of COPCs in groundwater and surface water. The models were based on hydrologic and geochemical data from site-specific baseline studies (Whetstone 2014) and the conceptual geochemical and hydrologic models discussed in **Sections 3.1.3, 3.3.1, 3.3.2,** and **4.3.1.1.1**.

Infiltration and Seepage Modeling

The software package SVFlux (Soil Vision 2005, 2012) was used to model infiltration and percolation of meteoric water through the proposed cover systems for pit backfill and overburden (BC 2015a). SVFlux is a finite-element model that uses the Richard's Equation to calculate variably saturated flow in soil and other geologic materials. The software evaluates the effects of seasonal surface storage, ground frost, snowmelt, runoff, infiltration, evapotranspiration, vegetative growth, soil moisture storage, lateral subsurface drainage, and seepage through various types of cover layers.

Seepage through the proposed cover systems was simulated either by one-dimensional vertical flow (e.g., for store-and-release cover alternatives), or by two-dimensional flow assuming a 1-meter width (e.g., for compacted barrier and geosynthetic clay laminated liner [GCLL] designs). Input to the models included the estimated hydraulic properties of the proposed cover materials (hydraulic conductivity and soil moisture characteristics), climatic data (precipitation, temperature, relative humidity, wind speed, and solar radiation), and information about the planned reclamation vegetation (root depth over time, root distribution, leaf area index, and wilting point). The hydraulic properties of the cover materials input to the model were calculated from site-specific investigations and laboratory testing by BC (2014d). The computer code WGEN (Richardson and Wright 1984), was used to generate daily climate input based on monthly precipitation and temperature averages, the latitude of the Study Area (42° 50' 20", 42.8389°), and distribution parameters from a nearby analog city, specifically Pocatello Idaho (Whetstone 2014). Vegetation properties were based on the proposed reclamation seed mixture (Great Ecology 2015) and literature estimated values (Clark and Seyfried 2001; Finzel et al. 2012; Iio and Ito 2014; Law and Waring, 1994; Link et al. 1996; Naylor-Murphy 2012; Allen et al. 2012).

A total of seven cover designs were evaluated for the Proposed Action and the RCA. The cover model for the Proposed Action was based on the cover design identified in the Mine and Reclamation Plan (Agrium 2011). The cover designs modeled for the RCA included three store-and-release covers (A, B, and C), a capillary break cover (essentially a store-and-release cover), a compacted alluvium barrier layer cover with a drainage layer, and a GCLL cover with a drainage layer. The covers are described in **Sections 2.8.5** through **2.8.9**.

Based on review of the modeling results and a cost/construction feasibility analysis, the capillary break cover was omitted from further consideration because suitable on-site coarse-grained materials would not be available for construction or would be prohibitively expensive to acquire from off site. The compacted alluvium barrier layer cover was also omitted because infiltration modeling results indicated that it would have a higher net percolation rate than the other designs. The Agencies remain concerned about a GCLL because of its technical challenges for construction, maintenance, and very high costs to construct and maintain. It also carried higher costs per reduction in seepage rate compared to the other covers. Finally, Store-and-Release Covers A and B were omitted from further consideration because they exhibited higher net percolation rates than Store-and-Release Cover C. Store-and-Release Cover C appears to meet water quality criteria and site re-vegetation criteria, but at a much lower cost than the other covers that also met the criteria and thus was selected to move forward in the impact analysis for the RCA. Details of the infiltration analysis for the evaluated cover designs are presented in the Cap-and-Cover Alternatives Analysis Report (BC 2015a).

The hydrologic characteristics of the proposed cover construction materials used as input parameters for the infiltration model are summarized in **Table 4.3-2**. K_{sat} is the saturated hydraulic conductivity of the materials. The variables α and n relate hydraulic conductivity to the water content of the material. Sat VWC is the saturated volumetric water content of the material at the saturation suction pore pressure.

Table 4.3-2 Model Input Parameters for the Proposed Cover Construction Materials

Cover Material Type	K_{sat} (cm/sec)	α (1/kPa)	N (dimensionless)	Sat VWC (dimensionless)
Pit Growth Medium	3.59E-05	0.088	1.276	0.396
Pit Alluvium/Colluvium	9.96E-06	0.050	1.263	0.377
External Combined Growth Medium and Alluvium/Colluvium	2.51E-06	0.074	1.279	0.367
Non-Meade-Peak Overburden	7.00E-04	0.430	1.528	0.389

Abbreviations: cm/sec = centimeters per second, kPa = kiloPascals

The model's upper physical boundary was defined as ground surface and was used to define climatic conditions and variables that add or remove water at the surface. Input data for the upper boundaries included daily precipitation, temperature, net solar radiation, relative humidity, and wind speed. Plant transpiration was modeled based on the planned reclamation vegetation type, which was assumed to be a grassland cover in good condition (ARCADIS 2014b). This type of vegetation guided the determination of input values related to leaf area index, rooting depth, and root distribution. WGEN (Richardson and Wright 1984) was used to stochastically generate 100 years of daily precipitation, temperature, and solar radiation data for model input (Whetstone 2014). Daily values for minimum and maximum relative humidity were derived from the analysis performed by O'Kane (2009) for the Blackfoot Bridge Mine. A constant wind speed value of 5.4 miles/hour was used for all simulations. Albedo values (incident light reflected at the surface) used to calculate solar radiation inputs for the model were based on a grassland cover and varied

seasonally. Fully mature root systems were assumed for each cover system. The root system for the Proposed Action cover was assigned a depth of 2 feet assuming that the plant roots would not grow into the non-Meade-Peak overburden material underlying the 2-foot soil layer. The root system for the RCA cover (Store-and-Release Cover C) was assigned a depth of 3 feet to correspond to the maximum practical rooting depth given the type of vegetation proposed for the reclamation of the cover and the water storage functionality of the upper 3 feet of cover. The lower boundaries of the models were specified to have a unit gradient, which allowed free drainage of water downward out of the models.

Simulations for the Proposed Action and RCA cover systems evaluated net percolation rates once model stabilization occurred. These rates are considered to be representative of the long-term annual infiltration and percolation rates. Summaries of the infiltration modeling results for the Proposed Action and RCA cover designs are shown in **Table 4.3-3**. The sublimation values were calculated outside of SVFlux, assuming that 20 percent of the precipitation falling on the covers when the temperature is below freezing is lost to sublimation from snowpack. This assumption is consistent with empirical data from a test plot at the Enoch Valley Mine (O'Kane 2013), which has a similar elevation and slope aspect, and with a snow sublimation study by Reba et al. (2011).

Table 4.3-3 SVFlux Modeling Results for the Proposed Action and RCA Covers

Annual Output (model year 5)	Proposed Action Cover[1]	RCA Cover[2]
Sublimation (in/yr)	2.82	2.82
Runoff (in/yr)	1.40	3.47
Evaporation (in/yr)	10.70	10.66
Transpiration (in/yr)	6.18	6.41
Net Percolation (in/yr)	2.40	0.14
Change in Storage (in/yr)	0.00	0.02

Notes:

1 The Proposed Action Cover would consist of 2 feet of pit GM over 3 feet of non-Meade-Peak-containing overburden

2 The RCA cover would consist of 1 foot of pit GM atop 2 feet of either external alluvium or external GM, underlain by 3 feet of pit alluvium

Any modeling effort requires the use of certain simplifying assumptions regarding material conditions and flow processes, which results in inherent limitations and uncertainties when compared to an actual flow system. In this case, uncertainty can be directly related to the following:

- While it is expected that the placement of the cover would be relatively homogeneous, a certain level of heterogeneity related to material distribution and soil properties is to be expected because of the use of concurrent reclamation that the model does not simulate.
- Because the modeling simulations have been performed with anticipated long-term characteristics of the cover, the model does not account for near-term or potential temporal changes in cover properties.
- The model does not account for the degree of variability in climate conditions and imperfections during actual cover construction.

Groundwater Flow and Solute Transport Modeling

A three-dimensional numerical groundwater flow and contaminant transport model (groundwater model) was prepared to evaluate the potential impacts to water resources from the proposed

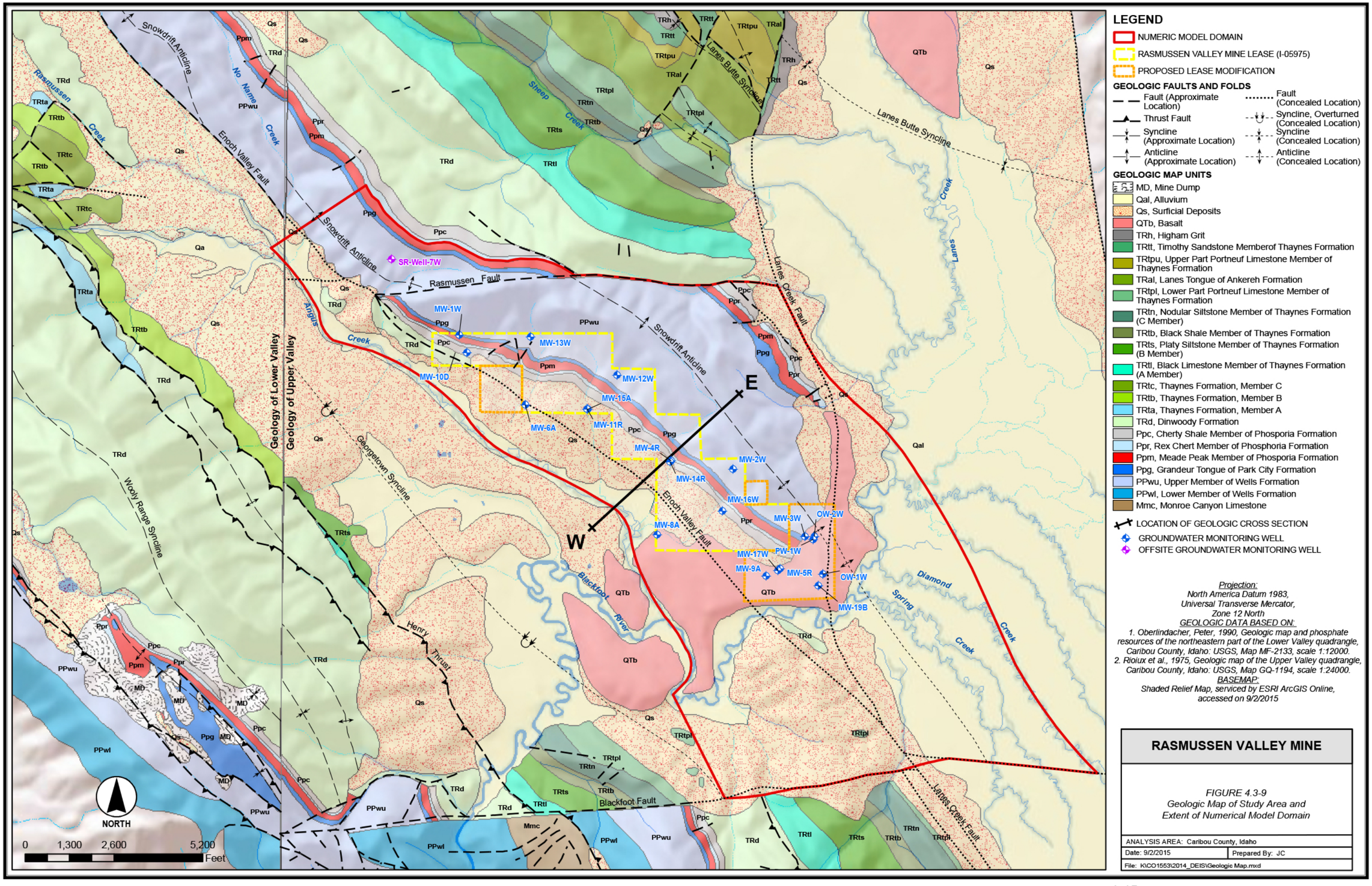
mining operation (ARCADIS 2015g). The model was prepared using MODFLOW-SURFACT (HydroGeologic 2011). MODFLOW-SURFACT is a finite-difference modeling package that is functionally identical to the U.S. Geological Survey (USGS) code MODFLOW (Harbaugh 2005) but has several enhancements that improve its numerical stability and ability to solve matrices with steep gradients.

The groundwater model domain covers an area of approximately 9 square miles (**Figure 4.3-9**). The model extends 4.5 miles northwest along the axis of the Snowdrift Anticline from the Blackfoot Fault to 0.6 mile northwest of the Rasmussen Valley Fault, a distance of 4.5 miles. The southwest-northeast extent of the model is approximately 2 miles and extends from Angus Creek to Upper Valley. Twelve model layers are used to simulate the folded and faulted geologic strata that form the groundwater flow system. The model includes representations of the Wells Regional Aquifer, Phosphoria Formation (Meade Peak, Rex Chert, and Cherty Shale Members), Dinwoody Formation, basalt, and alluvium (**Figure 4.3-10**). Hydrologically important faults and zones of increased fracturing are simulated according to the conceptual hydrogeologic model developed by ARCADIS (2015g). Zones of high hydraulic conductivity were assigned to the Enoch Valley Fault and hinge of the Snowdrift Anticline to simulate their function as conduits for groundwater flow. The Blackfoot Fault is represented as a strong barrier (no-flow) between groundwater systems in the Study Area and Dry Valley.

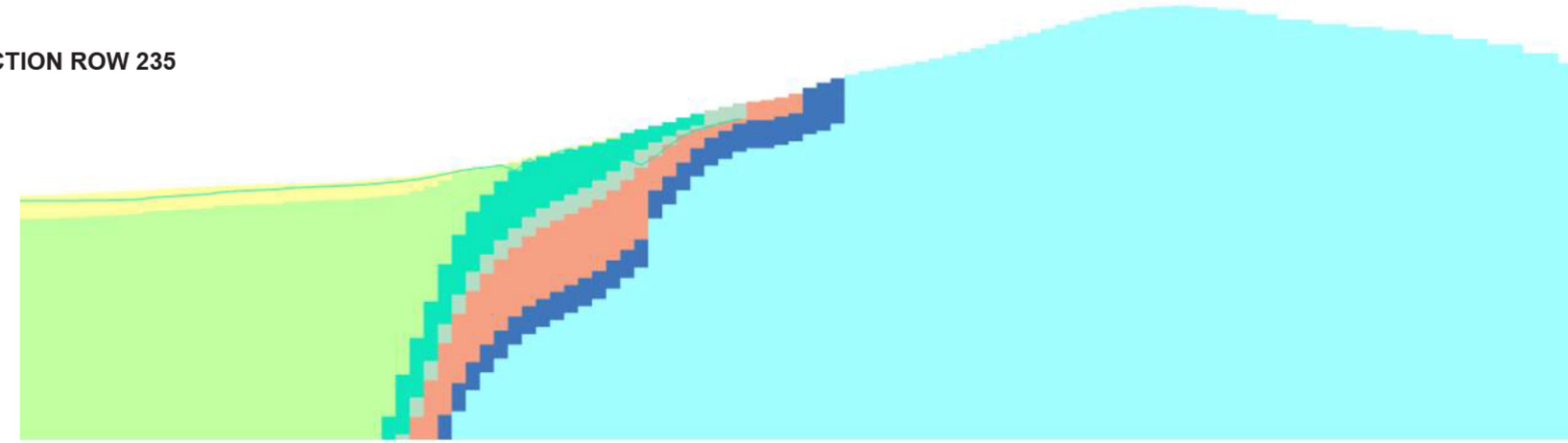
The Rasmussen Fault is represented as a leaky barrier near the northwestern edge of the model. Flow enters the model in the Wells Regional Aquifer at the southeastern edge and exits northwest. The average regional gradient across the model domain is approximately 0.0008 ft/ft, consistent with water level data developed during the Baseline Water Resources Report (Whetstone 2015b). Recharge is variably assigned using PRISM precipitation distribution patterns (Daly et al. 2013; Whetstone 2014) scaled for recharge using the approach developed by Buck and Mayo (2004) (**Table 3.3–10**). Blackfoot River is simulated as a surface water feature that either adds or removes water from the model, depending on the simulated groundwater levels in adjacent cells. Angus Creek, intermittent streams, and springs are modeled as features that remove water from the model if the simulated groundwater level is above the streambed or ground surface. Evapotranspiration is variably assigned to simulate wetland and upland areas.

Modeled values for hydraulic conductivity, storage, and porosity are distributed by geologic unit. The Meade Peak is simulated as an aquitard, having a low hydraulic conductivity of about 0.001 ft/d. The other formations are simulated as aquifers, having hydraulic conductivities between 0.002 and 150 ft/d. The assigned hydraulic conductivities are consistent with site-specific testing and other regional hydrologic data (Whetstone 2015b). Modeled specific storage values range from 1.0E-5 to 4.85E-5, and reflect differences in rock type and confining conditions. Assigned effective porosity values ranged from 10 percent for alluvium to 1 percent for fractured bedrock.

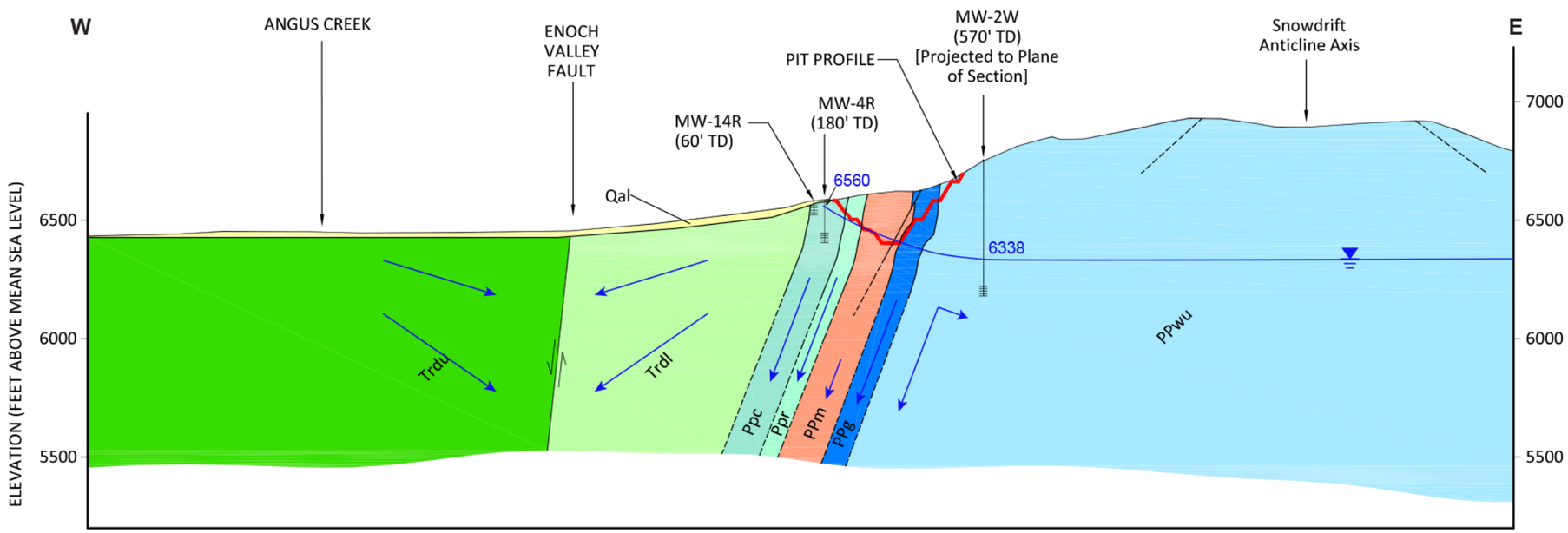
The groundwater model was prepared in four steps including an initial steady-state simulation calibrated to the existing (pre-mining) base flow condition, a transient (time-dependent) simulation calibrated to reproduce groundwater drawdowns from the PW-1W pumping test, a second transient simulation used to qualitatively assess the models ability to reproduce observed seasonal fluctuations in water levels across various hydrogeologic units, and predictive simulations to evaluate the potential physical and chemical changes that could occur in groundwater and surface water from the Proposed Action. The steady-state simulation was calibrated to match groundwater levels in baseline monitoring wells and measured discharges to springs and seeps. Data from gain-loss surveys on Blackfoot River and Angus Creek were also


LEGEND
NUMERIC MODEL DOMAIN
RASMUSSEN VALLEY MINE LEASE (I-05975)
PROPOSED LEASE MODIFICATION
GEOLOGIC FAULTS AND FOLDS
Fault (Approximate Location)
Fault (Concealed Location)
Thrust Fault
Syncline, Overturned (Concealed Location)
Syncline (Approximate Location)
Syncline (Concealed Location)
Anticline (Approximate Location)
Anticline (Concealed Location)
GEOLOGIC MAP UNITS
MD, Mine Dump
Qal, Alluvium
Qs, Surficial Deposits
QTb, Basalt
TRh, Higham Grit
TRtt, Timothy Sandstone Memberof Thaynes Formation
TRtpu, Upper Part Portneuf Limestone Member of Thaynes Formation
TRal, Lanes Tongue of Ankereh Formation
TRtpl, Lower Part Portneuf Limestone Member of Thaynes Formation
TRtn, Nodular Siltstone Member of Thaynes Formation (C Member)
TRtb, Black Shale Member of Thaynes Formation
TRts, Platy Siltstone Member of Thaynes Formation (B Member)
TRtl, Black Limestone Member of Thaynes Formation (A Member)
TRtc, Thaynes Formation, Member C
TRtb, Thaynes Formation, Member B
TRta, Thaynes Formation, Member A
TRd, Dinwoody Formation
Ppc, Cherty Shale Member of Phosporia Formation
Ppr, Rex Chert Member of Phosphoria Formation
Ppm, Meade Peak Member of Phosporia Formation
Ppg, Grandeur Tongue of Park City Formation
PPwu, Upper Member of Wells Formation
PPwl, Lower Member of Wells Formation
Mmc, Monroe Canyon Limestone
LOCATION OF GEOLOGIC CROSS SECTION
GROUNDWATER MONITORING WELL
OFFSITE GROUNDWATER MONITORING WELL
Projection:
North America Datum 1983,
Universal Transverse Mercator,
Zone 12 North
GEOLOGIC DATA BASED ON:
1. Oberlindacher, Peter, 1990, Geologic map and phosphate resources of the northeastern part of the Lower Valley quadrangle, Caribou County, Idaho: USGS, Map MF-2133, scale 1:12000.
2. Rioux et al., 1975, Geologic map of the Upper Valley quadrangle, Caribou County, Idaho: USGS, Map GQ-1194, scale 1:24000.
BASEMAP:
Shaded Relief Map, serviced by ESRI ArcGIS Online, accessed on 9/2/2015
RASMUSSEN VALLEY MINE
FIGURE 4.3-9
Geologic Map of Study Area and Extent of Numerical Model Domain
ANALYSIS AREA: Caribou County, Idaho
Date: 9/2/2015
Prepared By: JC
File: K:\CO1553\2014_DEIS\Geologic Map.mxd
Geology of Lower Valley
Geology of Upper Valley
Snowdrift Anticline
Enoch Valley Fault
Rasmussen Fault
Lanes Butte Syncline
Lanes Creek Fault
Georgetown Syncline
Wooly Range Syncline
Henry Thrust
Blackfoot Fault
Rasmussen Creek
No Name Creek
Angus Creek
Sheep Creek
Lanes Creek
Diamond Spring Creek
Blackfoot River
SR-Well-7W
MW-1W
MW-13W
MW-10D
MW-12W
MW-15A
MW-6A
MW-11R
MW-4R
MW-2W
MW-14R
MW-16W
MW-8A
MW-3W
OW-2W
MW-17W
PW-1W
MW-9A
MW-5R
OW-1W
MW-19B
E
W
NORTH
0 1,300 2,600 5,200 Feet

MODEL CROSS-SECTION ROW 235



GEOLOGIC CROSS-SECTION W-E



LEGEND

- Qal — SURFICIAL DEPOSITS (QUATERNARY)
- Trdu — UPPER DINWOODY FORMATION (LOWER TRIASSIC)
- Trdl — LOWER DINWOODY FORMATION (LOWER TRIASSIC)
- GROUNDWATER FLOW DIRECTION
- WATER TABLE

PHOSPHORIA FORMATION (PERMIAN)

- Ppc — CHERTY SHALE MEMBER
- PPr — REX CHERT MEMBER
- PPm — MEADE PEAK MEMBER
- PPg — GRANDEUR TONGUE (PERMIAN)
- PPwu — WELLS FORMATION (PERMIAN-PENNSYLVANIAN)

Source:
Geology based on Agrium exploration borings and well logs, Rioux et al. (1975), and professional judgement.

RASMUSSEN VALLEY MINE

FIGURE 4.3-10
Model and
Geologic Cross-Section E-W

ANALYSIS AREA: Caribou County, Idaho
Date: 08/26/2015 | Prepared By: JC
File: K\CO1553\2015_DEIS\EIS_Model and Geo Cross-Section E-W.ai

used to calibrate the steady-state model. The initial transient calibration used the steady-state run as the starting point and simulated the 72-hour aquifer test performed in the Wells Regional Aquifer near the proposed pit (BC 2013c). Calibration of the transient model was an iterative process requiring simultaneous recalibration of the steady-state model to the adjusted input parameters. Following the steady-state and transient calibrations, a second transient run was prepared to evaluate the model's ability to match seasonal water level fluctuations observed in baseline groundwater monitoring data. This run was an independent demonstration of the model's ability to accurately simulate groundwater response to changes in hydrologic stress. A complete discussion of the groundwater model calibration procedure is presented in the Groundwater Modeling Report (ARCADIS 2015g).

Predictive simulations were performed for the Proposed Action and RCA. The predictive runs used the final calibrated steady-state model as the starting point and simulated the proposed mining and reclamation conditions. COPC loads to groundwater from the Proposed Action were simulated according to the conceptual models presented in **Sections 4.3.1.1.1** and **4.3.1.2.1**. Input concentrations and volumes (source terms) for the COPC loads were developed from column leaching tests described in **Section 4.1.1.1.2** and infiltration modeling described in **Section 4.3.1.1.1**. Modeled sources of COPC loading under the Proposed Action include the North, South Main, and South-South Overburden Piles, the optional Temporary Ore Stockpile and Overburden Pile, and the pit backfill and External Overfill Piles. COPC loading under the RCA was developed using the model described above for the pit backfill and overfill.

Modeling of COPC loading from the South Rasmussen Mine is discussed further in **Section 4.3.1.2.2**. The GM stockpiles were not modeled because potential seepage from this material is expected to exhibits characteristics similar to water infiltrating through undisturbed soils. Temporary piles internal to the pit footprint also were not modeled. The source term for the pit backfill simulates COPC loading by percolation of meteoric water through unsaturated backfill for both the Proposed Action and RCA and by groundwater leaching of material that would be placed below the regional water table under the Proposed Action. Seepage originating from percolation of meteoric water through unsaturated mine facilities was applied to the simulated water table as recharge (a volume of water with a specified concentration over a period of time). Leaching of backfill by groundwater was simulated as a mass COPC load with negligible volume applied in the area of the pit that would be excavated below the water table.

Potential changes in COPC loading over time were simulated using a pore volume approach where concentrations from each source changed as successive volumes of water equal to the estimated pore space were modeled to move through the material. Backfill and external overburden piles were assumed to exhibit an effective porosity of 15 percent. Concentrations for each pore volume were specified based on the results of column leaching tests (Whetstone 2015a). Permanent facilities and the ore stockpile were developed using columns weighted to match the material balance by weight of the facility. Temporary facilities were developed by mathematically weighting leachates from the monolithologic columns in proportion to the material balance of each facility. Percolation rates for the mine facilities were specified based on the results of cover system modeling by BC (2015a). To be conservative, COPC transport in groundwater was simulated without attenuation by precipitation or adsorption to aquifer solids, as well as by chemical or biological reactions. The starting concentrations of COPCs in groundwater were assumed to be 0 milligrams per liter (mg/L). Simulated pore volume times for the Proposed Action are summarized in **Table 4.3-4**. COPC source term concentrations are presented in **Table 4.3-5**.

Table 4.3-4 Pore Volume Times for Modeled Source Terms for the Proposed Action

Mine Facility	Percolation Rate (in/yr)	Facility Footprint (acres)	Seepage Rate (ft^3/day)	Material Volume (LCY)	Effective Porosity (%)	Pore Volume Time (years)
North Overburden Pile	2.4	26.0	620	689,0001	15	12.3
South-South Overburden Pile	2.4	32.8	782	2,842,000	15	40.3
South Main Overburden Pile	2.4	37.9	904	4,052,000	15	2
Pit Backfill and External Overfill, Unsaturated	2.4	174.8	4,169	36,921,000	15	98.2
Pit Backfill, Saturated	2.4	2.4	400	108,689	15	3.0
Optional Ore Stockpile/Overburden Storage Area	2.4	3	3	3	3	3

Notes:

1 The maximum volume of the North Overburden Pile during mining is 2,132,000 LCY. Approximately 1,443,000 LCY would be re-handled into pit backfill.

2 Pore volume times were not calculated because the entire pile would be re-handled into the pit backfill at the end of mining. The modeled seepage from the South Main Overburden Pile was assumed to be represented by pore volume 1.

3 Pore volume times were not calculated because material would be continuously added and removed from stockpile during mining. The modeled seepage from the ore stockpile is assumed to be represented by pore volume 1.

Table 4.3-5 Modeled Source Concentrations (mg/L) for the Proposed Action

Waste Facility	Pore Volume	North Overburden Pile	South-South Overburden Pile	South Main Overburden Pile	Pit Backfill, Unsaturated	Optional Ore Stockpile	Pit Backfill, Saturated
Sulfate (mg/L)	PV-1	1,420	1,420	2,327	2,393	1,216	852
	PV-2	428	428	1,889	1,739	804	568
	PV-3	332	332	1,684	1,595	551	416
	PV-4	506	506	1,613	1,828	413	315
	PV-5	646	646	1,637	1,788	384	240
	PV-6	625	625	1,616	1,745	533	177
	PV-7	635	635	1,615	1,738	852	147
Total Dissolved Solids (mg/L)	PV-1	2,389	2,389	3,883	4,157	2,183	1,550
	PV-2	870	870	3,048	2,681	1,398	1,206
	PV-3	729	729	2,638	2,529	1,005	886
	PV-4	997	997	2,584	2,972	789	710
	PV-5	1,141	1,141	2,603	2,925	695	565
	PV-6	1,062	1,062	2,509	2,751	891	422
	PV-7	1,088	1,088	2,516	2,705	1,344	410
Total Aluminum (mg/L)	PV-1	0.045	0.045	0.134	0.131	0.071	0.030
	PV-2	0.030	0.030	0.055	0.060	0.030	0.030
	PV-3	0.030	0.030	0.054	0.060	0.034	0.032
	PV-4	0.047	0.047	0.049	0.060	0.036	0.038
	PV-5	0.033	0.033	0.062	0.066	0.030	0.030
	PV-6	0.038	0.038	0.073	0.073	0.034	0.030
	PV-7	0.034	0.034	0.050	0.047	0.035	0.030
Total Antimony (mg/L)	PV-1	0.0031	0.0031	0.0212	0.0071	0.0125	0.0063
	PV-2	0.0026	0.0026	0.0157	0.0096	0.0110	0.0006
	PV-3	0.0016	0.0016	0.0139	0.0103	0.0103	0.0010
	PV-4	0.0019	0.0019	0.0157	0.0098	0.0098	0.0031
	PV-5	0.0012	0.0012	0.0128	0.0093	0.0095	0.0004
	PV-6	0.0009	0.0009	0.0127	0.0091	0.0092	0.0009
	PV-7	0.0008	0.0008	0.0112	0.0081	0.0088	0.0005

Table 4.3-5 Modeled Source Concentrations (mg/L) for the Proposed Action

Waste Facility	Pore Volume	North Overburden Pile	South-South Overburden Pile	South Main Overburden Pile	Pit Backfill, Unsaturated	Optional Ore Stockpile	Pit Backfill, Saturated
Total Cadmium (mg/L)	PV-1	0.0210	0.0210	0.0565	0.0126	0.0630	0.0008
	PV-2	0.0092	0.0092	0.0512	0.0146	0.0311	0.0001
	PV-3	0.0052	0.0052	0.0496	0.0225	0.0176	0.0001
	PV-4	0.0136	0.0136	0.0455	0.0324	0.0196	0.0001
	PV-5	0.0186	0.0186	0.0483	0.0420	0.0358	0.0001
	PV-6	0.0186	0.0186	0.0564	0.0557	0.0549	0.0001
	PV-7	0.0155	0.0155	0.0468	0.0627	0.0776	0.0001
Total Copper (mg/L)	PV-1	0.0018	0.0018	0.0025	0.0024	0.0012	0.0005
	PV-2	0.0008	0.0008	0.0016	0.0010	0.0007	0.0005
	PV-3	0.0005	0.0005	0.0009	0.0010	0.0005	0.0005
	PV-4	0.0005	0.0005	0.0009	0.0010	0.0005	0.0005
	PV-5	0.0007	0.0007	0.0010	0.0010	0.0005	0.0005
	PV-6	0.0010	0.0010	0.0009	0.0010	0.0008	0.0005
	PV-7	0.0007	0.0007	0.0009	0.0010	0.0010	0.0005
Total Iron (mg/L)	PV-1	0.0301	0.0301	0.1330	0.0702	0.0302	0.3304
	PV-2	0.0200	0.0200	0.0367	0.0400	0.0200	0.2443
	PV-3	0.0200	0.0200	0.0338	0.0335	0.0200	0.4072
	PV-4	0.0200	0.0200	0.0237	0.0247	0.0200	0.5126
	PV-5	0.0200	0.0200	0.0364	0.0400	0.0200	0.4096
	PV-6	0.0427	0.0427	0.0341	0.0400	0.0399	0.2420
	PV-7	0.0305	0.0305	0.0335	0.0313	0.0466	0.0850
Total Manganese (mg/L)	PV-1	2.5330	2.5330	2.9121	1.7446	0.5574	1.6406
	PV-2	0.4546	0.4546	2.2904	1.1692	0.3172	1.7976
	PV-3	0.3225	0.3225	2.1694	1.2773	0.2047	1.5959
	PV-4	0.4451	0.4451	1.8470	1.5587	0.1550	1.2979
	PV-5	0.4907	0.4907	1.6848	1.4112	0.1556	1.0194
	PV-6	0.4465	0.4465	1.6815	1.2259	0.2040	0.7793
	PV-7	0.3719	0.3719	1.6268	1.0658	0.3077	0.5762
Total Nickel (mg/L)	PV-1	0.9397	0.9397	2.9648	1.7848	0.6428	0.6144
	PV-2	0.1510	0.1510	1.7004	0.9912	0.2841	0.3171
	PV-3	0.0858	0.0858	1.3343	0.9907	0.1723	0.2081
	PV-4	0.1137	0.1137	1.2299	1.3131	0.1310	0.1400
	PV-5	0.1532	0.1532	1.1917	1.4295	0.1390	0.1018
	PV-6	0.1600	0.1600	1.2629	1.4747	0.2275	0.0700
	PV-7	0.1470	0.1470	1.2175	1.4291	0.4048	0.0430
Total Selenium (mg/L)	PV-1	1.147	1.147	7.901	4.724	1.584	0.409
	PV-2	0.271	0.271	2.730	1.189	0.753	0.008
	PV-3	0.160	0.160	0.819	0.575	0.426	0.004
	PV-4	0.119	0.119	0.240	0.262	0.274	0.003
	PV-5	0.099	0.099	0.157	0.143	0.202	0.002
	PV-6	0.082	0.082	0.136	0.099	0.167	0.006
	PV-7	0.073	0.073	0.095	0.071	0.148	0.002
Total Thallium (mg/L)	PV-1	0.0021	0.0021	0.0031	0.0109	0.0038	0.0002
	PV-2	0.0005	0.0005	0.0016	0.0068	0.0018	0.0001
	PV-3	0.0004	0.0004	0.0012	0.0056	0.0011	0.0001
	PV-4	0.0003	0.0003	0.0013	0.0048	0.0008	0.0001
	PV-5	0.0003	0.0003	0.0014	0.0042	0.0007	0.0001

Table 4.3-5 Modeled Source Concentrations (mg/L) for the Proposed Action

Waste Facility	Pore Volume	North Overburden Pile	South-South Overburden Pile	South Main Overburden Pile	Pit Backfill, Unsaturated	Optional Ore Stockpile	Pit Backfill, Saturated
	PV-6	0.0003	0.0003	0.0015	0.0037	0.0009	0.0001
	PV-7	0.0002	0.0002	0.0012	0.0030	0.0012	0.0001
Total Uranium (mg/L)	PV-1	0.0253	0.0253	0.0498	0.0378	0.0543	0.0237
	PV-2	0.0131	0.0131	0.0231	0.0168	0.0260	0.0224
	PV-3	0.0115	0.0115	0.0225	0.0154	0.0196	0.0176
	PV-4	0.0096	0.0096	0.0230	0.0153	0.0153	0.0111
	PV-5	0.0086	0.0086	0.0243	0.0158	0.0143	0.0080
	PV-6	0.0089	0.0089	0.0257	0.0174	0.0139	0.0056
	PV-7	0.0072	0.0072	0.0215	0.0171	0.0149	0.0043
Total Zinc (mg/L)	PV-1	1.6223	1.6223	5.8538	4.6170	2.2280	0.4042
	PV-2	0.1142	0.1142	2.7522	2.4357	0.4320	0.0101
	PV-3	0.0597	0.0597	2.3888	3.0843	0.1448	0.0195
	PV-4	0.2443	0.2443	2.6941	4.5186	0.1926	0.0108
	PV-5	0.3711	0.3711	2.5416	4.5350	0.6404	0.0064
	PV-6	0.4157	0.4157	2.7160	4.1077	1.2265	0.0048
	PV-7	0.3007	0.3007	2.4640	3.8542	1.7316	0.0032

Source: Whetstone 2015a

Predictive simulations for the Proposed Action were performed for COPCs listed in **Table 4.3-1**. The simulations considered a 700-year time-span based on the time required for COPCs to reach their maximum modeled concentration in groundwater at observation points located on the Blackfoot River and the Rasmussen Fault.

It should be noted that, although COPC loading rates from the proposed mine facilities can be estimated from laboratory tests, uncertainty exists in the source terms because scale-dependent factors, such as the volume and frequency of infiltration and percolation, residence time of pore water, presence of preferential flow pathways, microbiological activity, and spatial variability of redox conditions exert significant control over concentrations in overburden seepage (Whetstone 2013, 2015a). The Agencies currently consider column leaching tests to be the best model available to predict overburden seepage chemistry, but the accuracy of the predictions under real-world conditions is difficult to evaluate. Model predictions are also affected by uncertainty related to the input hydrologic parameters. This uncertainty was evaluated by ARCADIS (2015g) and is addressed, in part, by calibrating the model to existing site conditions and observed hydrologic stresses. However, given the potential uncertainty associated with input parameters, model results in the following sections should not be interpreted as absolute numerical values, but rather in broader terms, with the simulated scenarios being either unlikely to have impacts at levels of regulatory concern, likely to have impact at or near levels of regulatory concern, or as being likely to have impacts above levels of regulatory concern. Overall effects to water resources under the Proposed Action would be long-term and minor and would differ in duration and intensity between surface water and groundwater.

4.3.1.1.3 Impacts to Groundwater Resources

The Proposed Action would have direct impacts to groundwater resources in the Study Area. The impacts would include changes in groundwater levels and availability and increased loading of COPCs to groundwater.

Impacts to Groundwater Levels

The Proposed Action would require pumping for pit dewatering to facilitate mining below the regional groundwater table near the southern end of the excavation (**Figure 4.3-1**). The elevation of the regional water table within the pit footprint is near 6,340 feet amsl (Whetstone 2015b). The lowest portion of the pit, at 6,280 feet amsl, would extend approximately 60 feet below the regional water table. Dewatering was modeled assuming a complete hydraulic connection of the pit with the regional water table.

Pit dewatering model results for the Proposed Action indicate that an average pumping rate of approximately 4,300 gpm would be required for approximately 7 to 8 months to temporarily lower water levels in the Wells Regional Aquifer and permit Phase 1 mining below 6,340 feet amsl. According to the Mine and Reclamation Plan (Agrium 2011), dewatering discharge would be pumped from the working area to an unreclaimed area of backfill for re-infiltration. However, because the mining sequence would be south to north, no areas of backfill would exist during Phase 1 mining. Therefore, re-infiltration of the dewatering discharge would not be possible and was not simulated. The RCA solves the issue by eliminating dewatering because there would be no mining below the regional water table. If a viable method of handling dewatering water were proposed and dewatering occurred, modeling results indicate that upon cessation of pumping, the water level in the regional aquifer would return to the pre-pumping elevation in about 3 months. The projected maximum drawdown in the Wells Regional Aquifer is approximately 60 feet centered on the south end of the pit (**Figure 4.3-11**). Temporary drawdown of several feet in the Wells Regional Aquifer may extend north into the South Rasmussen Mine area, where it may impact water levels in monitoring wells or industrial supply wells. Temporary drawdown of shallow groundwater levels west of the pit near Angus Creek is predicted to be negligible because the predicted and modeled low hydraulic conductivity of the Meade Peak (0.001 ft/d) limits propagation of the cone of depression from the Wells Regional Aquifer into the alluvium, Rex Chert, and the Dinwoody Formation. Up to 10 feet of drawdown is predicted along a narrow band of shallow groundwater in alluvium southeast of Blackfoot River. Drawdown in this area would be propagated along the buried hinge of the Snowdrift Anticline, which extends below the alluvium and basalt cover. The hinge of the Snowdrift Anticline is conceptualized to be a fracture zone with higher permeability than the surrounding bedrock based on pumping test data from well PW-1W (BC 2013c). The numerical simulation by ARCADIS (2015g) indicates that pit dewatering under the Proposed Action is expected to result in localized moderate impacts to water levels in the Wells Regional Aquifer for about 10 to 11 months starting during Phase 1 mining. Impacts to shallow groundwater levels in alluvium and bedrock west of the mine pit and south of Blackfoot River would be negligible to minor, localized, and would have a similar duration to those projected for the Wells Regional Aquifer.

The pit excavation would also intersect localized pockets of groundwater at elevations higher than the regional water table. These perched groundwater zones would be quickly drained after they are opened and would not result in significant long-term inflow to the pit. Draining of the perched water would result in moderate localized impacts to groundwater levels in unconsolidated deposits and the Rex Chert that may persist after final reclamation of the pit backfill. The pit excavation and backfill could provide a permanent pathway for the transfer of groundwater from the local- and intermediate-scale aquifers to the Wells Regional Aquifer.

It is anticipated that capping of the permanent overburden piles and pit backfill under the Proposed Action would permanently reduce the amount of recharge reporting to groundwater by approximately 8 percent from a pre-mining 2.6 inches per year to a permanent 2.4 inches per year for those areas of covered overburden and backfill. Modeling results indicate that, under

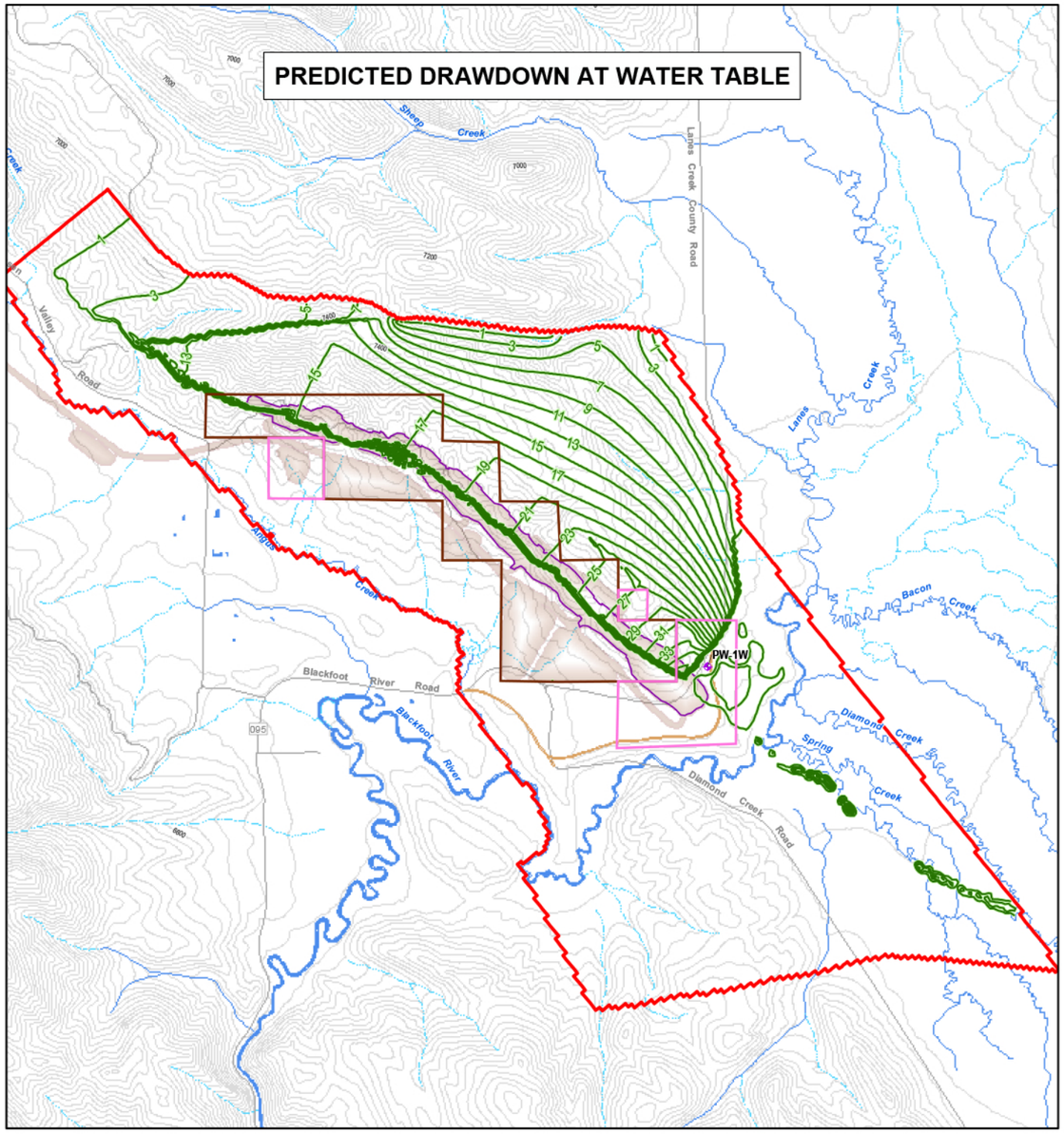
post-reclamation conditions, groundwater levels in the shallow, intermediate, and regional groundwater systems near the reclaimed mine facilities would decrease by approximately 1 to 5 feet, 0.5 to 1 foot, and 0 to 0.05 foot, respectively. Long-term decreases in shallow groundwater levels by reduced infiltration and percolation through areas reclaimed by cover systems would therefore be long-term, minor and localized. Long-term reduction in groundwater levels in the Wells Regional Aquifer would be negligible.

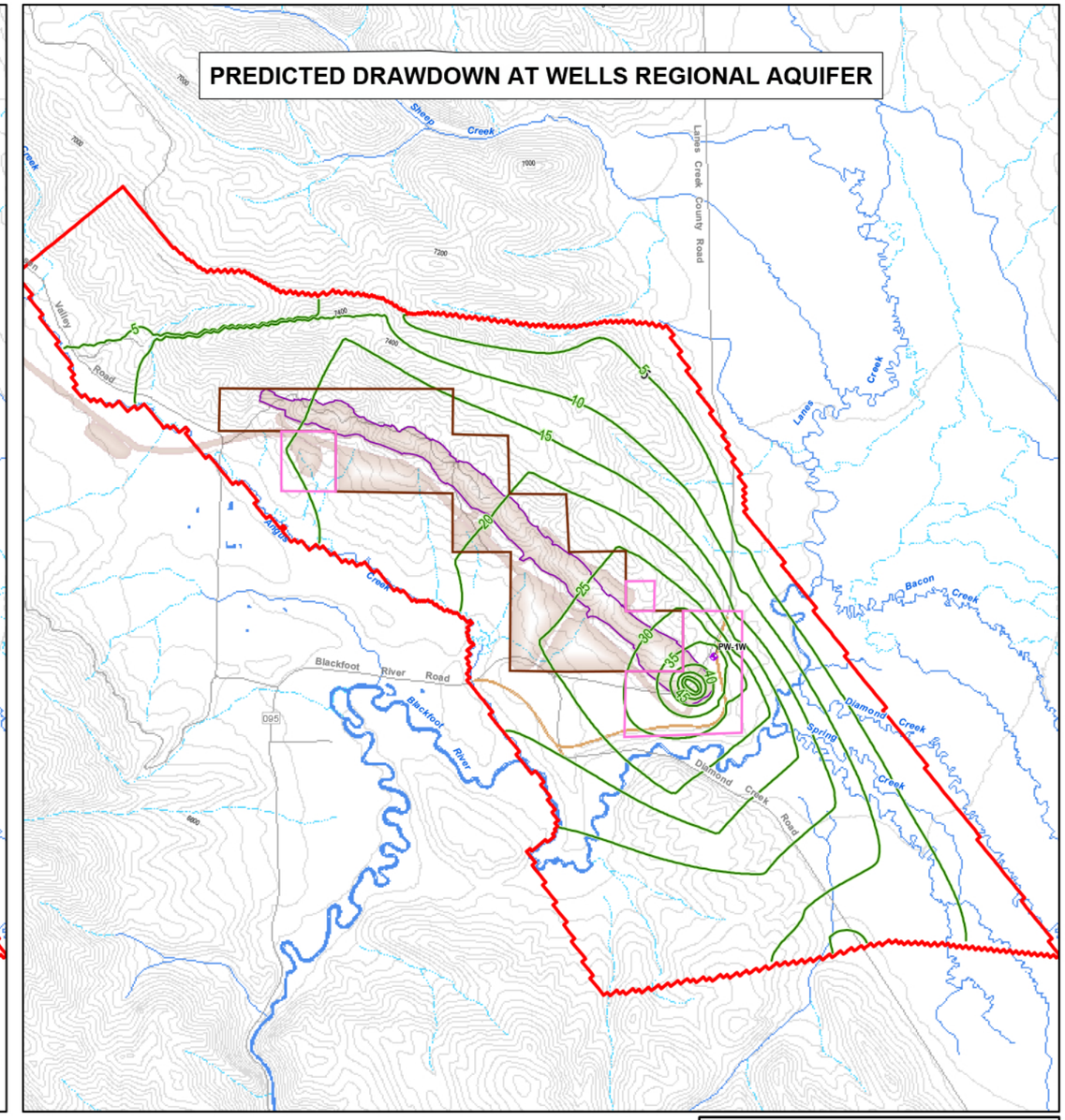
Impacts to Groundwater Quality

The Proposed Action would result in moderate impacts to groundwater quality in the local- intermediate- and regional-scale aquifers. The impacts described in the following sections do not incorporate the existing baseline chemistry of groundwater, which is variable and currently exceeds applicable groundwater standards for some parameters at some locations. Therefore, the concentrations discussed for the Proposed Action in the following text and figures would need to be added to existing groundwater concentrations to calculate concentrations expected if the groundwater were sampled or withdrawn at any given point. This simplification was made to facilitate the disclosure of impacts as a result of the Proposed Action and numerical modeling and allow for the collection and consideration of additional monitoring data, which may modify calculated baseline concentrations for groundwater seepage from mine facilities, resulting in increased loading of selenium and other COPCs to groundwater. Modeling reveals that these constituents would be transported northwest in the Wells Regional Aquifer and southwest in the local- and intermediate-scale aquifers, forming plumes with COPC concentrations higher than in unaffected groundwater. Increased loading of COPCs to groundwater from disturbed areas and partially constructed overburden piles and backfill is predicted to begin shortly after the start of mining. Overburden and backfill would be capped and reclaimed concurrent with mining to limit exposure of overburden to infiltrating precipitation. Runoff from unreclaimed overburden within the pit area would be captured in an interceptor ditch within the pit footprint, where it would be routed to the pit sump. This water would report to the regional aquifer, where it would be transported in groundwater to the northwest with seepage from the pit backfill. Runoff from unreclaimed external overburden piles located on alluvium west of the pit would report to sediment ponds, where it would evaporate, infiltrate into underlying alluvial groundwater or be transported to other approved storm water holding areas. Runoff that infiltrates into alluvial groundwater would follow a groundwater flow path toward Angus Creek similar to seepage from the adjacent external overburden piles.

Shallow Groundwater

Modeling results indicate that contaminant plumes of selenium and other COPCs would form beneath the external overburden piles overlying the alluvial aquifer soon after commencement of mining, and would migrate southwest in shallow alluvial groundwater toward Angus Creek and Blackfoot River. Simulated groundwater plumes for selenium and manganese in shallow groundwater under the Proposed Action are shown in **Figure 4.3-12**, **Figure 4.3-13** and **Figure 4.3-14**. Concentrations for COPCs in shallow groundwater at model observation points OBS-1 through OBS-4, GLS-AC2-OBS, and GLS-AC3-OBS (**Figure 4.3-12**) are shown on **Figure 4.3-15**. Peak and long-term concentrations at model observation points are summarized in **Table 4.3-6** and **Table 4.3-7**.





LEGEND

- NUMERICAL MODEL EXTENT
- LEASE I-05975
- PROPOSED LEASE MODIFICATION
- PROPOSED PIT BOUNDARY
- PROPOSED HAUL ROAD AND MINE FOOTPRINT
- COUNTY ROAD REALIGNMENT
- EXISTING ROAD
- INTERMITTENT STREAM
- PERENNIAL STREAM
- TOPOGRAPHIC CONTOUR
- SIMULATED DRAWDOWN CONTOUR (LEFT PANEL: 2-FOOT INTERVAL, RIGHT PANEL: 5-FOOT INTERVAL)

Projection:
North America Datum 1983,
Universal Transverse Mercator,
Zone 12 North

NORTH

0 3,200 6,400 Feet

RASMUSSEN VALLEY MINE

FIGURE 4.3-11
Predicted Maximum Drawdown
during Mine Dewatering for the Proposed Action

ANALYSIS AREA: Caribou County, Idaho
Date: 9/2/2015 | Prepared By: JC
File: K:\CO1553\2015_DEIS\Chapter4\Max DrawDown_PA.mxd

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Table 4.3-6 Predicted Peak Concentrations in Shallow Groundwater for the Proposed Action at Model Observation Points OBS-1 through OBS-4, GLS-AC2-OBS, and GLS-AC3-OBS

Constituent	OBS-1	OBS-2	OBS-3	OBS-4	GLS-AC2-OBS	GLS-AC3-OBS	Groundwater Standard (mg/L)
Aluminum	0.0007	0.0055	0.0596	0.0045	0.0009	0.0007	0.2
Antimony	0.00003	0.0006	0.0093	0.0003	0.00005	0.00008	0.006
Cadmium	0.0003	0.0024	0.0252	0.002	0.0004	0.0003	0.005
Copper	0.00001	0.0002	0.0011	0.0002	0.00003	0.00002	1.3
Iron	0.0006	0.0046	0.0588	0.0041	0.0007	0.0006	0.3
Manganese	0.017	0.215	1.331	0.24	0.039	0.027	0.05
Nickel	0.008	0.118	1.317	0.089	0.014	0.015	N/A
Selenium	0.012	0.232	3.478	0.109	0.018	0.029	0.05
Sulfate	13	134.7	1049.8	134.6	21.9	16.7	250
TDS	22.5	226	1752.1	226.5	37.2	28.0	500
Thallium	0.00002	0.0002	0.0014	0.0002	0.00003	0.00002	0.002
Uranium	0.0002	0.0026	0.0224	0.0024	0.0004	0.0003	0.03014
Zinc	0.014	0.219	2.595	0.154	0.024	0.027	5

Notes:
Primary Idaho Groundwater Standard for antimony, cadmium, copper, selenium, thallium, and thallium
Secondary Idaho Groundwater Standard for aluminum, iron, manganese, sulfate, TDS, and zinc
Primary Federal Drinking Water Standard for uranium
N/A – Not Applicable

Table 4.3-7 Predicted Long-Term Concentrations in Shallow Groundwater for the Proposed Action at Model Observation Points OBS-1 through OBS-4, GLS-AC2-OBS, and GLS-AC3-OBS

Constituent	OBS-1	OBS-2	OBS-3	OBS-4	GLS-AC2-OBS	GLS-AC3-OBS	Groundwater Standard (mg/L)
Aluminum	0.0007	0.0029	0.0013	0.0033	0.0008	0.0005	0.2
Antimony	0.00002	0.00007	0.00003	0.00008	0.00002	0.00001	0.006
Cadmium	0.0003	0.0013	0.0006	0.0015	0.00038	0.00024	0.005
Copper	0.00001	0.00006	0.00003	0.00007	0.00002	0.00001	1.3
Iron	0.0006	0.0026	0.0012	0.0029	0.0007	0.0005	0.3
Manganese	0.008	0.032	0.014	0.036	0.009	0.006	0.05
Nickel	0.003	0.013	0.006	0.014	0.004	0.002	N/A
Selenium	0.002	0.007	0.003	0.007	0.002	0.001	0.05
Sulfate	13	54.3	24.6	61.2	15.6	9.8	250
TDS	22.5	93	42	104.8	26.7	16.8	500
Thallium	0.000005	0.00002	0.000008	0.00002	0.00001	0.000003	0.002
Uranium	0.0002	0.0006	0.0003	0.0007	0.0002	0.0001	0.03014
Zinc	0.006	0.026	0.012	0.029	0.007	0.005	5

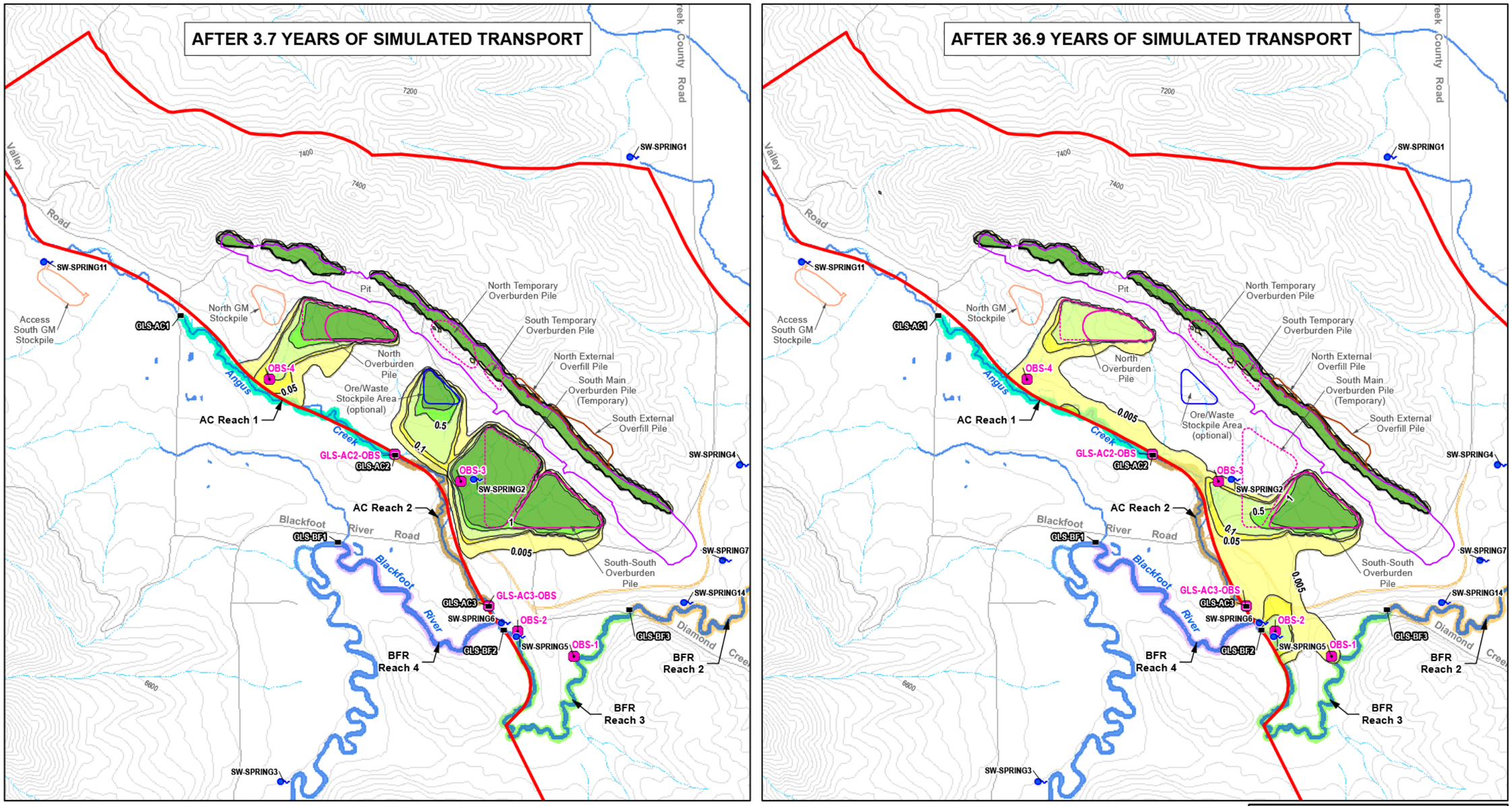
Notes:
Primary Idaho Groundwater Standard for antimony, cadmium, copper, selenium, thallium, and thallium
Secondary Idaho Groundwater Standard for aluminum, iron, manganese, sulfate, TDS, and zinc
Primary Federal Drinking Water Standard for uranium
N/A – Not Applicable

Modeling results indicate that construction of the of the North, South Main, and South-South Overburden Piles and the Optional Ore Stockpile/Overburden Storage Area would result in the release of COPCs in shallow groundwater at concentrations that exceed Idaho groundwater quality standards. With the exceptions of aluminum, copper, and iron, simulated concentrations of COPCs exceed the applicable standards in shallow groundwater below the external overburden and ore storage facilities. The simulated concentrations of antimony, cadmium, manganese, selenium, sulfate, and TDS were higher than groundwater standards outside of the facility footprints. In the shallow groundwater, manganese exhibited the greatest mobility at levels above Idaho groundwater quality standards. The simulated plumes for all other COPCs are contained within the footprints of the manganese plumes shown on **Figure 4.3-13**. Contaminant loading to shallow groundwater below the external overburden storage facilities is modeled to correspond to the pore volume timing for the highest source term concentrations in **Table 4.3-5**. The timing of peak concentrations at model observation points OBS-1 through OBS-4, GLS-AC2-OBS and GLS-AC3-OBS is shown on **Figure 4.3-15**. The South Main Overburden Pile, portions of the Optional Ore Stockpile/Overburden Storage Area would be removed at the end of mining, and these facilities would not be a source of long-term COPC loads to shallow groundwater.

Regional Groundwater

Fate-and-transport modeling results for the Proposed Action predict that contaminant plumes of selenium and other COCPs would form in the Wells Regional Aquifer beneath the backfilled pit soon after commencement of mining, and would migrate northwest toward the intersection of the Rasmussen and Enoch Valley Faults. Simulated groundwater plumes for selenium and manganese in the Wells Regional Aquifer under the Proposed Action are shown on **Figure 4.3-16**. Concentrations of COPCs in the Wells Regional Aquifer at model observation point OBS-5 (**Figure 4.3-16**) are shown on **Figure 4.3-17**. Peak and long-term (700 years) concentrations at model observation points are summarized in **Table 4.3-8**.

Modeling results indicate that seepage and groundwater movement through the backfilled pit and overfill areas under the Proposed Action would result in the release of COPCs into the Wells Regional Aquifer at concentrations that exceed Idaho groundwater quality standards. With the exceptions of aluminum, copper, iron, and zinc, modeled concentrations of remaining COPCs exceed the applicable standards in the regional aquifer at least at one location below the proposed pit backfill and overfill areas. Cadmium, manganese, selenium, sulfate, TDS, and thallium are modeled as being mobile at concentrations higher than groundwater standards outside of the pit backfill and overfill areas. Selenium is modeled to exhibit the greatest mobility in the Wells Regional Aquifer at levels above Idaho groundwater quality standards. The simulated plumes for all other COPC are contained within the footprint of the selenium plume shown on **Figure 4.3-16**. Contaminant loading to the Wells Regional Aquifer at the pit backfill and overfill area is modeled to correspond to the pore volume timing for the highest source term concentrations in **Table 4.3-8**. The timing of peak concentrations at model observation point OBS-5 is shown on **Figure 4.3-17**. The footprints of the maximum and long-term extents of the contaminant plumes are approximately equal.



LEGEND

- SPRING
- OBSERVATION POINT
- GAIN/LOSS STUDY STATION
- NUMERICAL MODEL EXTENT
- PIT
- GM STOCKPILE
- PERMANENT OVERBURDEN PILE
- TEMPORARY OVERBURDEN PILE
- PERMANENT OVERFILL PILE
- TEMPORARY ORE STOCKPILE
- AC REACH 1
- AC REACH 2
- BFR REACH 2
- BFR REACH 3
- BFR REACH 4
- INTERMITTENT STREAM
- PERENNIAL STREAM
- COUNTY ROAD REALIGNMENT
- EXISTING ROAD
- TOPOGRAPHIC CONTOUR
- SELENIUM PLUME CONTOUR (mg/L)

PREDICTED SELENIUM CONCENTRATION

- 0 - 0.005 mg/L
- 0.005 - 0.05 mg/L
- 0.05 - 0.1 mg/L
- 0.1 - 0.5 mg/L
- 0.5 - 1 mg/L
- >1 mg/L

Projection:
North America Datum 1983,
Universal Transverse Mercator,
Zone 12 North

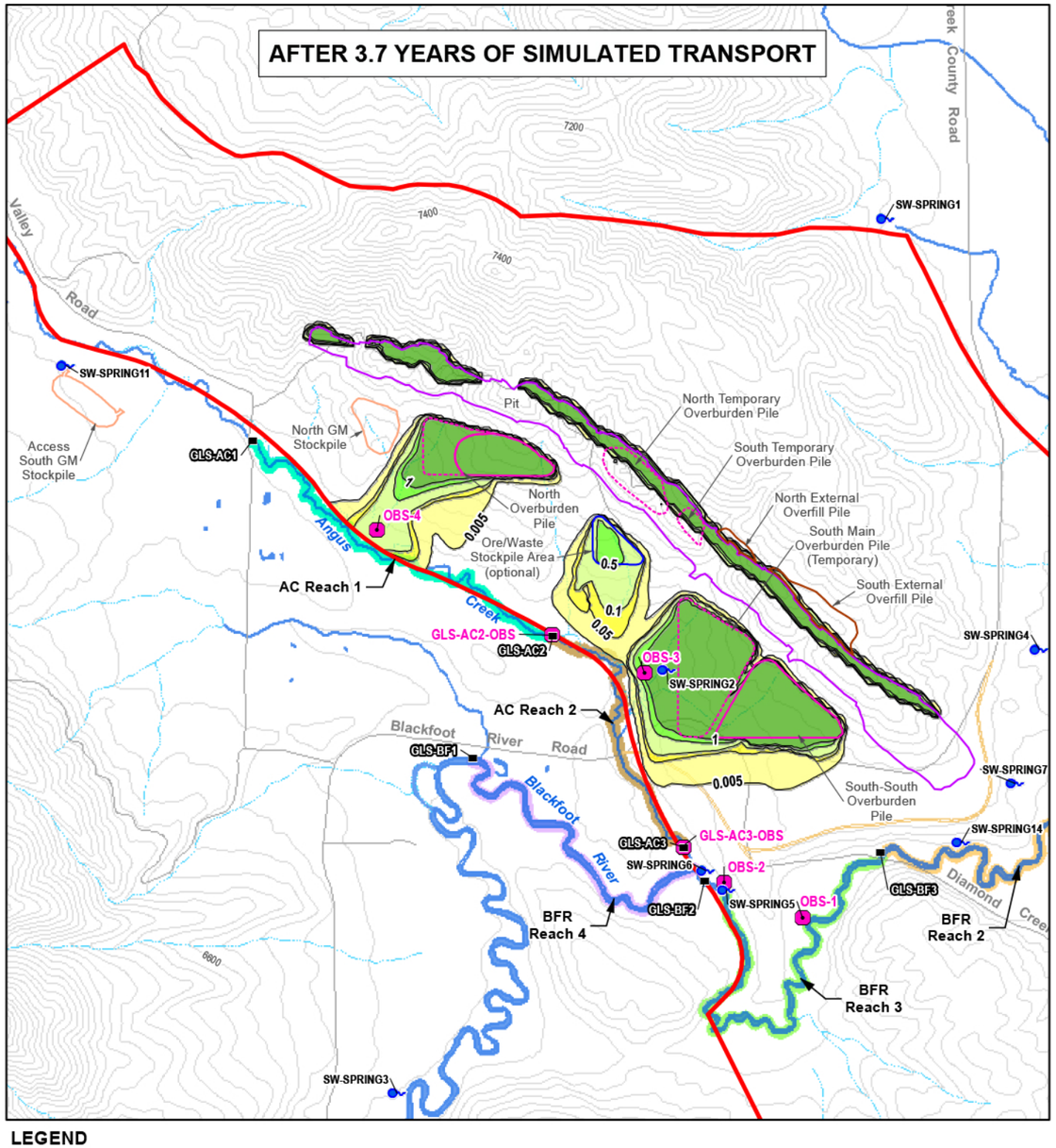
NORTH

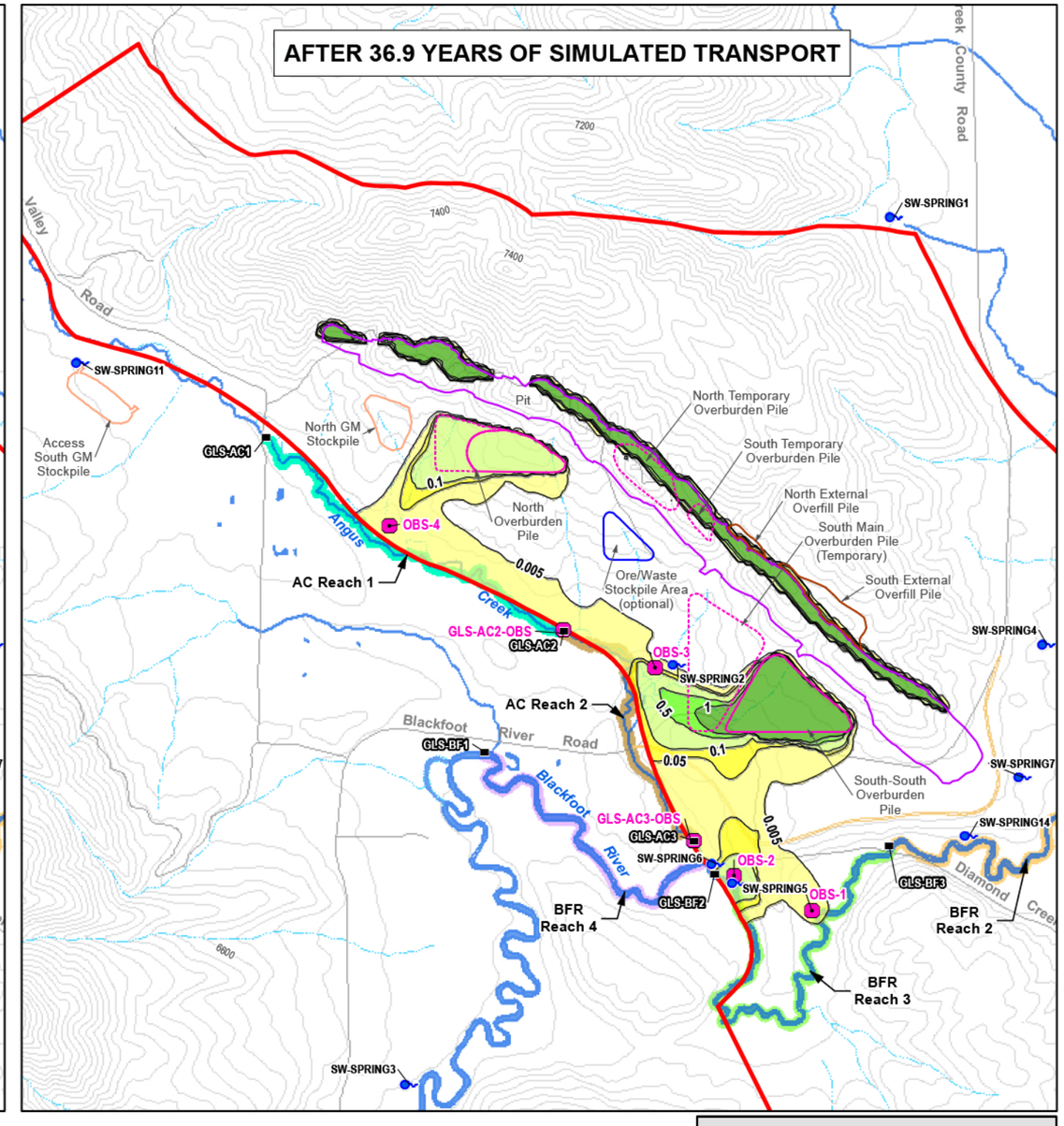
0 2,200 4,400 Feet

RASMUSSEN VALLEY MINE

FIGURE 4.3-12
Plan Map Showing
Simulated Maximum Extent
of Selenium Plumes at the Water Table
for the Proposed Action

ANALYSIS AREA: Caribou County, Idaho
Date: 9/2/2015 | Prepared By: JC
File: K:\CO1553\2015_DEIS\Chapter4\Se Plume at Water Table_PA_2Panels.mxd





LEGEND

- SPRING
- OBSERVATION POINT
- GAIN/LOSS STUDY STATION
- NUMERICAL MODEL EXTENT
- PIT
- GM STOCKPILE
- PERMANENT OVERBURDEN PILE
- TEMPORARY OVERBURDEN PILE
- PERMANENT OVERFILL PILE
- TEMPORARY ORE STOCKPILE
- AC REACH 1
- AC REACH 2
- BFR REACH 2
- BFR REACH 3
- BFR REACH 4
- INTERMITTENT STREAM
- PERENNIAL STREAM
- COUNTY ROAD REALIGNMENT
- EXISTING ROAD
- TOPOGRAPHIC CONTOUR
- MANGANESE PLUME CONTOUR (mg/L)

PREDICTED MANGANESE CONCENTRATION

- 0 - 0.005 mg/L
- 0.005 - 0.05 mg/L
- 0.05 - 0.1 mg/L
- 0.1 - 0.5 mg/L
- 0.5 - 1 mg/L
- >1 mg/L

Projection:
North America Datum 1983,
Universal Transverse Mercator,
Zone 12 North

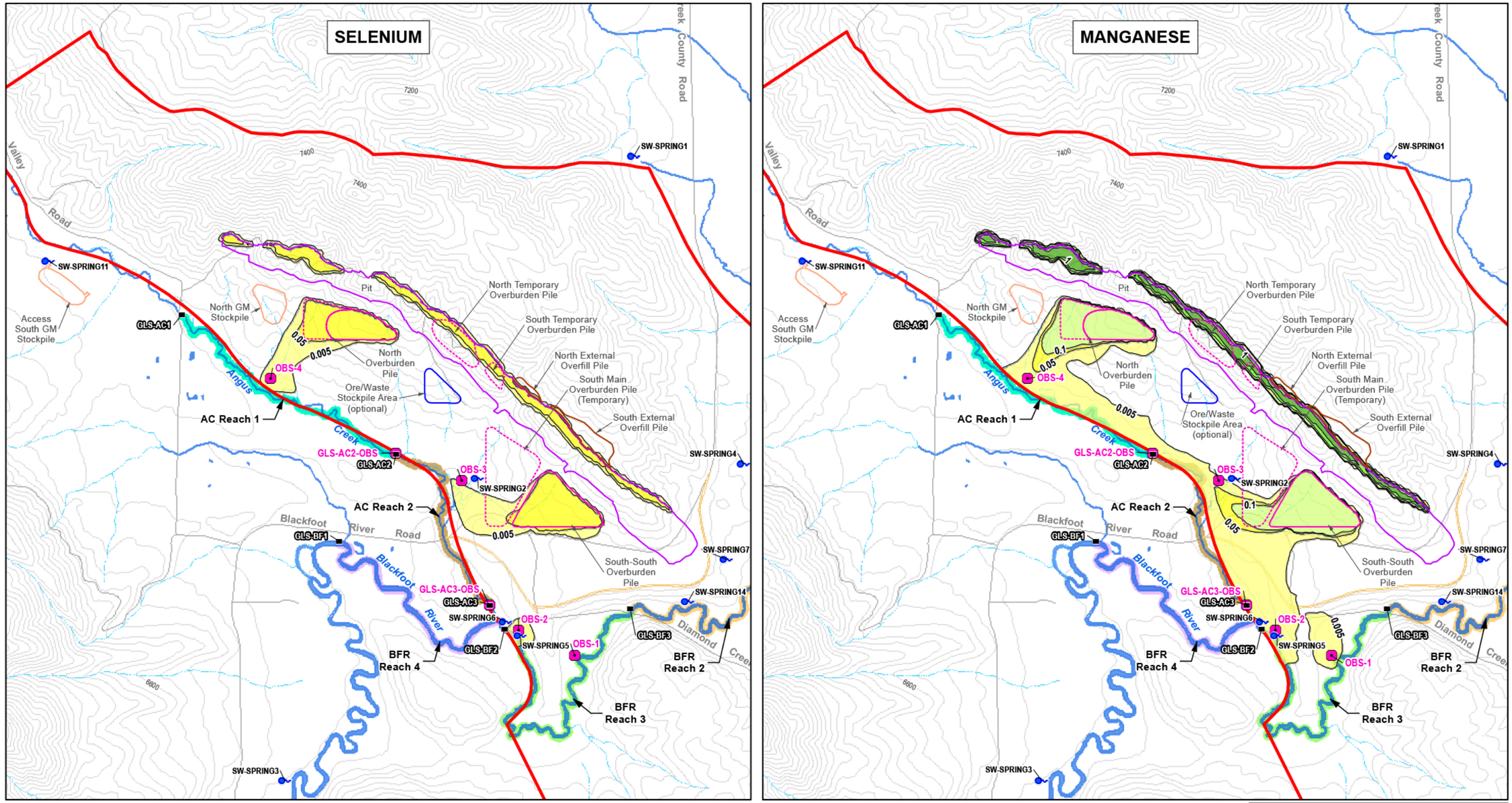
NORTH

0 2,200 4,400 Feet

RASMUSSEN VALLEY MINE

FIGURE 4.3-13
Plan Map Showing
Simulated Maximum Extent
of Manganese Plumes at the Water Table
for the Proposed Action

ANALYSIS AREA: Caribou County, Idaho
Date: 9/2/2015 | Prepared By: JC
File: K:\CO1553\2015_DEIS\Chapter4\Mn Plume at Water Table_PA_2Panels.mxd


SELENIUM
MANGANESE
Valley Road
Creek County Road
7200
7400
6800
SW-SPRING1
SW-SPRING11
SW-SPRING4
SW-SPRING7
SW-SPRING14
SW-SPRING3
SW-SPRING2
SW-SPRING6
SW-SPRING5
GLS-AC1
GLS-AC2
GLS-AC3
GLS-BF1
GLS-BF2
GLS-BF3
OBS-1
OBS-2
OBS-3
OBS-4
GLS-AC2-OBS
GLS-AC3-OBS
Access South GM Stockpile
North GM Stockpile
Pit
North Temporary Overburden Pile
South Temporary Overburden Pile
North Overburden Pile
North External Overfill Pile
South Main Overburden Pile (Temporary)
Ore/Waste Stockpile Area (optional)
South External Overfill Pile
South-South Overburden Pile
AC Reach 1
AC Reach 2
BFR Reach 2
BFR Reach 3
BFR Reach 4
Angus Creek
Blackfoot River
Blackfoot River Road
Diamond Creek
0.005
0.05
0.1
1
LEGEND
SPRING
OBSERVATION POINT
GAIN/LOSS STUDY STATION
NUMERICAL MODEL EXTENT
PIT
GM STOCKPILE
PERMANENT OVERBURDEN PILE
TEMPORARY OVERBURDEN PILE
PERMANENT OVERFILL PILE
TEMPORARY ORE STOCKPILE
AC REACH 1
AC REACH 2
BFR REACH 2
BFR REACH 3
BFR REACH 4
INTERMITTENT STREAM
PERENNIAL STREAM
COUNTY ROAD REALIGNMENT
EXISTING ROAD
TOPOGRAPHIC CONTOUR
SELENIUM/MANGANESE PLUME CONTOUR (mg/L)
PREDICTED SELENIUM/MANGANESE CONCENTRATION
0 - 0.005 mg/L
0.005 - 0.05 mg/L
0.05 - 0.1 mg/L
0.1 - 0.5 mg/L
0.5 - 1 mg/L
>1 mg/L
Projection:
North America Datum 1983,
Universal Transverse Mercator,
Zone 12 North
NORTH
0
2,200
4,400
Feet
RASMUSSEN VALLEY MINE
FIGURE 4.3-14
Plan Map Showing
Simulated Long-Term (700 Years)
Extents of Selenium and Manganese Plumes
at the Water Table for the Proposed Action
ANALYSIS AREA: Caribou County, Idaho
Date: 9/2/2015
Prepared By: JC
File: K:\CO1553\2015_DEIS\Chapter4\LT_Se_Mn at Water Table_PA_2Panels.mxd

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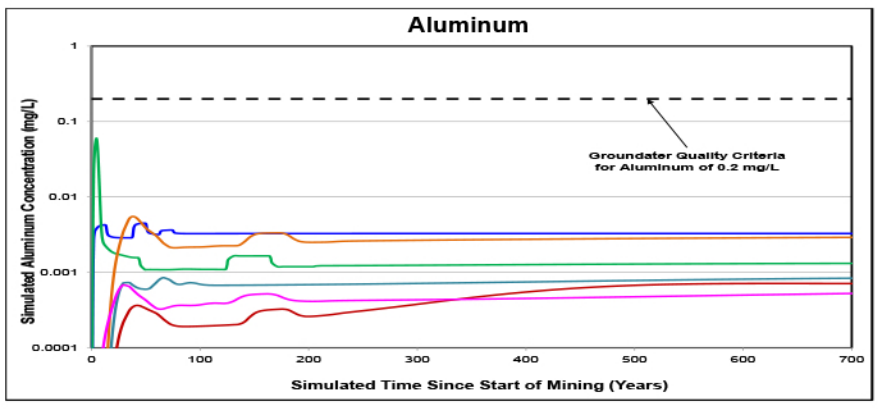

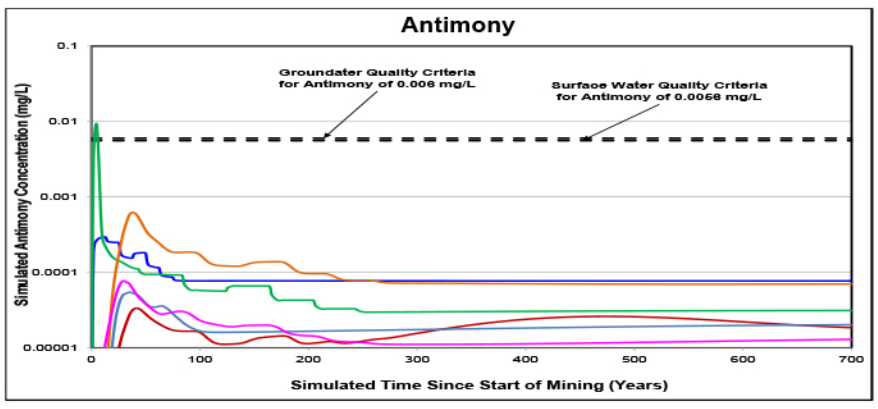

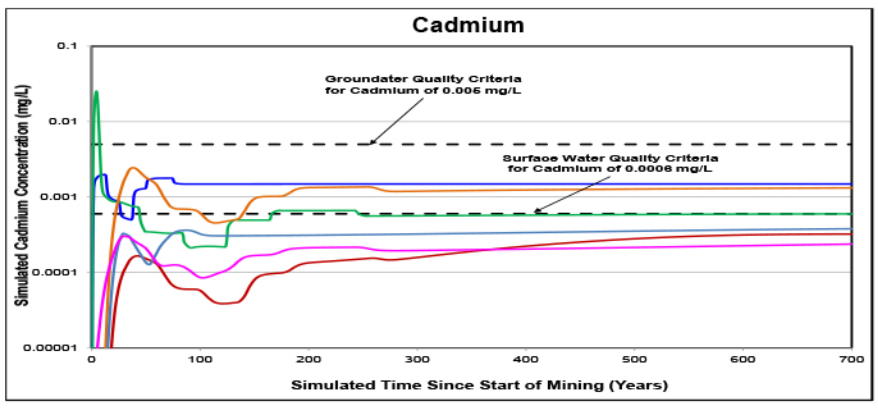

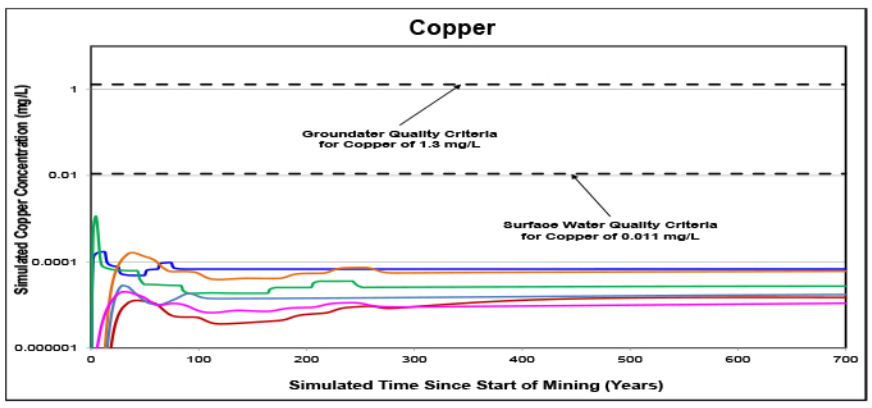

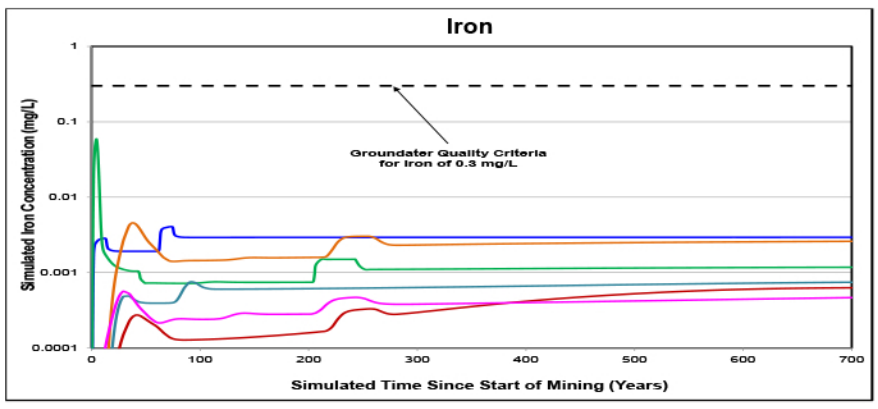

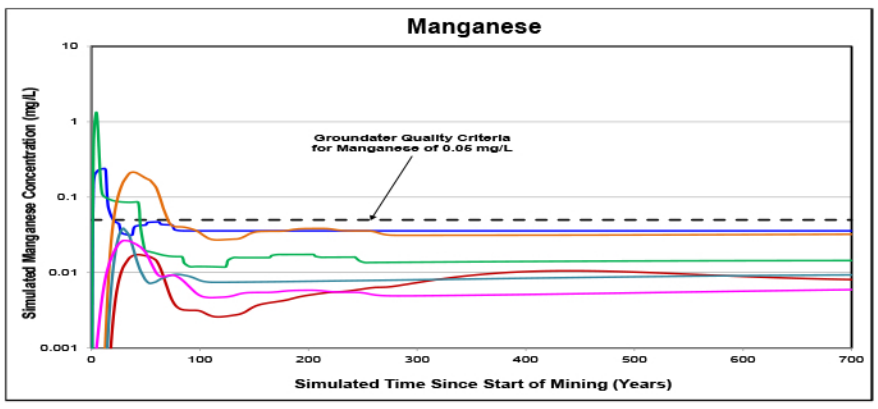

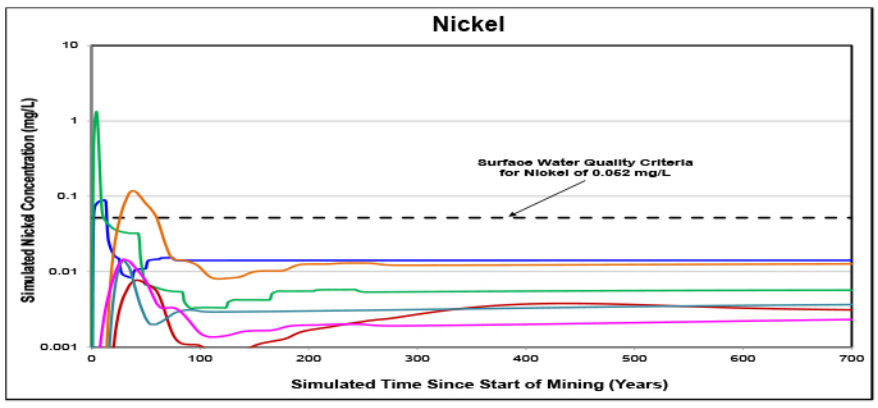

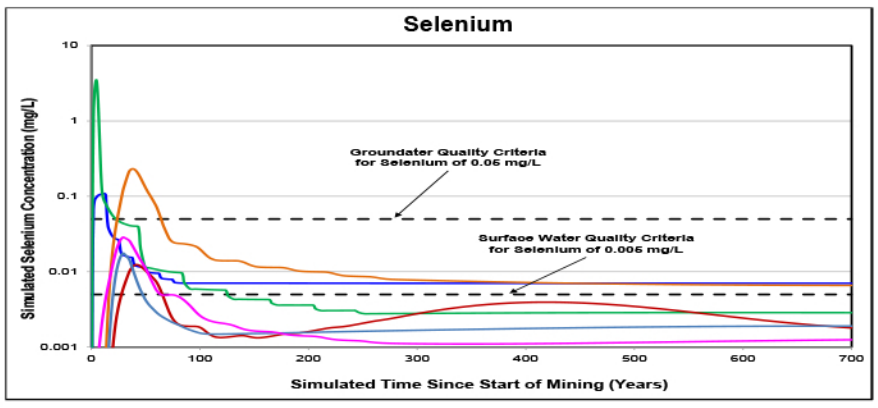

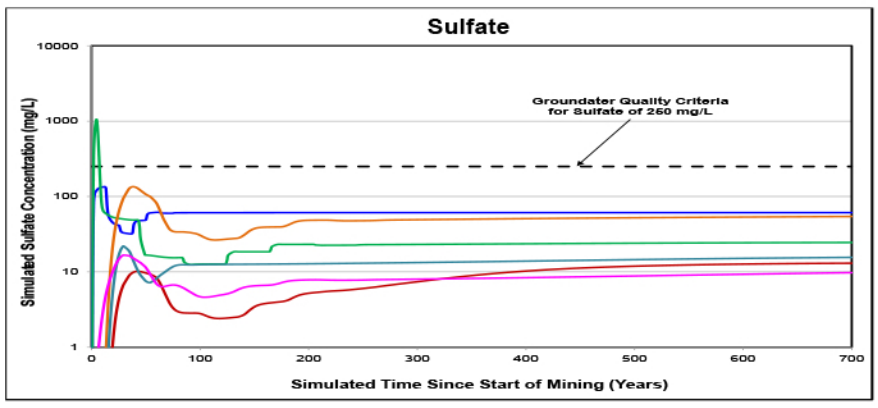

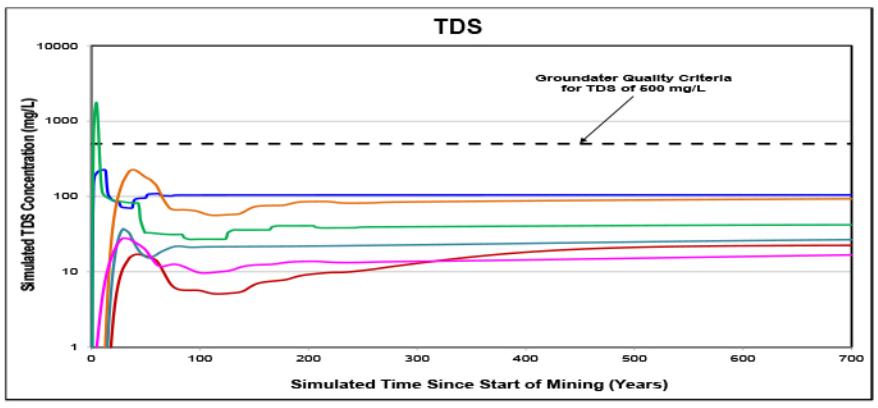

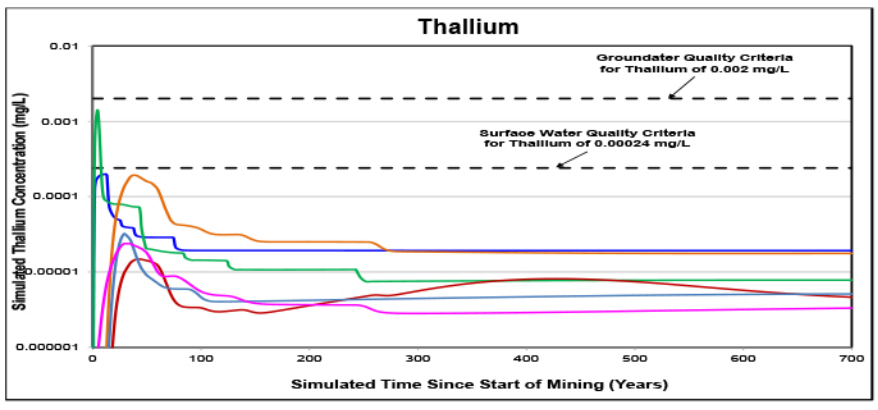

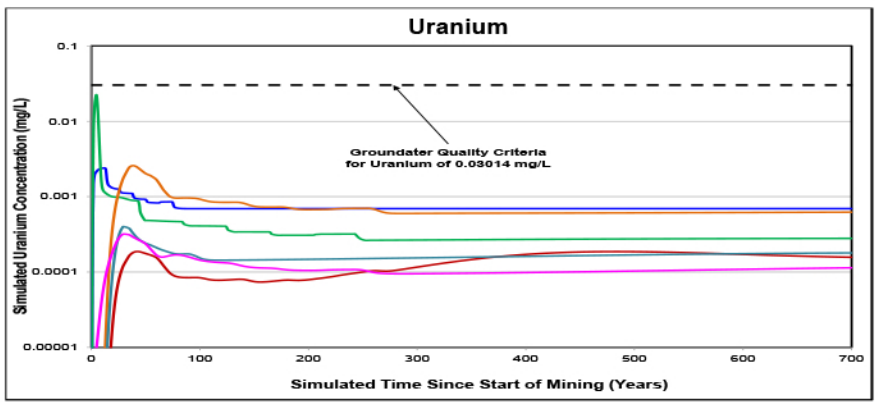

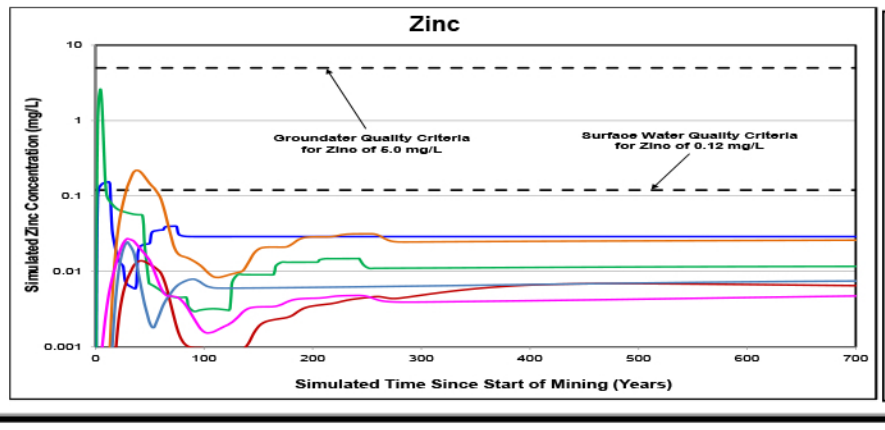

LEGEND

- OBS-4
- OBS-3
- OBS-2
- OBS-1
- GLS-AC2-OBS
- GLS-AC3-OBS

NOTES:
1. Surface and Groundwater quality criteria are based on Idaho Water Quality Standard except for Uranium which is based on Federal Drinking Water Standard.
2. COPC concentrations are zero under RCA at these observation locations.
3. No applicable surface water quality criteria for Aluminum, Copper, Iron, Manganese, Sulfate, TDS and Uranium.
4. No applicable groundwater quality criteria for Nickel.

RASMUSSEN VALLEY MINE

FIGURE 4.3-15
Modeled COPC Concentrations in Shallow Groundwater at Select Observation Points: OBS-1 through OBS-4, GLS-AC2-OBS, and GLS-AC3-OBS

ANALYSIS AREA: Caribou County, Idaho
Date: 09/01/2015 | Prepared By: JC
File: K:\CO1553\Image\2015_DEIS\COPC in GW_Well Formation+OBS1-4plus.ai

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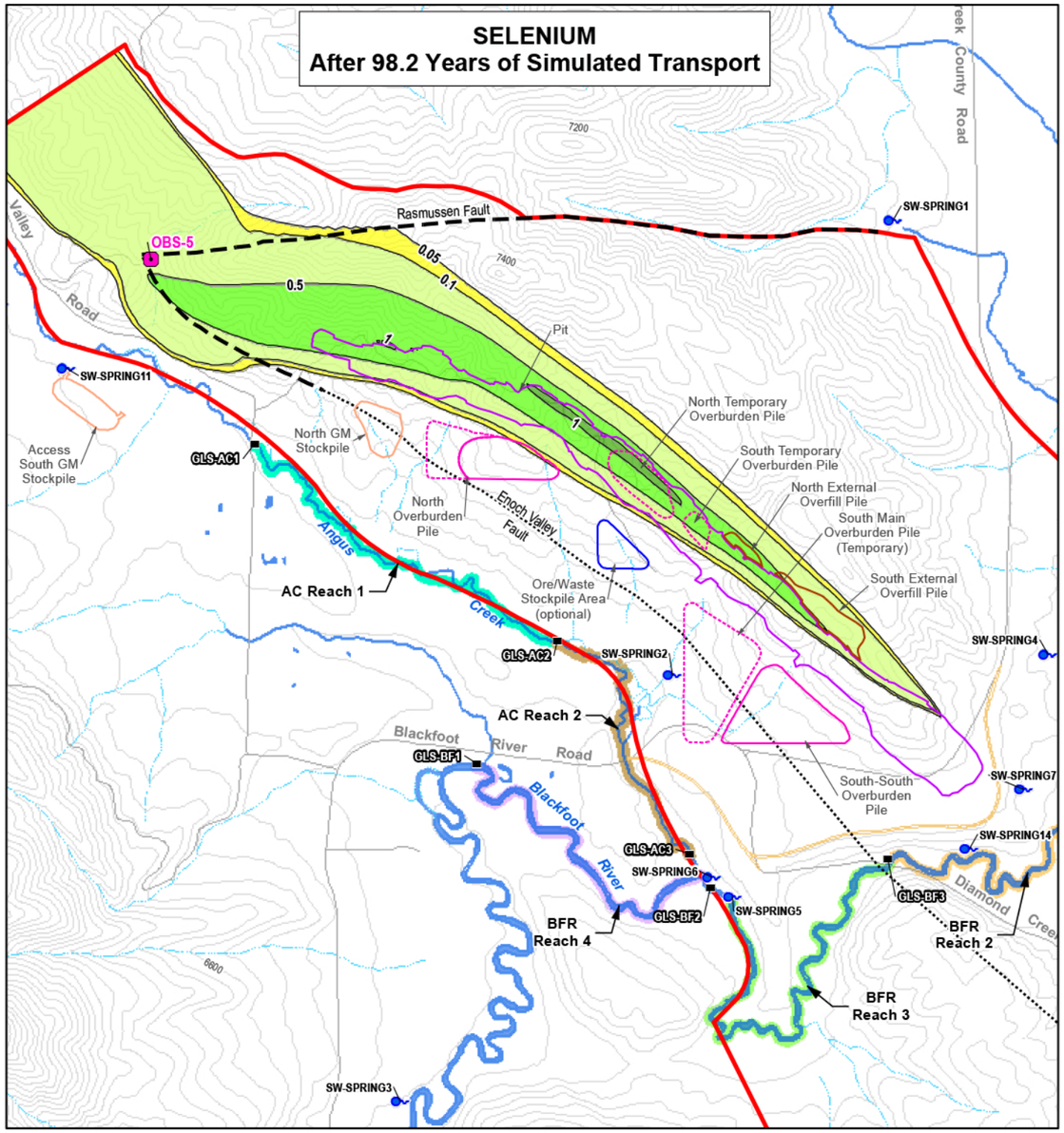

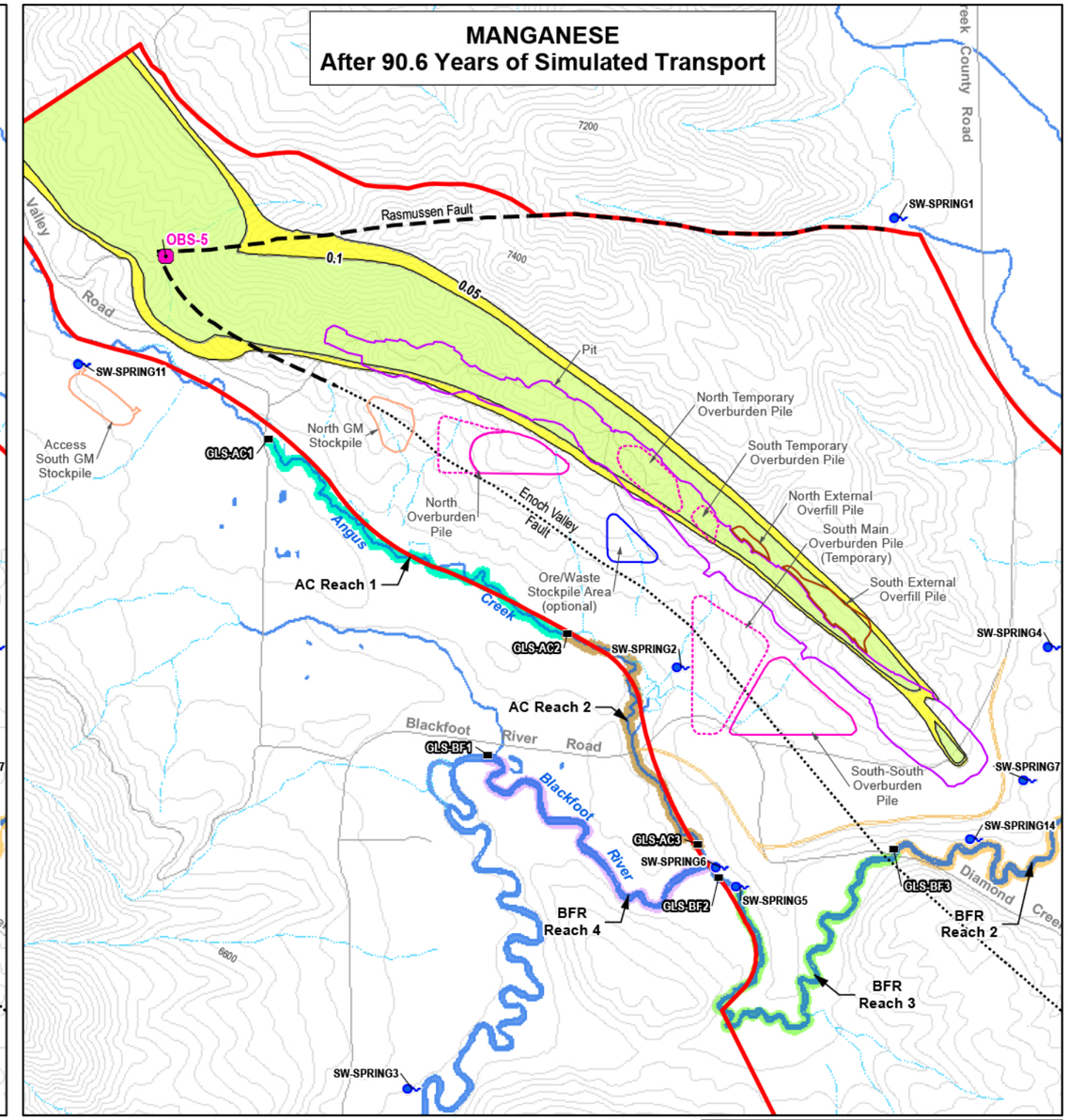

LEGEND

- SPRING
- OBSERVATION POINT
- GAIN/LOSS STUDY STATION
- NUMERICAL MODEL EXTENT
- PIT
- GM STOCKPILE
- PERMANENT OVERBURDEN PILE
- TEMPORARY OVERBURDEN PILE
- PERMANENT OVERFILL PILE
- TEMPORARY ORE STOCKPILE
- AC REACH 1
- AC REACH 2
- BFR REACH 2
- BFR REACH 3
- BFR REACH 4
- INTERMITTENT STREAM
- PERENNIAL STREAM
- COUNTY ROAD REALIGNMENT
- EXISTING ROAD
- FAULT (APPROXIMATE LOCATION)
- FAULT (CONCEALED LOCATION)
- TOPOGRAPHIC CONTOUR
- 0.1 SELENIUM/MANGANESE PLUME CONTOUR (mg/L)

PREDICTED SELENIUM/MANGANESE CONCENTRATION

- 0 - 0.05 mg/L
- 0.05 - 0.1 mg/L
- 0.1 - 0.5 mg/L
- 0.5 - 1 mg/L
- >1 mg/L

Projection:
North America Datum 1983,
Universal Transverse Mercator,
Zone 12 North

NORTH

0 2,200 4,400 Feet

RASMUSSEN VALLEY MINE

FIGURE 4.3-16
Plan Map Showing
the Simulated Maximum Extent of
Selenium and Manganese Plumes
in the Wells Regional Aquifer for the Proposed Action

ANALYSIS AREA: Caribou County, Idaho
Date: 9/2/2015 | Prepared By: JC
File: K:\CO1553\2015_DEIS\Chapter4\Max_Se_Mn at Wells_PA_2Panels.mxd

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Table 4.3-8 Predicted Peak and Long-term Concentrations in the Wells Regional Aquifer for the Proposed Action at Model Observation Point OBS-5

Constituent	Peak Concentration (mg/L)	Long-Term Concentration (mg/L)	Groundwater Standard (mg/L)
Aluminum	0.013	0.0048	0.2
Antimony	0.001	0.0008	0.006
Cadmium	0.0061	0.0061	0.005
Copper	0.0002	0.0001	1.3
Iron	0.011	0.0038	0.3
Manganese	0.184	0.108	0.05
Nickel	0.178	0.139	N/A
Selenium	0.46	0.007	0.05
Sulfate	238.37	169.73	250
TDS	414.73	265.7	500
Thallium	0.00106	0.00029	0.002
Uranium	0.00385	0.00169	0.03
Zinc	0.45	0.374	5

Notes:
Primary Idaho Groundwater Standard for antimony, cadmium, copper, selenium, and thallium
Secondary Idaho Groundwater Standard for aluminum, iron, manganese, sulfate, TDS, and zinc
Primary Federal Drinking Water Standard for uranium
N/A – Not Applicable

4.3.1.1.4 Impacts to Surface Water Resources

Mining activities associated with the Proposed Action carry the potential to impact surface waters through changes in volume and timing of surface water runoff and flow patterns; by the introduction of pollutants such as sediment, selenium, and other COPCs by storm water runoff and spills; by surface runoff contacting exposed overburden; and by discharge of shallow aquifers to surface waters.

Watershed Area Disturbance

Revised Forest Plan (RFP) guidelines for the Caribou National Forest (CNF; USFS 2003) recommend that less than 30 percent of HUC 5 and HUC 6 watershed areas should be hydrologically disturbed at any given time. Hydrologic disturbance is defined as changes in natural canopy cover (vegetation removal) or a change in surface soil characteristics (such as compaction) that may alter natural streamflow quantities and character. HUC 6 sub-watersheds that contain elements of the Proposed Action or the RCA were evaluated for conformance to RFP guidelines. Existing hydrologic disturbances in the three HUC 6 sub-watersheds (Angus Creek-Blackfoot River, Lower Lanes Creek, and Diamond Creek) that would be affected by the Proposed Action or the RCA include roads, recreational trails, utility lines, agricultural fields, homes, mining areas, and wildfires or timber harvesting that remove trees and have not recovered to a sapling/pole size class. Additional areas that would be disturbed include the open pit, stockpiles, external overburden disposal piles, roads, staging areas, and other facilities. These disturbances and prescribed percentage within HUC 6 watersheds pertain only to areas located on USFS land. Existing and proposed hydrologic disturbances in the HUC 6 sub-watersheds that would be affected by the Proposed Action are summarized in **Table 4.3-9** (USFS 2015; BLM 2015a).

Table 4.3-9 Existing and Proposed Hydrologic Disturbances on Forest Service Lands under the Proposed Action

Sub-Watershed	Existing HUC 6 Watershed Disturbance (% area)	New Disturbances in HUC 6 watershed under the Proposed Action During Mining					
		Pit (% area)	External Stockpiles (% area)	Water Retention/ Sediment Basins (% area)	Roads (% area)	Fuel Storage Staging Area (% area)	Total New Disturbance (%)
Angus Creek-Blackfoot River	23.60	0.80	0.43	0.02	0.33	0.01	1.59
Lower Lanes Creek	16.98	0.00	0.00	0.00	0.00	0.00	0.00
Diamond Creek	3.30	0.00	0.00	0.00	0.00	0.00	0.00

Notes:
Existing disturbances of HUC 6 watersheds from USFS 2015; BLM 2015a

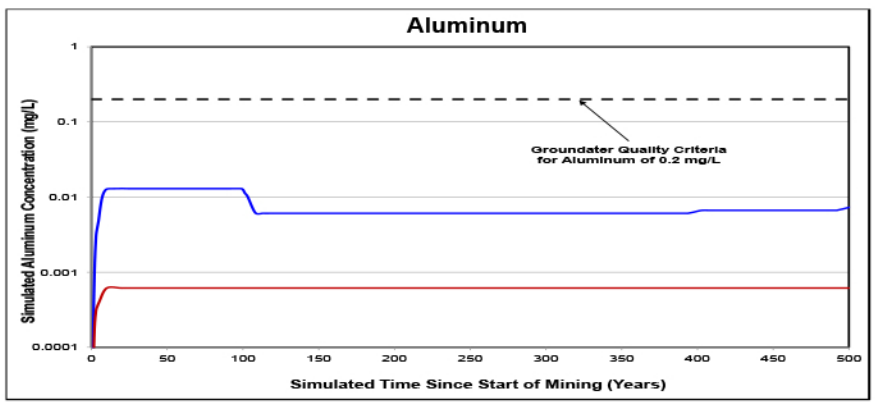
During mining, the Proposed Action would increase hydrologic disturbances in the Angus Creek-Blackfoot River sub-watershed by 1.59 percent. The total hydrological disturbance of 25.18 percent in the Angus Creek-Blackfoot River sub-watershed would meet the USFS guideline of less than 30 percent. There would be no disturbance on USFS lands in Lower Lanes Creek and Diamond Creek sub-watersheds under the Proposed Action.

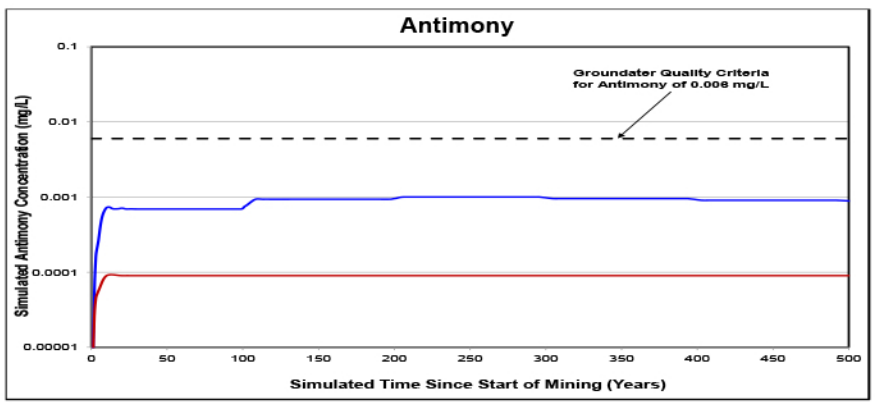
The CNF RFP (USFS 2003) notes that the USEPA and USGS assessed the Blackfoot River watershed (4th level Hydrologic Unit Code [HUC]) with a rating of 5 on their 1 to 6 Index of Watershed Indicators (IWI). This rating indicates “more serious water quality problem, low vulnerability”, which means that the existing condition may not meet the designated uses, but the vulnerability to additional stressors, such as pollutant loadings, is low.

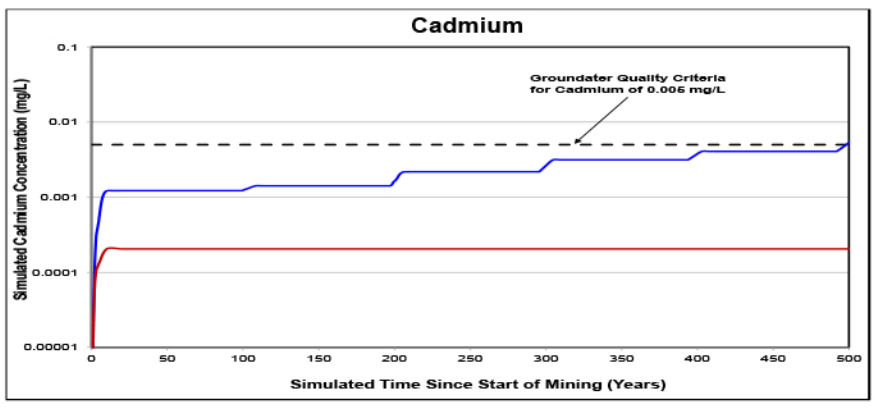
Impacts to a hydrologically disturbed condition resulting from Proposed Action would be considered minor, local, and long-term, lasting until vegetation fully recovered and trees reached sapling/pole size class.

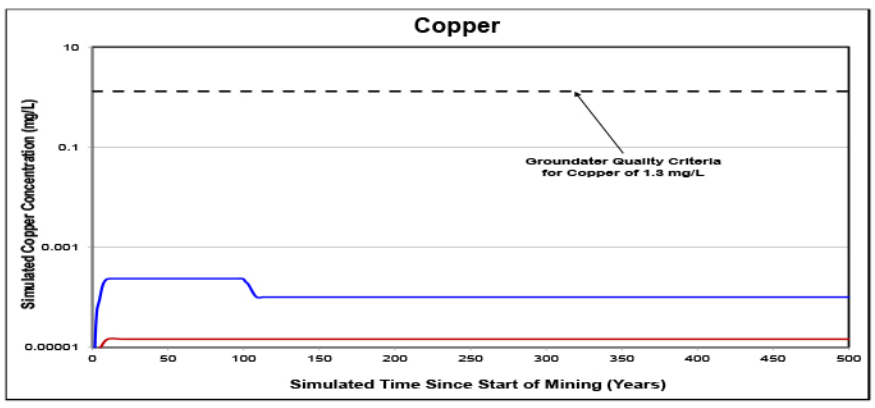
Impacts to Runoff Areas

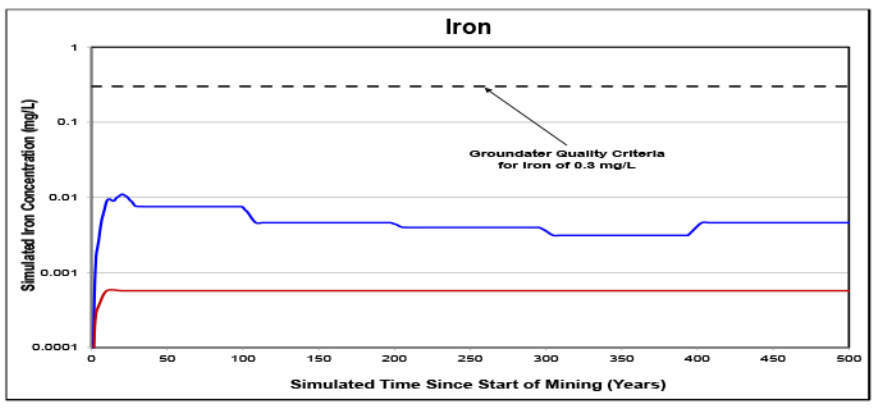
Precipitation falling on disturbed areas associated with the pit, stockpiles, and haul roads and other facilities would infiltrate or be retained in sediment catchment and runoff retention basins. Water in these basins would evaporate or infiltrate, or be transported to other available approved storm water storage and infiltration areas. No discharge of runoff water would occur unless the design storm event is exceeded. This means that runoff from the disturbed areas, as well as undisturbed drainages captured by the pit, diversion ditches, and sediment retention pond, would be retained during mining and would not contribute to runoff in the surrounding drainages as would normally occur under the baseline condition. Drainage areas upslope of the pit would not contribute to the affected downstream watersheds, thereby potentially reducing runoff volumes and peak flows during mining until reclamation is completed and the retention basins are removed. The percent reduction in the contributing watershed is used in the following analysis to estimate the percent reduction in stream flow that could occur from the Proposed Action. This is a useful simplification that does not consider all factors that contribute to the volume of runoff generated by a drainage area. The analysis is used to compare the Proposed Action to the RCA, but should not be interpreted to represent quantitative changes in flows. Estimated reductions in runoff areas related to Proposed Action for each sub-watershed are presented in **Table 4.3-10**.

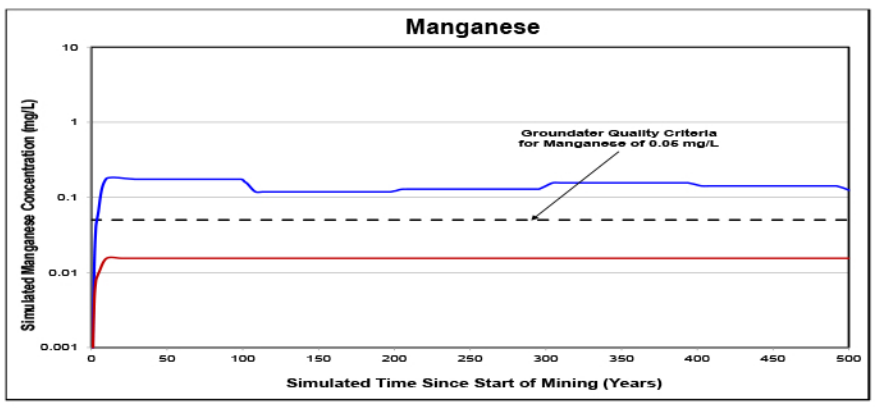


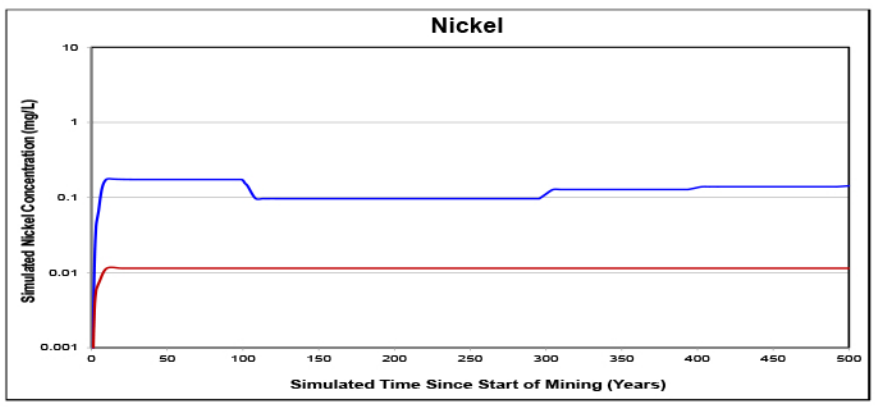


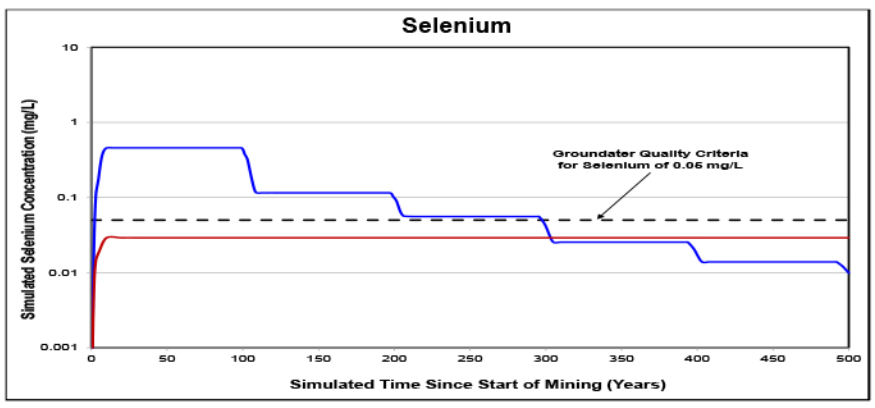


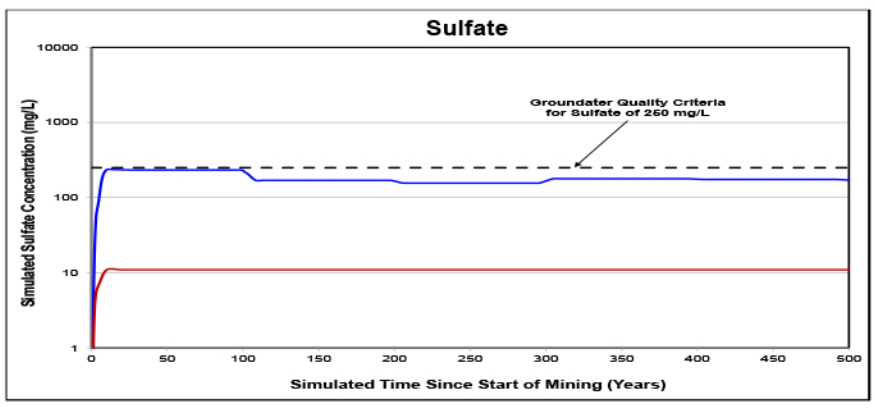


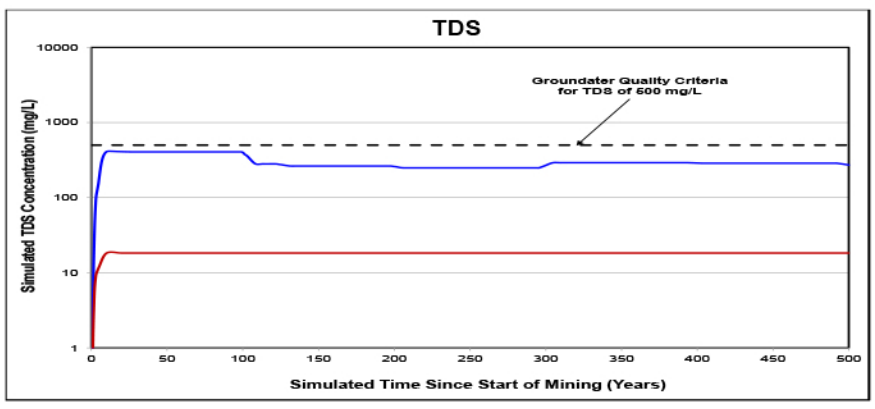


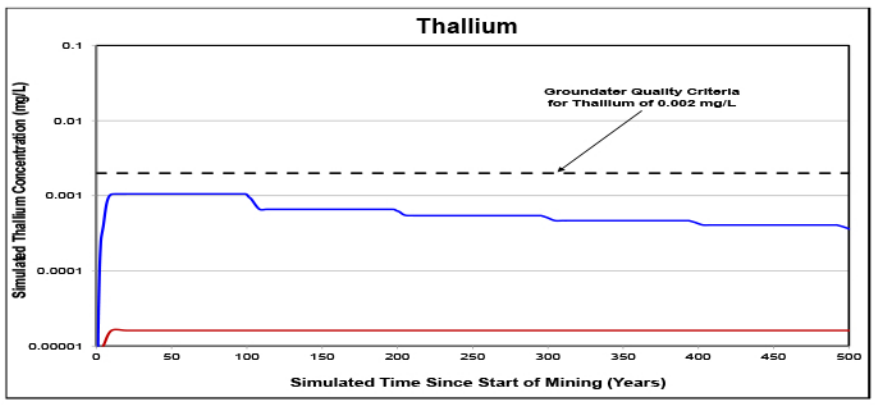


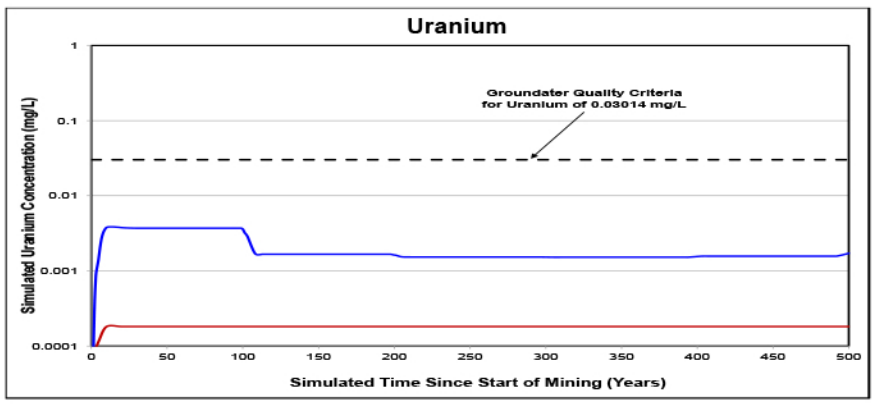


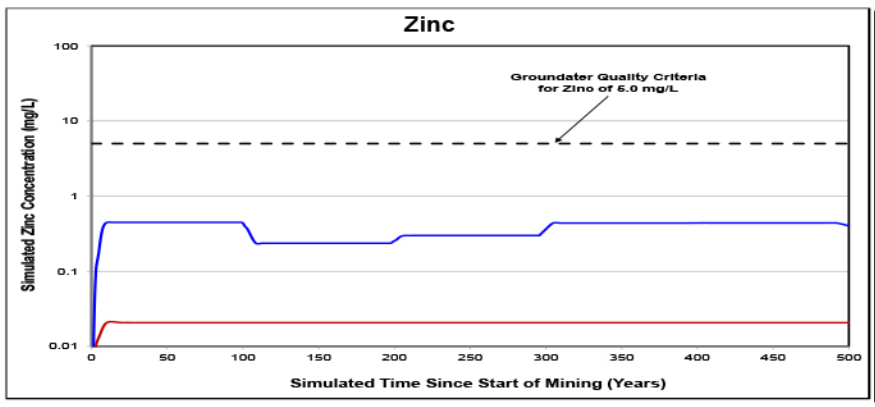












LEGEND

SIMULATED CONCENTRATION UNDER PROPOSED ACTION

SIMULATED CONCENTRATION UNDER RCA

NOTES:
1. Groundwater quality criteria are based on Idaho Water Quality Standard except for Uranium which is based on Federal Drinking Water Standard.
2. No applicable groundwater quality criteria for Nickel.

RASMUSSEN VALLEY MINE

FIGURE 4.3-17
Simulated COPC Concentrations in the Wells Regional Aquifer at Select Observation Point OBS-5 at the Rasmussen Valley Fault

ANALYSIS AREA: Caribou County, Idaho

Date: 09/01/2015 | Prepared By: JC

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Table 4.3-10 Reduction in Runoff Areas under the Proposed Action

Sub-Watershed	Pit and upstream drainages (acres)	External Stockpiles (acres)	Haul Roads (acres)	Water Retention/ Sediment basins (acres)	Fuel Storage Staging Area	Subtotal (acres)	Percent of Watershed
Angus Creek-Blackfoot River	589.00	116.77	79.83	7.02	1.40	794.02	4.14
Lower Lanes Creek	8.14	0.0	0.0	0.0	0.0	8.14	0.03
Diamond Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.00

The area of the Angus Creek-Blackfoot River sub-watershed is 19,167 acres. The total runoff area that would be intercepted by the pit during mining would be about 589 acres; however, the runoff area captured at any given time would be smaller because the pit would be backfilled and reclaimed as mining advances. This area would also include 12 drainage basins (1 through 12), located directly upstream of the pit, which would contribute surface runoff to the open pit during the life-of-mine (**Figure 2.3–5**). Disturbances for external overburden piles and GM stockpiles (North Overburden, South-South Overburden, Optional Ore, South Main Temporary Overburden, and North GM Stockpiles) and water retention basins would total 125 acres. Runoff from the North and South External Overfill Piles would be captured by the pit during mining. Runoff from the North and South GM Stockpiles would not be retained in sediment ponds and were excluded from the analysis. The total area that would be captured by the haul road during operation would be 80 acres. Overall, the total runoff area would represent about 4.14 percent of the Angus Creek-Blackfoot River sub-watershed (**Table 4.3-10**). Based on this evaluation of the intercepted runoff areas, the reduction of runoff in the Angus Creek-Blackfoot River sub-watershed during would be minor, local, and limited to the life of proposed mining activities. After final reclamation, 11.2 acres of the pit wall would remain unreclaimed, but runoff from these areas and the overlying drainages would be rerouted and still report to Angus Creek. For this reason, no reduction to runoff would occur from the backfilled and reclaimed pit. All external stockpiles and haul/access would be fully reclaimed, and these areas would again function as part of the watershed and fully contribute runoff to Angus Creek.

The area of the Lower Lanes Creek sub-watershed is 26,864 acres. A total runoff area of 8.14 acres within Lower Lanes Creek sub-watershed would be captured by the pit during mining (**Table 4.3-10**). The captured area represents approximately 0.03 percent of the Lower Lanes Creek sub-watershed; therefore, impacts related to reduction of runoff within Lower Lanes Creek sub-watershed during mining would be negligible. Agrium would also have the option to divert runoff from drainage areas 3 and 4 using an interceptor ditch during mining of Phase 4. Water intercepted by the ditch would be routed to drainage area 20, which drains into Lower Lanes Creek sub-watershed. This operational decision, if implemented, would result in a slight increase (106 acres or 0.4 percent) in runoff area contributing to Lower Lanes Creek sub-watershed during Phase 4 of mining. After mining cessation, the portion of the southern end of the pit in Lower Lanes Creek sub-watershed would be fully reclaimed and there would be no reduction in runoff to Lanes Creek.

There would be no surface disturbance in the Diamond Creek sub-watershed; therefore, no changes in the amount of runoff reporting to Diamond Creek are expected to occur from the Proposed Action.

To assess impacts from runoff reduction to Angus Creek, the same type of analysis was performed for only areas of Angus Creek-Blackfoot River sub-watershed which drain into Angus Creek. This area encompasses approximately 9,289 acres. The total runoff area that would be temporarily removed from Angus Creek drainage would be 722.4 acres under the Proposed

Action. As discussed above, the total acreage that would be removed at any given time would be lower because the pit would be backfilled and reclaimed as mining advances. Overall, the total runoff area reduction would represent approximately 7.8 percent of the Angus Creek drainage.

All disturbed areas under the Proposed Action are tributary to Blackfoot River. A combined total of approximately 802 acres (**Table 4.3-10**) would be temporarily removed from the Blackfoot River Watershed. However, the total acreage that would be removed at any given time would be less. The total drainage area of the Blackfoot River above the Study Area, including the Lanes Creek-Diamond Creek watershed and excluding the Spring Creek drainage (which is part of Angus Creek-Blackfoot River watershed), is about 83,828 acres. The combined total capture area under the Proposed Action would be less than 1 percent of the total runoff area reporting to Blackfoot River.

Impacts to Peak Flows

Haul and access roads under the Proposed Action carry the potential to affect peak flows through two primary mechanisms. First, the road drainage network of in-slope ditches and cross-drains could alter peak flows and accelerate runoff by increasing drainage density, extending the stream network and causing small-scale trans-basin diversions (Furniss et al. 2000). The Proposed Action would minimize this potential to the extent possible by reducing the amount of hydrologically connected roads. Hydrologically connected roads are defined as “any road segment that, during a design runoff event, has a continuous surface flow path between any part of the road prism and a natural stream channel” (Furniss et al. 2000).

Second, if a stream crossing or culvert cannot pass all stream flow, either because it is blocked or the design event is exceeded, the flow could overtop the crossing or culvert, flow down the road, and be redirected to a tributary channel other than the intended one, which could result in locally higher peak flows, head cutting, and erosion (Furniss et al. 1997). The Mine and Reclamation Plan (Agrium 2011) addresses this concern by designing all ditches, culverts, crossings for the 100-year, 24-hour storm event.

Final reclamation would include removal of some road material and re-contouring of the remaining road bed. Linear, on-contour road bed features would remain. The potential peak flow alterations resulting from these remaining features under the Proposed Action would be minor, local, and have short durations. The County Road re-alignment would have localized minor impacts that would be long-term.

Impacts to Channels

Runoff from temporary and permanent overburden piles, pit backfills, haul roads, and other disturbed areas would increase the potential for erosion.

Sediment loading in downstream waterbodies would be controlled by directing on-site surface water flow into retention ponds. Runoff from the proposed external overburden piles, optional ore stockpile, and North GM Stockpile would be collected in perimeter ditches at the bases of each facility and routed to sediment catchment basins. The North and South Temporary Overburden Piles and the North and South External Overfill Piles would drain into the mine pit and would not need sediment catchment basins. The two GM stockpiles, containing soils salvaged from construction of the haul roads, would be stabilized with vegetation. Sediment would be intercepted by straw wattles and silt fences, removing the need for sediment catchment basins. Culverts and ditches would be used to collect runoff from the haul road and divert it to retention basins located downslope of the West Side and Rasmussen Valley Haul Roads. Retention basins would be in place during construction and mining, and would be designed to retain sediment and runoff

generated by the 100-year, 24-hour precipitation event. An event producing runoff greater than the 100-year, 24-hour precipitation event could fill and discharge from the retention basins. Runoff from disturbances associated with the external overburden piles, optional ore stockpile, and North GM Stockpile are not predicted to result in increased sedimentation of stream channels in the Study Area.

Mining under the Proposed Action would intercept a number of upslope drainages crossing the pit area. Disruption of these drainages would change the flow dynamics of the channels as well as limit the amount of runoff that reaches Angus Creek. The drainages would be re-established as the backfilled pit is reclaimed. The Proposed Action would also affect four drainages below the pit by the construction of external overburden piles within and adjacent to intermittent stream channels (**Figure 2.3–2**). Construction of these facilities would alter the natural flow patterns by changing overland flow characteristics and diverting the flow away from the natural channels. The intermittent drainages affected by the South Main Overburden Piles would be re-established after reclamation, and the drainages and overland flow affected by the North and South-South Overburden Piles would be permanently diverted. The permanent diversions would route surface flow around the overburden piles and are not expected to affect sediment loads to downstream channels and waterbodies.

Impacts to stream channels from the Proposed Action would generally be minor, local, and short-term. Exceptions to this generalization include the channel diversions associated with the North and South-South Overburden Piles. Diversion of the channels around these facilities would be minor, local, and long-term.

Impacts to Stream and Spring Flows

Changes in surface runoff and groundwater flow that would result from the Proposed Action carry the potential to impact stream flows, spring flows, and water availability for wetlands.

Angus Creek and Associated Wetlands and Springs

Direct impacts to stream flow in Angus Creek would be primarily related to reduced runoff reaching the creek during mining operations. Runoff areas in the Angus Creek-Blackfoot River sub-watershed would be temporarily reduced by a maximum of 4.14 percent during mining under the Proposed Action (**Table 4.3-9**). The Proposed Action would also result in reduced surface water flow to the wetland adjacent to Angus Creek. Reduced runoff to the wetland springs could temporarily decrease the size of some wetland areas. These impacts would be minor to moderate in extent and limited to the projected life of proposed mining activities of 4.8 years.

Dewatering of the pit to facilitate mining below the regional water table would not impact flows in Angus Creek or the associated wetlands. Groundwater pumped from the pit would primarily originate from the Wells Regional Aquifer, the water level of which is approximately 100 feet lower than the lowest elevation of Angus Creek, the point where it joins Blackfoot River. The numerical simulation of pit dewatering by ARCADIS (2015g) indicates that pumping to facilitate mining below the regional water table would not decrease the streamflow in Angus Creek.

Baseline monitoring data indicate that Angus Creek is a losing stream over its length during most flow conditions. However, numerical modeling by ARCADIS (2015g) suggests that Angus Creek gains about 0.01 cubic foot per second (cfs; Table 6 in ARCADIS 2015g) in the segment immediately above its confluence with Blackfoot River (AC Reach 2, **Figure 3.3–4**). Both the modeled gain and the range of measured losses (0.02 to 0.42 cfs) are small and are considered to be within the accuracy of field measurements performed for the baseline surface water monitoring program. It is also noted that the gain-loss measurement on Angus Creek and the

groundwater model do not account for flow in the hyporheic zone. The hyporheic zone is the region below and beside the streambed where there is mixing of shallow groundwater flow and surface water flow. As a result, AC Reach 2 is interpreted as a relatively neutral reach under the base flow conditions with complex interaction with groundwater in the hyporheic zone rather than having dominantly losing characteristics.

Impacts to stream flow in Angus Creek and water availability in the adjacent wetlands during mining would be temporary, localized, and minor. After reclamation, surface water flow to the wetland would be fully restored, and long-term impacts to stream flows and water availability in the wetlands after final reclamation would be negligible.

Blackfoot River, Lanes Creek, and Associated Springs

The Proposed Action would have negligible impact to the total runoff area reporting to Blackfoot River below the Study Area (less than 1 percent reduction), and potential reductions in runoff would not measurably affect stream flows.

Numerical modeling indicates that the Proposed Action would result in negligible impacts to shallow groundwater flow to Blackfoot River during mining and after reclamation of the mine facilities (ARCADIS 2015g). As indicated in Table 6 of the Groundwater Monitoring Report (ARCADIS 2015g), model predicted shallow groundwater fluxes to Blackfoot River vary between 0.008 cfs and 0.145 cfs and indicate that the majority of the shallow groundwater flow would be concentrated in the valley at the junction with Angus Creek within the BFR Reach 3 (**Figure 4.3-12**).

Dewatering for mining would not measurably affect stream flows in Blackfoot River, and no impacts are predicted to Lanes Creek above the Blackfoot River headwater. However, as indicated on **Figure 4.3-11,** some temporary stream flow depletions to Springs Creek may occur as a result of dewatering during the first 7 to 8 months of mining operations. Numerical modeling indicates that flows from springs along the banks of Blackfoot River (SW-Spring3, SW-Spring5, SW-Spring6 SW-Spring7 and SW-Spring14) and in Upper Valley (SW-Spring1, SW-Spring4, and SW-Spring10) (Figure 4.3-12) would not be measurably affected by mining, dewatering, or reclamation under the Proposed Action.

Impacts to Surface Water Quality

The Proposed Action carries the potential to impact water quality in Blackfoot River, Angus Creek, and springs and wetlands in the Study Area. Potential impacts to water quality include increases in suspended sediment and turbidity, and increase of concentrations of the COPCs listed in **Table 4.3-1**.

Temporary impacts to water quality from increased sediment yield could occur from disturbances related to construction of haul roads and other mine facilities. BMPs, including sediment fences, straw bales, or geotextiles, would be used to mitigate sediment and turbidity in runoff during construction. The South Main Overburden Pile and South-South Overburden Pile would be constructed within the footprint of the wetland complex in Assessment Area (AA) 2, and sedimentation impacts during the construction phase for these facilities would be minimized by implementing BMPs.

Impacts to water quality from sedimentation during mining would be controlled by diversion structures, runoff retention/sediment catchments basins, slope stabilization, and other BMPs described in **Section 2.3.5**. The Proposed Action is expected to result in negligible sedimentation impacts to Angus Creek and Blackfoot River because runoff from disturbed areas would be

captured in sediment basins and BMPs would be used to control sediment and turbidity as required.

After mining, the overburden piles and backfilled pit would be capped and reclaimed. All disturbance areas would be graded to a stable slope and vegetated to prevent erosion. Once reclamation is complete, sediment loads and turbidity in runoff from the previously disturbed areas would be similar to the pre-mining condition, thus no long-term impacts from sedimentation would occur from the Proposed Action. The cover systems over the reclaimed pit backfill and the North and South-South Overburden Piles would prevent contact of runoff with overburden, preventing COPC loading to streams and wetlands by this mechanism.

COPCs loading to surface water could occur when seepage from the North, South Main, and South-South Overburden Piles enters surface water via migration in shallow groundwater southwest toward the confluence of Angus Creek and Blackfoot River.

Angus Creek

Baseline monitoring data indicate that Angus Creek is a losing stream over its length during most flow conditions. However, numerical modeling by ARCADIS (2015g) suggests that Angus Creek gains approximately 0.01 cfs in Reach 2 above its confluence with Blackfoot River (**Figure 3.3–4**). Both the modeled gain and the measured losses are relatively small and are considered to be within the accuracy of baseline monitoring. As a result, AC Reach 2 is interpreted as a relatively neutral reach under base flow conditions with complex interaction with groundwater in the hyporheic zone. The following COPC loading analysis for Angus Creek assumes the modeled gain from shallow groundwater in Reach 2 of the stream under base flow conditions. Reach 1 is conceptualized as a losing stream segment consistent with baseline surface water monitoring data (Whetstone 2015b), thus chemical loading of Reach 1 by the migration of COPCs in shallow groundwater from the Proposed Action is not predicted.

Predicted chemical loadings and concentrations of COPCs in Angus Creek Reach 2 are presented in **Table 4.3-11**. The peak and average groundwater concentrations (e.g., long-term average concentrations over the modeling period of 700 years) represent modeled concentrations in groundwater directly prior to mixing with surface water of Angus Creek. Simulated concentrations of COPCs in the discharging groundwater generally peak during the first 35 years and then decrease rapidly to a steadily declining long-term concentration. The presented peak mass loading rates to Angus Creek are based on the maximum of the average annual discharging COPC concentrations and would occur for only a short period of time. Increases in instream concentrations are based on peak chemical loadings and represent the estimated COPC concentration increase in Angus Creek after mixing of discharging groundwater with the surface water under both low flow and high flow conditions.

Stream flow measurements from surface water station SW-AC1 collected during baseline monitoring performed from 2010 through 2014 were used to calculate representative stream flows for Angus Creek. Data from year 2011 were excluded because of anomalously high stream flow conditions during this year. The average of measured stream flow values during the months of August through October were used to calculate representative low flow conditions, while data from the months of April through July were used to calculate representative high flow conditions. A measurement of 0.004 cfs, recorded in August 2014, was identified as an outlier (being 2 orders of magnitude lower than the next lowest measurement) and was therefore excluded from the calculations. The resulting average stream flow in Angus Creek is 0.7 cfs under low flow and 8.0 cfs under high flow conditions.

Applicable surface water quality standards, as well as baseline statistics calculated for surface water quality stations at Angus Creek between 2010 and 2013 (BC 2015b), are also provided in **Table 4.3-11**.

Table 4.3-11 Predicted COPC Loadings and Concentrations in Angus Creek AC Reach 2

Constituent		Predicted Peak GW Concentration (mg/L)	Predicted Long-term GW Concentration (mg/L)	Predicted Peak Loading Rate (lbs/yr)	Predicted Peak In-stream Increase Concentration (mg/L)	Applicable Surface Water Standard (mg/L)	Surface Water Baseline Concentration [1] (mg/L)
Aluminum	Low Flow	0.001	0.0004	0.01	<0.0001	N/A	<0.03
	High Flow				<0.0001		0.12
Antimony	Low Flow	0.0001	0	0	0	0.0056	<0.0004
	High Flow				0		<0.0004
Cadmium	Low Flow	*0.0004*	*0.0002*	0.01	<0.0001	0.0006	<0.0001
	High Flow				<0.0001		<0.0001
Copper	Low Flow	0	0	0	0	0.011	0.003
	High Flow				0		0.007
Iron	Low Flow	0.001	0.0003	0.01	<0.0001	N/A	<0.02
	High Flow				<0.0001		0.15
Manganese	Low Flow	0.033	0.0077	0.52	0.0004	N/A	0.1
	High Flow				<0.0001		0.088
Nickel	Low Flow	*0.018*	0.0031	0.28	0.0002	0.052	<0.01
	High Flow				<0.0001		<0.01
Selenium	Low Flow	***0.035***	*0.004*	0.55	0.0004	0.005	0.001
	High Flow				<0.0001		0.003
Sulfate	Low Flow	20.54	7.68	326.07	0.23	N/A	46
	High Flow				0.02		37
TDS	Low Flow	34.47	13.47	547.12	0.39	N/A	272
	High Flow				0.03		217
Thallium	Low Flow	0	0	0	0	0.00024	<0.0001
	High Flow				0		<0.0001
Uranium	Low Flow	0.0004	0.0001	0.01	<0.0001	N/A	0.001
	High Flow				<0.0001		0.001
Zinc	Low Flow	*0.033*	0.0058	0.53	0.0004	0.12	0.018

Notes:
1 Surface Water Baseline Concentration calculated by BC (2015b)
Standard for Human Health based on consumption of water and organisms for antimony and thallium
CCC standard for cadmium, nickel, selenium, and zinc
Value in bold represents groundwater concentration prior to mixing in exceedance of applicable surface water quality standard
Value in italics represents groundwater concentration prior to mixing greater than surface water baseline statistics
N/A means no standard exists

The groundwater model indicates that selenium concentrations in groundwater flow that would report to AC Reach 2 would likely exceed the cold water aquatic life CCC chronic standard of 0.005 mg/L, starting in year 15, and attain a peak predicted concentration of about 0.035 mg/L about 35 years after the start of mining. Selenium concentrations in groundwater flow to the AC Reach 2 are projected to decrease rapidly after the peak but remain elevated above 0.005 mg/L for an additional 43 years. Long-term concentrations in groundwater reporting to AC Reach 2 are predicted to meet applicable surface water standards.

Figure 4.3-7 shows the modeled maximum selenium plume extent at the water table for the Proposed Action. The peak selenium groundwater concentration is reached at year 35 with highest concentrations predicted at the confluence of Angus Creek with Blackfoot River. While the modeled groundwater plume extends nearly to the stream at AC Reach 1, the modeling results indicate that the plume does not enter the stream and no COPC loading is predicted for AC Reach 1.

Baseline selenium concentrations in the Upper Blackfoot River Watershed tend to correlate positively with the streamflow (e.g., high concentrations typically observed with high stream flows; Mebane et al. 2015). This trend was also observed during baseline monitoring performed on Angus Creek between 2010 and 2014. Baseline selenium concentrations, as measured during this period at SW-AC1, SW-AC2, and SW-AC-3, averaged 0.001mg/L during low flow conditions and 0.003 mg/L during high flow conditions (BC 2015b). Predicted peak chemical loading of 0.55 lbs/yr would result in increase of selenium concentrations in AC Reach 2 by 0.0004 mg/L during low flow conditions (**Table 4.3-11**). No increase in selenium concentrations in streams is predicted under high flow conditions. Concentrations for all other COPCs in groundwater that would flow to AC Reach 2 are predicted to meet applicable surface water standards.

Predicted peak and long-term groundwater concentrations at AC Reach 2 are generally below the surface water baseline concentrations with the exception of peak groundwater concentrations for nickel and zinc and both peak and long-term groundwater concentrations for cadmium and selenium. Increases in instream concentrations at AC Reach 2 predicted for manganese, nickel, selenium, sulfate, TDS, and zinc would represent up to a 40-percent increase (for selenium) under low flow conditions and a 0.01-percent increase (for TDS) under high flow conditions, respectively.

Due to predicted moderate increases of in-stream COPC concentrations and projected 78-year exceedance of CCC for selenium in shallow groundwater prior to entering the creek, potential impacts to water quality of Angus Creek under the Proposed Action would be considered moderate and long-term.

Blackfoot River

Based on the site conceptual model, there would be no contribution from the regional or intermediate groundwater system to surface water in Blackfoot River (Whetstone 2015c). Modeling results indicate that there would be a shallow groundwater flow contribution from the alluvial and underlying basalt systems that would be concentrated primarily in the valley at the junction with Angus Creek within the BFR Reach 3 (**Figure 4.3-12**). As depicted on **Figure 4.3-12**, no shallow groundwater path is predicted from the pit to the Blackfoot River. The source of COPC loading to Blackfoot River would be the seepage from the South Main Overburden Pile and South-South Overburden Pile. The model predicts no COPC loading to BFR Reach 1 and BFR Reach 2.

Predicted chemical loadings and concentrations of COPCs in BFR Reach 3 are presented in **Table 4.3-12**. The peak and average groundwater concentrations represent modeled concentrations in groundwater directly prior to mixing with surface water of Blackfoot River. Concentrations of COPCs in groundwater flow generally peak during the first 35 years and then decrease rapidly to a steadily declining long-term concentration. The presented peak mass loading rates to BFR Reach 3 are based on the maximum of the average annual discharging COPC concentrations and would occur for only a short period. The mass loading analysis assumes the modeled gain from shallow groundwater in BFR Reach 3 of the stream under base flow conditions. Calculated increases in instream concentrations are based on peak chemical loadings and represent the estimated COPC concentration increases in Blackfoot River after mixing with the surface water of Blackfoot River under both low flow and high flow conditions.

Table 4.3-12 Predicted COPC Loadings and Concentrations in Blackfoot River BFR Reach 3

Constituent		Predicted Peak GW Concentration (mg/L)	Predicted Average GW Concentration (mg/L)	Predicted Peak Loading Rate (lbs/yr)	Predicted Peak In-stream Increase Concentration (mg/L)	Applicable Surface Water Standard (mg/L)	Surface Water Baseline Concentration[1] (mg/L)
Aluminum	Low Flow	*0.006*	*0.0003*	0.19	<0.0001	N/A	<0.03
	High Flow				<0.0001		0.083
Antimony	Low Flow	*0.0006*	0	0.02	<0.0001	0.0056	<0.0004
	High Flow				<0.0001		<0.0004
Cadmium	Low Flow	***0.0025***	0.0001	0.09	<0.0001	0.0006	<0.0001
	High Flow				<0.0001		<0.0001
Copper	Low Flow	0.0002	0	0.01	<0.0001	0.011	0.001
	High Flow				<0.0001		0.002
Iron	Low Flow	0.005	0.0003	0.16	<0.0001	N/A	<0.02
	High Flow				<0.0001		0.057
Manganese	Low Flow	*0.221*	0.0068	7.68	0.0001	N/A	0.017
	High Flow				<0.0001		0.036
Nickel	Low Flow	***0.12***	0.0028	4.13	0.0001	0.052	<0.01
	High Flow				<0.0001		<0.01
Selenium	Low Flow	***0.235***	***0.0037***	7.96	0.0001	0.005	0.001
	High Flow				<0.0001		0.005
Sulfate	Low Flow	*137.88*	6.65	4781.48	0.06	N/A	12
	High Flow				0.01		8.7
TDS	Low Flow	*231.34*	11.70	8023.50	0.11	N/A	214
	High Flow				0.02		194
Thallium	Low Flow	*0.0002*	0	0.01	<0.0001	0.00024	<0.0001
	High Flow				<0.0001		<0.0001
Uranium	Low Flow	*0.0026*	0.0001	0.09	<0.0001	N/A	0.001
	High Flow				<0.0001		0.0004
Zinc	Low Flow	***0.223***	0.0051	7.63	0.0001	0.12	0.008
	High Flow				<0.0001		0.017

Notes:
1 Surface Water Baseline Concentration calculated by BC (2015b)
Standard for Human Health based on consumption of water and organisms for antimony and thalium
CCC standard for cadmium, nickel, selenium and zinc
Value in bold represents groundwater concentration prior to mixing in exceedance of applicable surface water quality standard
Value in italics represents groundwater concentration prior to mixing greater than surface water baseline statistics
N/A means no standard exists

To estimate representative stream flows in Blackfoot River, baseline monitoring data from surface water station SW-BF1, collected between 2010 and 2014, were used. Data from year 2011 were excluded because of anomalously high stream flow conditions during that year. The average of measured stream flow values during the months of August through October were used to calculate representative low flow conditions. As a result of the large absence of measurements (resulting from the inability to collect flow data because of dangerously high flow conditions) during the months of April and May, the average of three highest values was used to estimate representative high flow conditions in the Blackfoot River. The resulting representative stream flow in Blackfoot River is 37 cfs under low flow conditions and 211 cfs under high flow conditions.

Applicable surface water quality standards, as well as baseline statistics calculated for surface water quality stations between 2010 and 2013 (BC 2015b), are provided in **Table 4.3-12** for comparison.

Results from the groundwater model indicate that selenium concentrations in groundwater flow to the BFR Reach 3 would likely exceed the cold water aquatic life CCC standard of 0.005 mg/L, starting in year 23. Peak selenium concentrations and loading to the river would occur approximately 38 years after the start of mining. Selenium concentrations in groundwater flow to the BFR Reach 3 would decrease rapidly after the peak but would remain elevated above 0.005 mg/L for the modeled period of 700 years (**Figure 4.3-15**).

As discussed in **Section 3.3.1.2.2**, selenium concentrations in Blackfoot River are cyclic and generally exceed the CCC of 0.005 mg/L for a short period of time in the spring during the peak flow period. Selenium concentrations in the river are typically below 0.005 mg/L during the remainder of the year. Mixing calculations for peak selenium concentrations in groundwater entering the Blackfoot River indicate that the Proposed Action would increase selenium concentrations in BFR Reach 3 by 0.0001 mg/L during low flow conditions. No increase in selenium concentrations is predicted under high flow conditions.

BFR Reach 3 is a segment of Blackfoot River listed as a 303(d) impaired stream for selenium from the confluence of Lanes and Diamond Creeks to Blackfoot Reservoir (**Figure 3.3–5**; Idaho Department of Environmental Quality [IDEQ] 2005a, 2014b). The model predicted that increases of selenium in-stream concentrations in BFR Reach 3 are approximately the same as the method detection limit (MDL) of 0.0001 mg/L, which represents the quantifiability threshold for selenium. Because of uncertainty related to the magnitude of the predicted concentration, the impact of additional selenium loading to the 303(d) stream segment would likely not be measurable.

Peak groundwater concentrations of cadmium, nickel, and zinc prior to mixing would also exceed their applicable surface water quality standards; however, long-term groundwater concentrations would be lower than the applicable surface water quality standards. Concentrations for the other COPCs in groundwater that would flow to BFR Reach 3 would meet applicable surface water standards.

Peak groundwater concentrations would be higher than the surface water baseline concentrations for all COPCs with the exception of iron and copper. However, long-term groundwater concentrations would be higher than surface water baseline concentrations for aluminum and selenium only. Modeled instream increases are predicted for manganese, selenium, nickel, sulfate, TDS, and zinc.

Due to the low predicted increases of in-stream COPC concentrations and projected long-term exceedances of CCC for selenium in shallow groundwater prior to entering the river, potential impacts to water quality of Blackfoot River under the Proposed Action would be considered minor and long-term.

4.3.1.2 Rasmussen Collaborative Alternative

Selection of the RCA would result in several changes to the mine facilities that would reduce impacts to water resources compared to those associated with the Proposed Action. Under the RCA, the pit would be reconfigured to eliminate mining below the regional water table, thus reducing the amount of pit water to be handled. The RCA would eliminate the proposed external North, South Main, and South-South Overburden Piles, which would be the primary sources of COPC loading to shallow groundwater and surface water under the Proposed Action. The RCA

would also result in placement of the majority of overburden from mining Phases 1 and 2 and a portion of the overburden from Phases 3 and 4 in P4's South Rasmussen Mine pit as backfill. Reconfiguration of the Rasmussen Valley pit; elimination of the external North, South Main, and South-South Overburden Piles; and placement of overburden in the South Rasmussen Mine pit would result in a different material balance in backfill and overfill in the RCA mine pit compared to the Proposed Action (**Table 4.1-1**).

Finally, the RCA would result in construction of a cover system, designated Cover C, over the backfill and overfill that has higher runoff and transpiration rates resulting in a lower net deep percolation compared to the Proposed Action cover.

Cover C would consist of three layers as described in **Chapter 2**. Cover C would be an evapotranspiration (ET) cover and would limit percolation into the backfill by shedding water to runoff, evaporation from the surface, and storing water within the various layers that would be removed by plant uptake (transpiration). Conceptual hydrologic models for mine facilities included in the RCA are discussed in the following sections. Because of the elimination of mining below the water table, the elimination of the overburden piles downslope of the mine pit the effects of the RCA to water resources would be much less than those associated with the Proposed Action. The overall effects of the RCA to water resources would be long-term and negligible.

4.3.1.2.1 Conceptual Hydrologic Models for Mine Facilities

Open Pit and Backfill

Under the RCA, the open pit and backfill, including the three permanent external overburden overfill areas, would be approximately 2.4 miles long with a footprint of 213.2 acres (**Figure 2.5-3**). The ore would be mined in nine phases over the course of 4.8 years, with the project, including initial infrastructure and reclamation requiring 7.1 years. The pit excavation would progress from north to south, starting adjacent to P4's partially backfilled South Rasmussen Mine West Limb Pit and terminating approximately 100 feet north of Blackfoot River (**Figure 2.3-4**). The bottom of the pit would slope generally to the south with a minimum elevation of about 6,340 feet amsl near the southern end. The RCA is designed with a shallower pit depth on the southern end compared to the Proposed Action to avoid mining below the water table in the Wells Regional Aquifer, thus avoiding encountering more groundwater in the pit than can be effectively managed within the pit area.

Backfilling of the Rasmussen Valley pit under the RCA would start when Phase 1 is complete, concurrent with mining of Phase 2 Three external overfill areas (North, Central, and South Overfill) would be constructed on the east side (upslope) of the excavation contiguous with the backfill. A total of about 36.9 MLCY of material would be placed as backfill and overfill including basalt (0.9 percent), alluvium (4.8 percent), Cherty Shale (5.7 percent), Rex Chert (18.9 percent), Meade Peak (44.3 percent), Grandeur Tongue (15.3 percent), and Wells Formation (10.0 percent). The backfilled pit and overfill areas would be configured to resemble the pre-mining topography and capped with Store-and-Release Cover C (which would consist of 1 foot of pit GM over 2 feet of external alluvium and GM above 3 feet of pit alluvium). The final reclaimed surface would be re-vegetated and contoured to have a maximum slope of 3H:1V. A small portion (13.2 acres) of the northeast pit wall would remain exposed after final reclamation. Reclamation of the completely backfilled pit and overfill would be completed 7.1 years after the start of construction.

Precipitation falling on the capped backfill and overfill would either run off, evaporate, or infiltrate and be transpired by vegetation, stored in the soil pore space, or continue percolating downward into the underlying backfill and overburden. The backfill would also receive runoff from a 394-acre undisturbed area northeast and uphill of the pit. Runoff from this upslope area would be allowed to enter the pit during mining, but Agrium would have the option to intercept and divert

the flow before it enters the pit (**Figure 2.3-5**). Runoff from upslope areas that contacts unreclaimed backfill and runoff from precipitation onto unreclaimed backfill would be captured in interceptor ditches on the downslope side of the backfill and be routed to the pit sump. The interceptor ditches would be located within the footprint of the pit to minimize infiltration into the alluvial aquifer.

The final reclamation surface of the backfill would be graded to re-establish drainage patterns that are similar to the pre-mining topography of the site. The proposed Store-and-Release Cover C is designed to limit the amount of meteoric water that would percolate through the overburden and prevent root uptake of selenium in cover vegetation. Based on the infiltration modeling results presented in **Section 4.3.1.1.2**, Cover C design would result in higher runoff characteristics compared to cover design under the Proposed Action. Runoff from the reclaimed backfill and overfill areas would have chemical characteristics similar to those of runoff from reclaimed backfill and overfill areas of the Proposed Action and would be managed in the same way using BMPs to mitigate suspended sediment during construction and reclamation.

Meteoric water that percolates through the cover and overburden would leach metals and other constituents into Wells Regional Aquifer, where they would be transported to the northwest in groundwater. The depth to the regional groundwater table from the bottom of the backfilled pit would range from 0 to approximately 60 feet depending on location. A conceptual diagram illustrating the release of solutes from the pit backfill is shown on **Figure 4.3-18**.

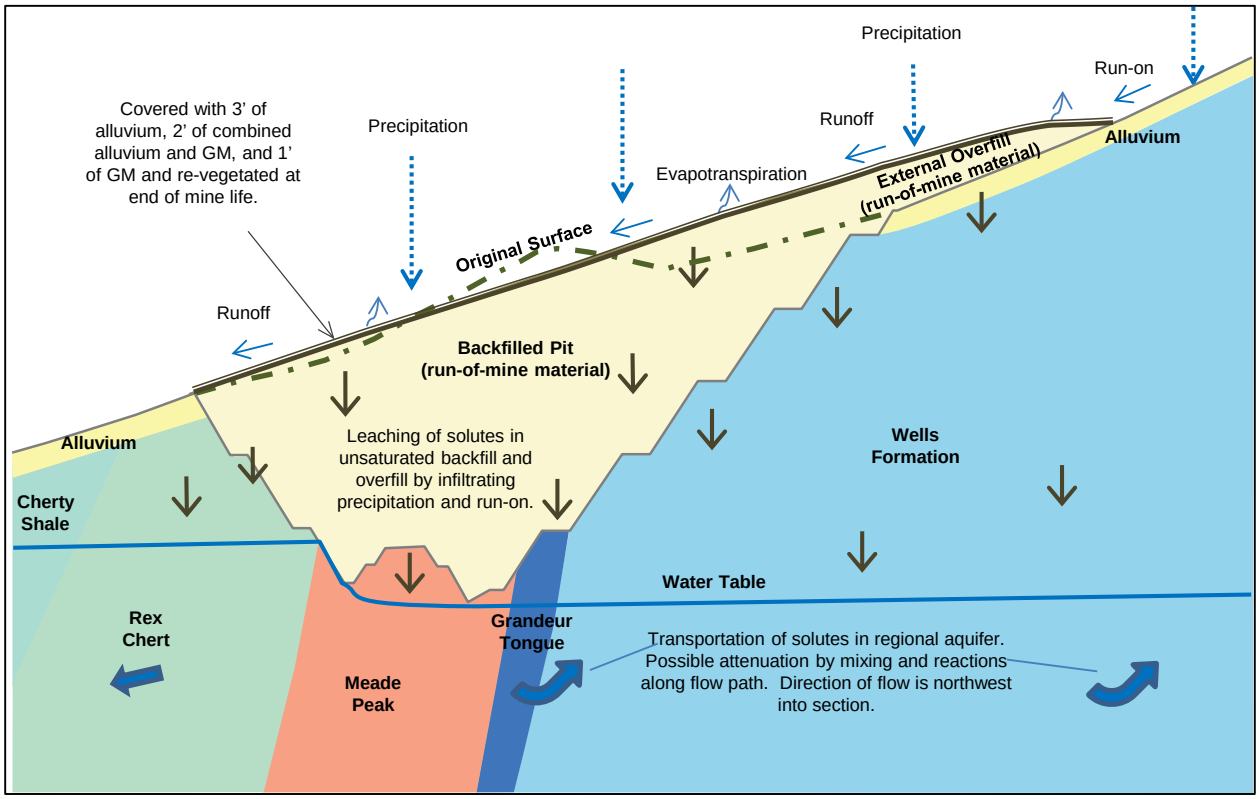


Figure 4.3-18 Conceptual Diagram Showing Runoff, Infiltration, and Solute Transport for Pit Backfill for the RCA after Reclamation

South Rasmussen Pit Backfill

Selection of the RCA would result in the placement of 7.61 MLCY of overburden as backfill in the

existing South Rasmussen Pit. Currently, the pit is partially backfilled with limestone that has a footprint of about 23.6 acres. Overburden from Rasmussen Valley would be added atop the existing backfill and would consist of alluvium (8.0 percent), Cherty Shale (4.1 percent), Rex Chert (16.0 percent), Meade Peak (45.9 percent), Grandeur Tongue (8.8 percent), and Wells Formation (17.1 percent) from mining Phase 1 and portions of Phases 2, 3, and 4. The backfill would be capped in accordance with the currently approved South Rasmussen Mine Reclamation Plan (P4 2014) and graded to slope west to route runoff to the footwall where it would infiltrate to groundwater through the Wells Formation. The footprint of the final reclaimed backfill would be about 58.8 acres. The depth to the regional water table below the bottom of the South Rasmussen Pit is approximately 330 feet (ARCADIS 2015h).

Precipitation falling on the capped backfill would either run off, evaporate, or infiltrate. The infiltration would then either be transpired by vegetation, stored in the soil pore space, or continue percolating downward into the underlying backfill. Meteoric water that percolates through the cover and overburden would leach metals and other constituents into the Wells Regional Aquifer, where they would be transported west in the groundwater toward the Enoch Valley Fault. A conceptual diagram illustrating the movement of water and release of solutes from the pit backfill is shown on **Figure 4.3-19**.

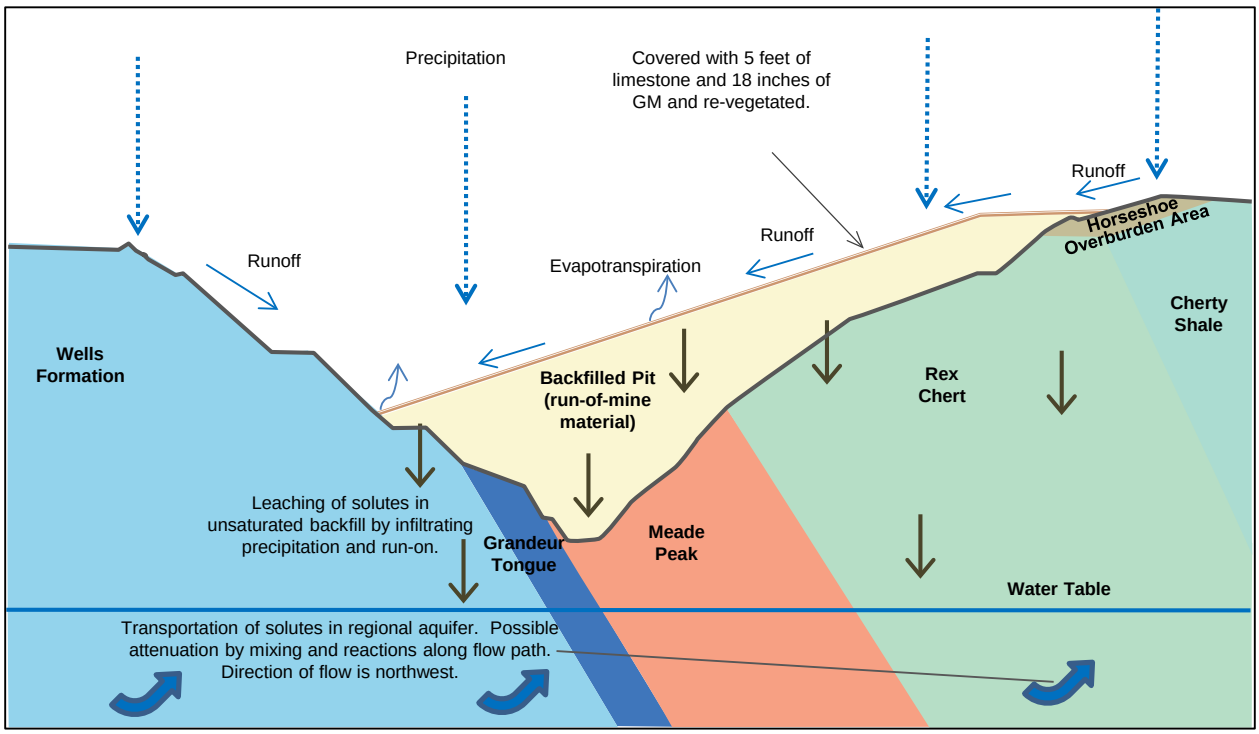


Figure 4.3-19 Conceptual Diagram Showing Runoff, Infiltration, and Solute Transport for South Rasmussen Mine Main Pit Backfill for the RCA after Reclamation

External Overburden Disposal Facilities and Stockpiles

Central and South Temporary Overburden Piles

The Central and South Temporary Overburden Piles would be located on pit backfill, with a portion of the piles extending upslope of the pit outside of the pit footprint (**Figure 2.5-3**). The internal temporary piles would replace the external permanent and temporary overburden piles for the Proposed Action, and would contain about 4.3 MLCY (7.3 million tons) of material at their largest

extent compared to 0.56 MLCY (0.85 million tons) for the internal overburden piles for the Proposed Action. The materials that would be placed in the temporary piles would include non-Meade-Peak-containing and Meade Peak-containing material. The approximate combined material balance of the North and Central Temporary Overburden Piles under the RCA would include alluvium (3.2 percent), Cherty Shale (0.6 percent), Rex Chert (3.2 percent), hanging wall mud (1.7 percent), center waste (12.1 percent), upper and lower ore partings (3.6 percent), footwall mud (1.2 percent), Grandeur Tongue (7.9 percent), and Wells Formation (6.3 percent). The Central Temporary Overburden Piles would be constructed during Phase 5 and the South during Phase 7. The piles would be re-handled into backfill in their entirety during Phases 8 and 9. The maximum duration that the piles would be present is approximately 38 months.

Meteoric water that percolates into the temporary overburden piles would leach metals and other constituents from the underlying backfill. Because of the limited time during which the piles would be in place and their locations (primarily over backfill), the temporary piles are expected to result in COPC loads to groundwater negligibly above those that would occur from the backfill. A conceptual diagram showing the impacts from the North and Central Temporary Overburden Piles is shown on **Figure 4.3-20**.

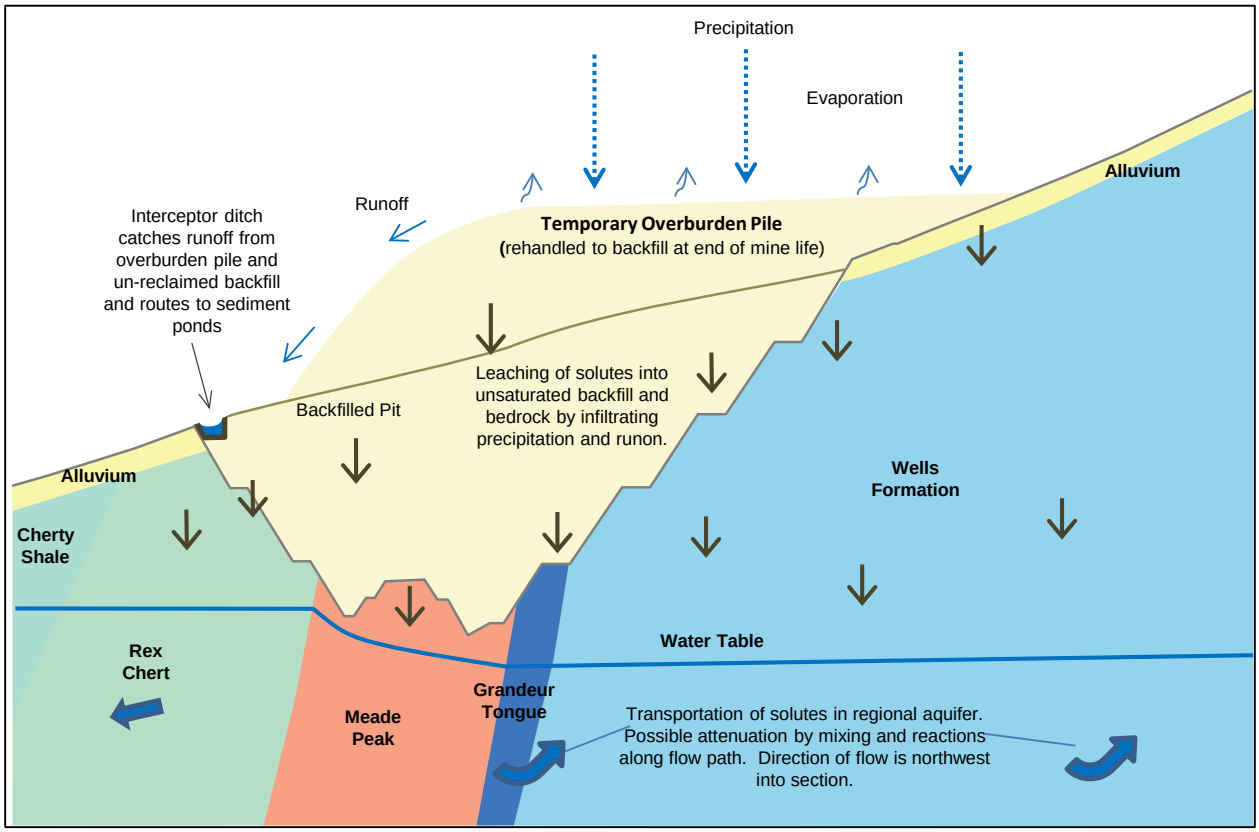


Figure 4.3-20 Conceptual Diagram Showing Runoff, Infiltration, and Solute Transport from the Central and South Temporary Overburden Piles of the RCA during Mining

Growth Medium Stockpiles

The RCA would result in the construction of four stockpiles and borrow areas for both GM and alluvium rather than three stockpiles that would be used only to store GM under the Proposed Action. The stockpile/borrow areas would be located along the haul road on the southwest side

of the pit and would include the North-North, North Main, Central, and South Main GM Stockpiles (**Figure 2.5-3**). The stockpile/borrow areas would result in a combined maximum disturbance of 84.8 acres. Construction of the North-North and North Main GM Stockpile/borrow areas would start during Phase 1. The Central GM Stockpile would be constructed during Phase 4, followed by the South Main GM Stockpile during Phase 5. The stockpile/borrow areas would vary in size and volume over time as disturbance areas expand and material is added or removed for concurrent reclamation.

Material would be removed from the piles and borrow area for reclamation activities as necessary throughout the life of proposed mining activities. Any GM material remaining in stockpiles after the reclamation is complete would be distributed along haul roads or other areas that may require in-filling. Approximately 2.05 MBCY of GM and alluvium would be required for reclamation of mine facilities. Precipitation that falls onto the GM Stockpiles would run off, evaporate, infiltrate, and be stored in the soil pore space, or infiltrate and continue percolating downward below the cap. GM would exhibit leaching characteristics similar to those of undisturbed soils, and runoff and seepage from the piles would meet applicable water quality standards (with the exception of TSS, which would be mitigated by the use of BMPs such as sediment fences, straw wattles, and retention basins). The conceptual hydrologic model for the GM and alluvium stockpiles under the RCA is similar to that for the Proposed Action (**Figure 4.3-8**).

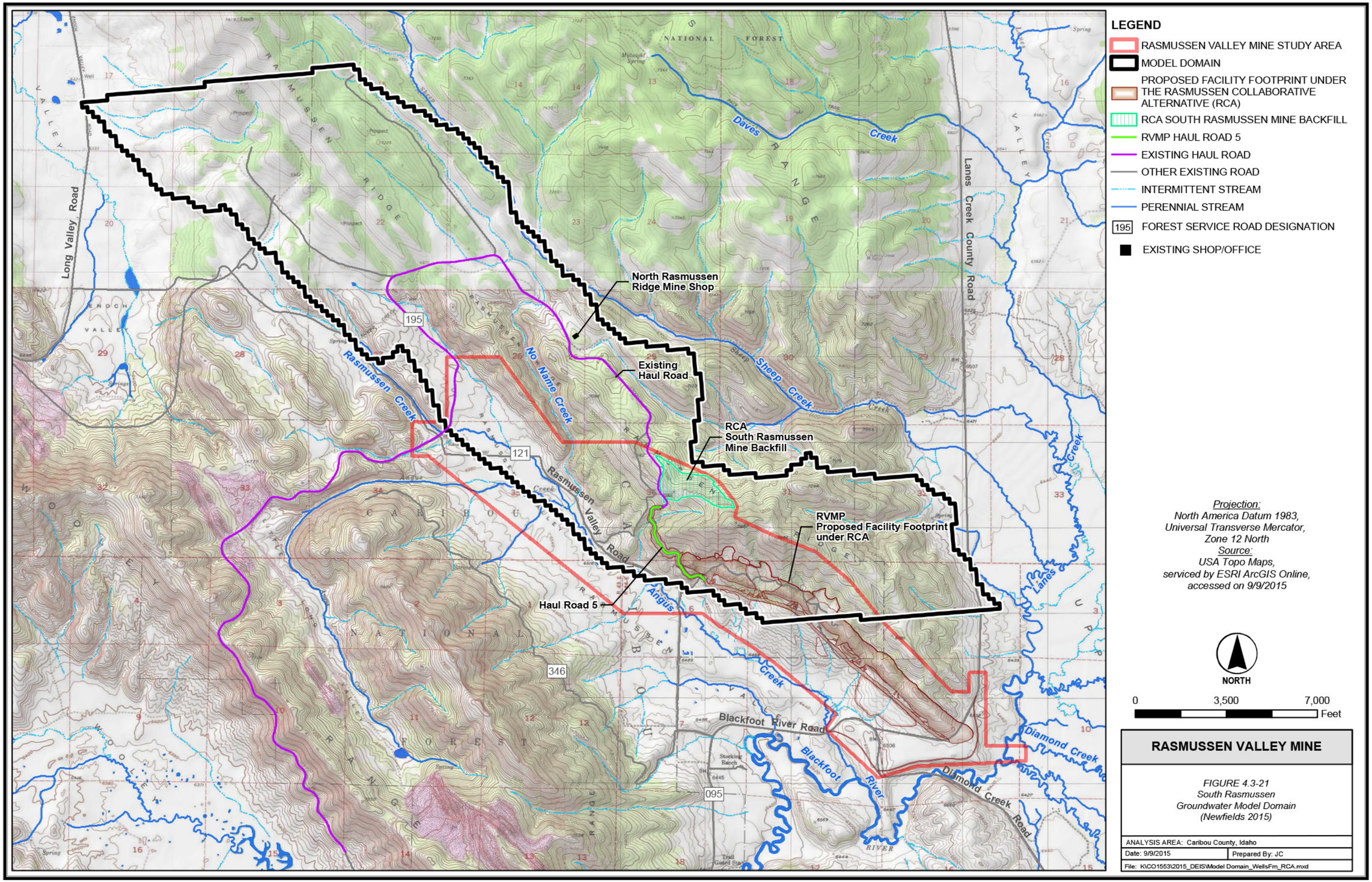
Seepage Chemistry and Constituents of Potential Concern

The chemistry of seepage from the backfilled Rasmussen Valley pit was evaluated with column leaching tests using the methods described for the Proposed Action (**Section 4.3.1.1.1**). The South Rasmussen pit was modeled by NewFields (2015) as part of proposed modifications to the South Rasmussen Mine Reclamation Plan (P4 2014). Seepage chemistry for the South Rasmussen pit was evaluated using SPLP tests.

4.3.1.2.2 Groundwater Flow and Solute Transport Modeling

Potential impacts to water resources from the RCA were evaluated using two separate groundwater models. Potential impacts from the RCA open pit and backfill were evaluated using the numerical groundwater contaminant fate-and-transport model discussed in **Section 4.3.1.1.2**. A second model prepared by NewFields (2015) (South Rasmussen Groundwater Model) was used to evaluate impacts from backfill that would be placed into the partially backfilled South Rasmussen Mine open pit.

The South Rasmussen Groundwater Model prepared using MODFLOW-SURFACT (HydroGeologic 2011) covers an area of approximately 8.8 square miles (**Figure 4.3-21**). The model extends 29,000 feet southeast along the axis of the Snowdrift Anticline and overlaps a portion of the Rasmussen Valley Mine Study Area. It is bound by the Enoch Valley Fault to the southwest. The southwest-northeast extent of the model is approximately 7,500 feet, with the boundaries set parallel to bedding. The model is restricted to the Wells Regional Aquifer and has 27 layers that extend vertically from the top of the regional aquifer to an elevation of 5,000 feet amsl. Hydrologically important faults and zones of increased fracturing are simulated according to the conceptual hydrogeologic model developed by AMEC (2010). Zones of higher hydraulic conductivity were assigned to the Enoch Valley Fault and hinge of the Snowdrift Anticline to simulate their function as conduits for groundwater flow. The Rasmussen Fault is represented as a leaky barrier to groundwater flow between the south Rasmussen and Rasmussen Valley Mines. Flow enters the model in the Wells Regional Aquifer at the southeastern edge and exits northwest.


LEGEND
RASMUSSEN VALLEY MINE STUDY AREA
MODEL DOMAIN
PROPOSED FACILITY FOOTPRINT UNDER THE RASMUSSEN COLLABORATIVE ALTERNATIVE (RCA)
RCA SOUTH RASMUSSEN MINE BACKFILL
RVMP HAUL ROAD 5
EXISTING HAUL ROAD
OTHER EXISTING ROAD
INTERMITTENT STREAM
PERENNIAL STREAM
195 FOREST SERVICE ROAD DESIGNATION
EXISTING SHOP/OFFICE
North Rasmussen Ridge Mine Shop
Existing Haul Road
RCA South Rasmussen Mine Backfill
RVMP Proposed Facility Footprint under RCA
Haul Road 5
Rasmussen Creek
No Name Creek
Sheep Creek
Daves Creek
Angus Creek
Blackfoot River
Diamond Creek
Lanes Creek
Long Valley Road
Rasmussen Valley Road
Blackfoot River Road
Diamond Creek Road
Lanes Creek County Road
Rasmussen Ridge
Daves Range
Caribou National Forest
Enoch Valley
Long Valley
Projection:
North America Datum 1983,
Universal Transverse Mercator,
Zone 12 North
Source:
USA Topo Maps,
serviced by ESRI ArcGIS Online,
accessed on 9/9/2015
NORTH
0
3,500
7,000
Feet
RASMUSSEN VALLEY MINE
FIGURE 4.3-21
South Rasmussen
Groundwater Model Domain
(Newfields 2015)
ANALYSIS AREA: Caribou County, Idaho
Date: 9/9/2015
Prepared By: JC
File: K:\CO1553\2015_DEIS\Model Domain_WellsFm_RCA.mxd

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The average regional gradient across the model domain is approximately 0.0008 ft/ft, consistent with water level data developed for the South Rasmussen Mine (AMEC 2010). An average recharge value of 2.64 inches is assigned across the model domain. This recharge is equal to 11 percent of the average precipitation estimated for the South Rasmussen Mine (AMEC Geomatrix 2008/2009).

Modeled values for hydraulic conductivity, storage, and porosity are variably distributed according to the conceptual model for the South Rasmussen Mine site (AMEC 2010). The ranges of assigned parameters are consistent with site-specific testing and regional hydrologic data with hydraulic conductivity values of 0.0011 to 15 feet/day and a porosity of 1.0 percent.

The groundwater model was prepared in two steps including an initial steady-state simulation calibrated to the existing groundwater elevation data for the South Rasmussen Mine and a predictive simulation that evaluates the transport of selenium and manganese in the Wells Regional Aquifer under the RCA. A more complete discussion of the groundwater model is presented in the RCA groundwater modeling memorandum prepared by NewFields (2015).

4.3.1.2.3 Chemical Loading, Transport, and Attenuation in Groundwater and Surface Water

Chemical loading to groundwater would occur when COPCs from overburden are leached by precipitation that has percolated below the cover root zone to become seepage. Seepage concentrations and timing for the backfilled Rasmussen Valley Pit were calculated using the same methods described for the Proposed Action (**Section 4.3.1.1.1**). Source term concentrations for the RCA were calculated by mathematically mixing the leachate concentrations from the monolithologic columns to represent the seepage released from the modeled facilities (Whetstone 2015c). A monolithologic column was not prepared for the Wells Formation because it was planned to represent less than 5 percent by weight of total material waste under the Proposed Action. However, the Wells Formation would represent more than 5 percent of the pit backfill under the RCA (10.2 percent). Leaching characteristics of the Wells Formation were evaluated using SPLP data and leachates from the Grandeur Tongue column (GTD-U1). NewFields (2015) calculated the source term concentrations for the backfilled South Rasmussen Pit by mathematically mixing SPLP leachate concentrations from testing performed by P4 for the South Rasmussen Mine on materials from that mine area (NewFields 2015). The results of the South Rasmussen Mine SPLP testing were weighted in proportion to the mass of each overburden type that would be produced from Rasmussen Valley Mine under the RCA. Because SPLP is a single-contact testing method, seepage quantity for the South Rasmussen pit was modeled using a single loading term for each constituent. Selenium and manganese were the only two constituents considered in the contaminant transport model prepared by NewFields (2015)

The simulated pore volume time for the RCA backfill is presented in **Table 4.3-13**. The South Rasmussen pit was not modeled using a pore volume approach; therefore, pore volume times were not calculated. Modeled concentrations for COPCs in seepage from backfill are presented in **Table 4.3-14**.

Table 4.3-13 Pore Volume Times for Modeled Source Terms for the RCA

Mine Facility	Percolation Rate (in/yr)	Facility Footprint (Acres)	Seepage Rate (ft^3/day)	Material Volume (lcy)	Pore Volume Time (years)
Pit Backfill and External Overfill	0.14	220.9	307	41,128,000	1,483.5

Table 4.3-14 Modeled Seepage Source Concentrations (mg/L) for the RCA

	PV-1	PV-2	PV-3	PV-4	PV-5	PV-6	PV-7
RCA Pit Backfill							
Sulfate	1,495	1,048	888	851	866	845	864
Total Dissolved Solids	2,499	1,763	1,472	1,440	1,441	1,372	1,392
Total Aluminum	0.084	0.044	0.044	0.042	0.047	0.054	0.047
Total Antimony	0.0123	0.0086	0.0075	0.0087	0.0069	0.0067	0.0059
Total Cadmium	0.0279	0.0243	0.0235	0.0220	0.0237	0.0277	0.0239
Total Copper	0.002	0.001	0.001	0.001	0.001	0.002	0.002
Total Iron	0.078	0.027	0.026	0.022	0.027	0.027	0.026
Total Manganese	2.11	1.45	1.30	1.17	1.10	1.08	1.13
Total Nickel	1.56	0.89	0.70	0.66	0.66	0.71	0.73
Dissolved Selenium	3.972	1.298	0.430	0.174	0.123	0.101	0.086
Total Thallium	0.0022	0.0010	0.0008	0.0008	0.0008	0.0008	0.0006
Total Uranium	0.0248	0.0121	0.0120	0.0119	0.0124	0.0131	0.0109
Total Zinc	2.827	1.336	1.155	1.347	1.329	1.434	1.418
South Rasmussen Mine Pit Backfill							
Manganese	0.1563						
Selenium	0.4805						

4.3.1.2.4 Impacts to Groundwater Resources

Installation of the Store-and-Release Cover C over the backfill Rasmussen Valley Pit as part of the RCA would reduce seepage to the Wells Regional Aquifer compared to the Proposed Action. Because the RCA eliminates mining below the regional water table, no dewatering activities would be required to lower the water table during mining operations. Therefore, no drawdown impacts would occur to the Wells Regional Aquifer or surrounding surface waters.

The RCA would also eliminate the proposed North, South Main, and South-South External Overburden Piles, which are the predicted sources of COPC loading to shallow and intermediate groundwater and connected surface waters under the Propose Action. As a result, no impacts to water levels and water quality in shallow groundwater systems or connected surface waters under the RCA are predicted.

The impacts described in the following sections do not incorporate the existing baseline chemistry of groundwater, which is variable and currently exceeds applicable groundwater standards for some parameters at some locations. Therefore, the concentrations discussed for the Proposed Action in the following text and figures would need to be added to existing groundwater concentrations to calculate concentrations expected if the groundwater were sampled or withdrawn at any given point.

Impacts to Groundwater Quality in the Wells Regional Aquifer

The RCA would result in reduced loading of COPCs to groundwater compared to the Proposed Action due to the implementation of Cover C and changes in backfill material ratios (percentages). Modeling results predict that contaminant plumes of selenium and other COCPs would still originate beneath the backfilled pit soon after commencement of mining. However, only selenium would migrate northwest in the Wells Regional Aquifer toward the intersection of the Rasmussen and Enoch Valley Faults at concentrations higher than the applicable water quality standard. Simulated groundwater plumes for selenium in the Wells Regional Aquifer under the RCA are shown on **Figure 4.3-22**. Peak and long-term concentrations at model observation points are summarized in **Table 4.3-15**.

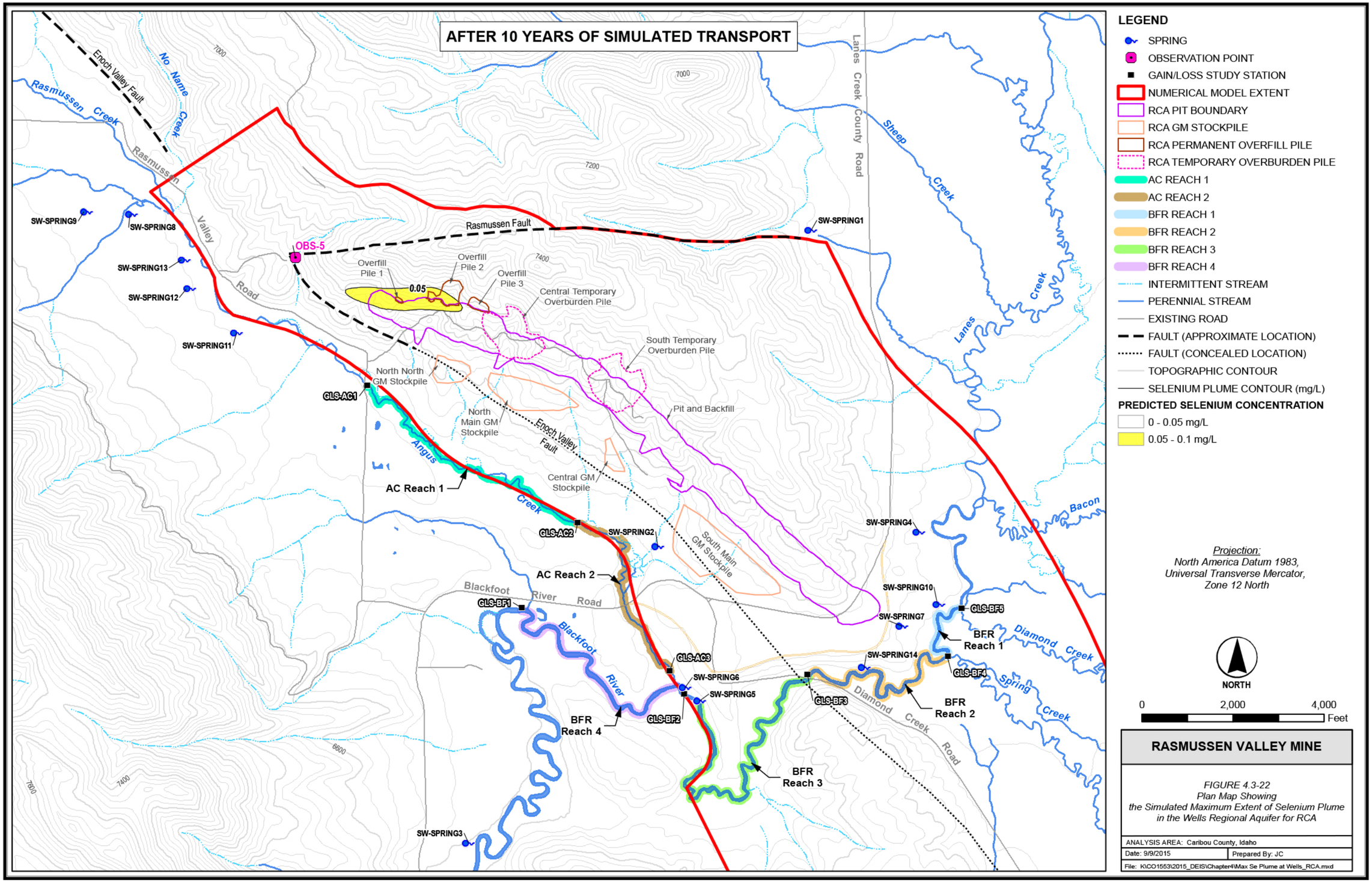
AFTER 10 YEARS OF SIMULATED TRANSPORT
LEGEND
SPRING
OBSERVATION POINT
GAIN/LOSS STUDY STATION
NUMERICAL MODEL EXTENT
RCA PIT BOUNDARY
RCA GM STOCKPILE
RCA PERMANENT OVERFILL PILE
RCA TEMPORARY OVERBURDEN PILE
AC REACH 1
AC REACH 2
BFR REACH 1
BFR REACH 2
BFR REACH 3
BFR REACH 4
INTERMITTENT STREAM
PERENNIAL STREAM
EXISTING ROAD
FAULT (APPROXIMATE LOCATION)
FAULT (CONCEALED LOCATION)
TOPOGRAPHIC CONTOUR
SELENIUM PLUME CONTOUR (mg/L)
PREDICTED SELENIUM CONCENTRATION
0 - 0.05 mg/L
0.05 - 0.1 mg/L
Projection:
North America Datum 1983,
Universal Transverse Mercator,
Zone 12 North
NORTH
0
2,000
4,000
Feet
RASMUSSEN VALLEY MINE
FIGURE 4.3-22
Plan Map Showing
the Simulated Maximum Extent of Selenium Plume
in the Wells Regional Aquifer for RCA
ANALYSIS AREA: Caribou County, Idaho
Date: 9/9/2015
Prepared By: JC
File: K:\CO1553\2015_DEIS\Chapter4\Max Se Plume at Wells_RCA.mxd
Enoch Valley Fault
Rasmussen Fault
Rasmussen Creek
No Name Creek
Rasmussen Valley Road
Lanes Creek County Road
Sheep Creek
Lanes Creek
Angus Creek
Blackfoot River
Blackfoot River Road
Diamond Creek
Diamond Creek Road
Spring Creek
Bacon
OBS-5
0.05
Overfill Pile 1
Overfill Pile 2
Overfill Pile 3
Central Temporary Overburden Pile
South Temporary Overburden Pile
Pit and Backfill
North North GM Stockpile
North Main GM Stockpile
Central GM Stockpile
South Main GM Stockpile
AC Reach 1
AC Reach 2
BFR Reach 1
BFR Reach 2
BFR Reach 3
BFR Reach 4
SW-SPRING1
SW-SPRING2
SW-SPRING3
SW-SPRING4
SW-SPRING5
SW-SPRING6
SW-SPRING7
SW-SPRING8
SW-SPRING9
SW-SPRING10
SW-SPRING11
SW-SPRING12
SW-SPRING13
SW-SPRING14
GLS-AC1
GLS-AC2
GLS-AC3
GLS-BF1
GLS-BF2
GLS-BF3
GLS-BF4
GLS-BF5
7000
7200
7400
6800
7600

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Table 4.3-15 Predicted Peak / Long-term Concentrations in the Wells Regional Aquifer for the RCA at Model Observation Point OBS-5

Constituent	Peak Concentration (mg/L)	Long-Term Concentration (mg/L)	Groundwater Standard (mg/L)
Aluminum	0.0006	0.0006	0.2
Antimony	0.00009	0.00009	0.006
Cadmium	0.0002	0.0002	0.005
Copper	0.00001	0.00001	1.3
Iron	0.0006	0.0006	0.3
Manganese	0.015	0.015	0.05
Nickel	0.011	0.011	N/A
Selenium	0.029	0.029	0.05
Sulfate	10.94	10.94	250
TDS	18.29	18.29	500
Thallium	0.00002	0.00002	0.002
Uranium	0.0002	0.0002	0.03014
Zinc	0.021	0.021	5

Notes:
Primary Idaho Groundwater Standard for antimony, cadmium, copper, selenium, and thallium
Secondary Idaho Groundwater Standard for aluminum, iron, manganese, sulfate, TDS, and zinc
Primary Federal Drinking Water Standard for uranium
N/A – Not Applicable

Overburden material placed in the existing South Rasmussen Pit under the RCA would also release COPCs to the Wells Regional Aquifer. The transport of selenium and manganese from the South Rasmussen Pit backfill was evaluated in a numerical groundwater model prepared by NewFields (2015). In general, the model indicated that impacts to water quality in the Wells Regional Aquifer would be similar to the predicted impacts for the currently approved reclamation plan for the facility (P4 2014). The backfill would cover a larger area within the planned South Rasmussen Mine open pit where pre-RCA backfill was not planned to be placed, thus impacting groundwater over a larger area and extending the time for predicted impacts as a result of the additional backfill pore volume available for leaching. Contaminant plumes with selenium and manganese concentrations higher than 0.05 mg/L are modeled to still be limited to a small downgradient area northwest of the South Rasmussen Pit.

4.3.1.2.5 Impacts to Surface Water Resources

The main differences between the Proposed Action and the RCA that would reduce the affect surface water resources include elimination of all external overburden piles downslope from the pit, mining below the water table, and eliminating the need for a haul road across the Rasmussen Valley floor. In addition, Store-and-Release Cover C, designed to decrease infiltration, would result in higher runoff that could have direct impacts to peak flows in streams and drainages in the analysis area under the RCA.

Watershed Area Disturbance

The larger mine pit footprint under the RCA would result in larger area in a hydrologically disturbed condition within the pit area. Eliminating the need for permanent external overburden storage downslope from the pit and using a smaller portion of these areas to salvage and store GM and alluvium would decrease the disturbance in these areas. Surface disturbance would also be decreased because of the shorter length of the HR-5 compared to the Rasmussen Valley Haul Road under the Proposed Action.

Existing and proposed hydrologic disturbances in the HUC 6 sub-watersheds that would be affected by the RCA are summarized in **Table 4.3-16** (USFS 2015; BLM 2015a).

Table 4.3-16 Existing and Proposed Hydrologic Disturbances on Forest Service Lands under the RCA

Sub-watershed	Existing Disturbance (% area)	Pit (% area)	External Stockpiles (% area)	Water Retention/ Sediment Basins (% area)	Roads (% area)	Fuel Storage Staging Area (% area)	Total New Disturbance (%)
Angus Creek-Blackfoot River	23.60	0.94	0.44	0.04	0.22	0.01	1.65
Lower Lanes Creek	16.98	0.00	0.00	0.00	0.00	0.00	0.00
Diamond Creek	3.30	0.00	0.00	0.00	0.00	0.00	0.00

Note:
Existing disturbances from USFS 2015; BLM 2015a

During mining operations, the RCA would increase hydrologic disturbance by 1.65 percent in the Angus Creek-Blackfoot River sub-watershed. The total new hydrologic disturbance would be 0.06 percent higher than that for the Proposed Action in the Angus Creek-Blackfoot River sub-watershed, and would be the same for Lower Lanes Creek and Diamond Creek sub-watersheds. Total hydrologically disturbed area in the sub-watersheds under the RCA would meet the USFS guidelines of less than 30 percent in all three sub-watersheds.

Impacts to Runoff Areas

Runoff volumes and peak flows reporting to Angus Creek and Blackfoot River would be affected under the RCA. Estimated reductions in runoff areas related to the RCA for each sub-watershed are presented in **Table 4.3-17**.

Table 4.3-17 Reduction in Runoff Areas under the RCA

Sub-watershed	Pit and upstream drainages (acres)	External GM Stockpiles (acres)	Haul Roads (acres)	Water Retention/ Sediment Basins (acres)	Subtotal (acres)	Percent of Watershed
Angus Creek-Blackfoot River	626.30	84.44	64.35	3.5	778.59	4.06
Lower Lanes Creek	7.85	0.00	0.00	0.00	7.85	0.03
Diamond Creek	0.00	0.00	0.00	0.00	0.00	0.00

During mining, the approximately 626 acres of runoff area would be removed from the Angus Creek-Blackfoot River sub-watershed; 37 acres greater than under the Proposed Action. The water from this area would be captured in the mine pit during operation. This area includes 14 drainage basins upslope of the pit, which would contribute surface runoff to the open pit during the life of proposed mining activities. There would be two more drainage areas (22 and 23) associated with the extended northern end of the pit for Phase 1 and Phase 2 under the RCA (**Figure 2.5-4**). Surface disturbance for the rest of the components would be decreased compared to the Proposed Action as a result of the shorter length of the HR-5 as well as fewer stockpiles associated with the RCA. Overall, the total runoff reduction area would represent about 4.06 percent of the Angus Creek-Blackfoot River sub-watershed. This reduction is 16 acres (or 2 percent) lower than under the Proposed Action.

The total runoff area that would be temporarily removed from the Angus Creek drainage under the RCA would be 722.0 acres (or 7.77 percent). While the disturbance associated with the pit would be larger, there would be smaller disturbance associated with haul roads and external stockpiles. Overall, there would be a 0.01-percent difference in total runoff area reduction between the Proposed Action and RCA, which is considered negligible.

The total disturbance area contributing to runoff reduction to the Blackfoot River would be about 786 acres under the RCA. This represents less than a 1-percent reduction in runoff reporting to Blackfoot River. The 8-acre difference in runoff area reduction for the Blackfoot River under the RCA and the Proposed Action would be negligible.

Impacts to Peak Flows

Based on the infiltration modeling results presented in **Section 4.3.1.1.2**, Cover C design would result in higher runoff characteristics (3.47 in/year) compared to the Proposed Action cover design (1.4 in/year). A potential volume of runoff was estimated using the approximate area of covered material (pit backfill and overburden piles, if applicable) and the runoff rates from the infiltration modeling. The covered areas are estimated to be 271.5 acres for the Proposed Action (Agrium 2011) and 221 acres for the RCA (Whetstone 2015c). The resulting runoff volumes are estimated to be 31.7 acre-feet for the Proposed Action and 63.9 acre-feet for the RCA. As a result, RCA cover design may result in increased peak flows during precipitation and snowmelt events compared to the Proposed Action.

Impacts to Channels

Direct impacts to channels under the RCA would be similar to those for the Proposed Action. During the construction and mining operations, sediment loading in downstream waterbodies would be controlled by implementing a surface water management plan and BMPs.

Construction of the pit under the RCA would disrupt channels and intercept runoff from two additional drainage basins located upslope from the pit. Flows in drainage basins 22 and 23 would be intercepted during mining Phases 1 and 2 (**Figure 2.5–4**). However, drainage runoff from above the pit would be re-established with their respective downstream drainages after mining.

While there would be up to four external GM stockpiles constructed within intermittent drainages downslope of the mine pit, these would all be reclaimed after the cessation of the mining activities, and there would be no permanent diversions from original stream channels under the RCA.

Impacts to Stream and Spring Flows

Angus Creek and Associated Wetlands and Springs

The RCA would result in reduced surface water flow reporting to Angus Creek and wetlands during the mining operations. Under the RCA, runoff areas in the Angus Creek-Blackfoot River watershed would be temporarily reduced by 4.06 percent compared to 4.14 percent under the Proposed Action. Reduced runoff area reporting to wetland in AA2 adjacent to Angus Creek would be the same as under the Proposed Action.

There would be no impacts from dewatering under the RCA because there would be no mining below the water table. Modeling predicted that shallow groundwater fluxes to Angus Creek would be the same as under the Proposed Action. However, the RCA cover design would result in increased runoff to Angus Creek compared to that under the Proposed Action.

Blackfoot River, Lanes Creek, and Associated Springs

Under the RCA, impacts to the total runoff area reporting to the Blackfoot River below the Study Area during mining operations would be the same as under the Proposed Action. The additional 8-acre reduction in runoff area under the RCA compared to the Proposed Action would have a negligible increased impact.

While there would be predicted dewatering-induced stream flow depletions in Spring Creek during Phase 1 mining under the Proposed Action, there would be no impacts from dewatering under the RCA because there would be no mining below the water table.

The RCA cover design over the reclaimed pit backfill and overfill would result in increased surface runoff entering the Blackfoot River compared to the Proposed Action. The shallow groundwater flow contribution to the Blackfoot River and springs after reclamation under both the Proposed Action and RCA would be negligible.

Impacts to Water Quality

The modeling predicts that there would be no impacts to surface water and shallow groundwater quality under the RCA. The source of the loading of COPCs via shallow groundwater migration under the Proposed Action is the seepage from the external overburden piles downslope from the pit. Eliminating all external overburden stockpiles southwest of the mine pit would eliminate the source of increased COPCs in shallow groundwater; hence, there would be no adverse impacts to surface water quality from COPC loading under the RCA. Based on the modeling results, all COPC concentrations in groundwater are several orders of magnitude lower than the quantifiable limit, and as such are predicted to meet applicable surface water standards for the RCA.

4.3.1.3 No Action Alternative

Implementation of the No Action Alternative would avoid water resource impacts described for the Proposed Action and RCA. Specifically, predicted impacts to hydrologically disturbed areas, runoff areas, groundwater flow to streams springs and wetlands, and surface and groundwater quality would not occur. Under the No Action Alternative, the federal phosphate leases would not be developed. However, this does not preclude future development of the federal phosphate leases under a different mine plan.

4.3.2 Irreversible and Irretrievable Commitment of Resources

Irreversible impacts to water resources from the Proposed Action would include changes in groundwater quality and recharge in the analysis area.

The loss of groundwater quantity during mine dewatering under the Proposed Action would last less than 1 year and would practically all be recovered through regional flow (as well as natural precipitation and infiltration during the life of proposed mining activities) and would not be irreversible or irretrievable. Because the RCA eliminates mining below the regional water table, no dewatering activities would be required to lower the water table during mining operation, and no irreversible or irretrievable water resource impacts would occur to the Wells Regional Aquifer. Final cover placement over the pit backfill and external stockpiles would decrease infiltration rates and thus slightly limit recharge after reclamation. Modeling results for the Proposed Action indicate that groundwater levels in the shallow and intermediate groundwater systems would decrease by approximately 1 to 5 feet and 0.5 to 1.0 foot, respectively. However, because the RCA eliminates all external overburden piles, no reduction in shallow and intermediate

groundwater levels would occur. Projected reduction in groundwater levels in the Wells Regional Aquifer would be negligible under both the Proposed Action and the RCA. Projected reduction in groundwater levels in the Wells Regional Aquifer would be negligible.

Irretrievable changes in groundwater quality under and downgradient of the overburden disposal areas would occur. An area of the Wells Regional Aquifer extending northwest from the Proposed Action has been modeled to have water quality impacts from seepage through the area of backfill. Peak concentrations of selenium and other COPCs within the affected areas of the aquifer are likely to exceed applicable groundwater quality standards under the Proposed Action. Impacts from seepage through backfill areas would be minimized under the RCA and would result in exceedance of only selenium concentrations within the Wells Regional Aquifer.

4.3.3 Unavoidable Residual Adverse Effects

Unavoidable adverse effects to water resources in the analysis area after mining ceases, and after any mitigation or final reclamation has occurred, would be mainly from water quality impacts. Under the Proposed Action, percolation of precipitation through pit backfill and external dumps would continue to affect water quality by releasing selenium and other COPCs into the environment. Under the Proposed Action, selenium concentrations in shallow groundwater entering Angus Creek and the Blackfoot River would exceed the surface water quality criteria of 0.005 mg/L for approximately 60 and 683 or more years after the end of mining, respectively. This represents a 40-percent and 10-percent increase in in-stream concentrations compared to baseline after mixing with surface water of Angus Creek and the Blackfoot River, respectively. However, because the RCA eliminates all external overburden stockpiles southwest of the Rasmussen Valley Mine pit, it would eliminate the source of COPCs in shallow groundwater, and unavoidable adverse impacts to Angus Creek and the Blackfoot River from COPC loading under the RCA would not occur.

4.3.4 Mitigation Measures

Agrium would design and implement BMPs to control erosion, sedimentation, and the release of COPCs from the project-related activities to protect groundwater and surface waters in and around the analysis area. In addition, Agrium would limit the surface area of Meade-Peak-containing material that would be exposed at any given time through direct backfilling and placing protective cap-and-cover material over any backfill. Additionally, surface water drainage diversion structures may be constructed prior to initiating each mining phase to intercept runoff before it reaches the pit, thereby avoiding runoff water contact with Meade Peak-containing material.

Surface water control structures would include several types of designs to reduce or eliminate risk of surface water contamination. Runoff retention basins for runoff water and sediments would be constructed at strategic locations before mining activities occur in that area to collect and contain water exposed to mining disturbances or overburden materials. Conveyance ditches constructed along the outer perimeters of the stockpile sites would transfer surface water runoff from these sites and carry it to runoff retention basins. Culverts would be constructed to convey water from natural drainages underneath linear obstructions, such as haul roads or county roads, to reduce the potential for impacts to sedimentation and stream channel stability. Stockpiles would be stabilized with vegetation, straw waddles, silt fences, and other BMPs as necessary to minimize erosion. These measures include diversion structures upslope of mine facilities, runoff conveyance ditches, and reclamation and covering of backfill and overfill concurrent with mining.

Protection of groundwater would include surface water control measures designed to limit surface

water exposure to COPC-containing material or keep COPC-containing surface water from infiltrating to groundwater. Cover C would be an ET cover that would limit percolation into the backfill by shedding water to runoff, evaporation from the surface, and storing water within the various layers that would be removed by plant uptake (transpiration).

Additionally, the conveyance ditch downslope of the pit backfill would be constructed within the footprint of the pit to limit infiltration from the ditch reaching the alluvial aquifer downslope.

A Spill Prevention Control and Countermeasure (SPCC) Plan would be developed prior to construction and operations, providing direction for preventing and controlling potential spills; describing the aboveground tanks and secondary containment structures for bulk petroleum products, solvents, and antifreeze; identifying the routine monitoring requirements; and describing BMPs for controlling releases of the pollutants of concern.

Agrium has prepared an Environmental Management Plan (EMP; **Appendix A**) identifying a groundwater and surface water monitoring network to monitor compliance with IDEQ water quality standards.

Project design features, BMPs, the SPCC Plan, and the EMP (including IDEQ Point of Compliance [POC] groundwater monitoring) are the project elements designed to reduce environmental impacts to water resources and are predicted to maintain compliance with IDEQ's regulations and approvals. Additional mitigation measures are not deemed necessary at this time.

4.4 SOILS

Issue: What are the potential impacts to soil resources?

Indicators:

- Acres of soil disturbance by soil type resulting from mining
- Estimated volumes of topsoil or other suitable material available for reclamation
- Acres not reclaimed at the conclusion of mining
- Compliance with the CNF RFP, BLM Pocatello Field Office (PFO) Approved Resource Management Plan (ARMP), and other applicable federal and state management plan direction

Issue: What is the potential for Proposed Action-related soil erosion and sediment delivery to impact surface water?

Indicators:

- Acres of soil disturbance creating areas of moderate to high erosion hazard

Issue: What is the impact on soil chemical and physical properties, specifically those related to selenium and other COPCs, and vegetative productivity?

Indicators:

- Estimated change in total selenium and other COPCs (in mg/kg), and change in soil depth between baseline conditions and final reclamation with GM

- Estimated changes in soil loss because of erosion
- Changes in soil chemical and physical properties affecting vegetative productivity

4.4.1 Direct and Indirect Impacts

Analysis of the Proposed Action and alternatives was limited to the Study Area, as defined for the Rasmussen Valley Mine.

4.4.1.1 Proposed Action

Direct impacts to soil resources include increased erosion; soil compaction; decreased soil productivity in disturbed areas; and potential contamination of soils from spills of chemicals during transport, storage, and use. Overall adverse impacts to soil resources from the Proposed Action construction activities (soil salvage and facility construction) are anticipated to be long-term and moderate. As described below, reclamation activities are expected to mitigate further impacts to soil resources but some impacts are still expected to occur.

Construction and operation activities, including salvage and stockpiling of topsoil, would directly impact soil resources. These activities would decrease soil productivity by directly impacting soil structures through direct removal of soil during salvage operations. Increasing bare ground distribution through stripping or other disturbances also decreases the ability of water to flow through soil, which decreases infiltration and increases runoff and soil loss (Jadczyszyn and Nidzwiecki 2005).

Soil compaction during these activities can also contribute to soil erosion and reduced soil productivity. Compaction can affect soil productivity by decreasing soil permeability, reducing water storage capacity, degradation of soil structures, damaging microbiotic crusts (if present) and other soil microorganisms, increasing bulk density, and increasing precipitation runoff and erosion potential. However, because soils would be salvaged prior to heavy or vehicle equipment operation, compaction-related impacts are expected to be negligible. Salvaged soils typically have a lower bulk density after placement during reclamation than prior to salvage, and bulk density tends to increase over time as a result of consolidation. No adverse impacts to soils related to compaction during reclamation are anticipated.

The Proposed Action would create approximately 440 acres of surface disturbance, of which about 422.5 acres would be reclaimed. The remaining 17.3 acres would consist of pit walls and permanently realigned county road. The remaining pit walls would have slopes so steep as to not be capable of holding a soil cover and thus would be impractical to reclaim. Soil productivity in areas of surface disturbance would be directly affected until reclamation and re-vegetation are achieved. The reduction in productivity of 440 acres would represent a long-term major impact to soils; however, these impacts are anticipated to decrease to minor or negligible as a result of reclamation. The approximately 17.3 acres of unreclaimed pit walls and realigned county roads would represent an additional, long-term impact to soils, but given that some rock outcrops void of soil exist before mining, the actual impact to soils would be less than 17.3 acres. Overall effects to soils under the Proposed Action would be long-term and moderate, but much of the impact would reduce over time with the success of reclamation.

Soils affected by the Proposed Action mostly have moderate to low erosion hazards. Disruption of vegetative cover and soil aggregates would potentially result in increased soil erosion and potential for sediment transport. Increased erosion and sediment transport off the disturbed areas would be a moderate, short-term impact. Overall erosion rates are expected to decrease as

portions of the Proposed Action are reclaimed and vegetation is established. Long-term effects on soil erosion rates would be minor. The potential for eroded soils to be transported downstream to Lanes and Angus Creeks is minimal as a result of the use of sediment retention basins and other erosion and sediment control BMPs (e.g., erosion mats, straw wattles, diversion ditches) (**Section 4.4.4**). Study Area soils are generally resistant to wind erosion; therefore, impacts to Study Area soils because of wind erosion are expected to be negligible.

4.4.1.1.1 Erosion Hazards

Table 4.4-1 summarizes disturbances by soil map unit and soil component. Because it is not known exactly which horizons would be exposed at a given time, **Table 4.4-1** provides the general erosion hazard for each of the major soil components. Under the Proposed Action, approximately 62 acres of surface disturbance would occur on soils with high erosion hazard (**Table 3.4-5**) and 126 acres on soils with moderate erosion hazard. Approximately 230 acres of disturbance would be to soils with low erosion hazard or are areas that consist of rock outcrops.

Table 4.4-1 Surface Disturbances by Soil Map Unit

Map Unit Symbol	Component Name	General Erosion Hazard	Disturbed Acres	
			Proposed Action	RCA
CFT	Chubbflat	M	18.0	0.1
	Turson	M	2.1	<0.1
	Inclusion-Enochville	M	0.4	<0.1
	Inclusion-Robana	H	0.4	<0.1
	Inclusion-Parkay	L	0.2	<0.1
DTL	Disturbed Land	NA	0.4	3.5
ENV	Enochville	M	1.4	<0.1
	Inclusion-Chubbflat	M	<0.1	<0.1
	Inclusion-Robana	H	<0.1	<0.1
	Inclusion-Turson	M	<0.1	<0.1
HAX	Hades	L	62.0	74.2
	Agassiz	L	28.2	33.7
	Rock Outcrop	NA	11.3	13.5
	Inclusion-loamy-skeletal soils	M	5.6	6.7
	Inclusion-moderately deep soils	L	5.6	6.7
HBP	Hagenbarth	M	50.7	32.4
	Parkay	M	25.4	16.2
	Inclusion-Robana	H	2.5	1.6
	Inclusion-Woolsted	H	2.5	1.6
	Inclusion-clayey soils	NA	2.5	1.6
	Inclusion-rock outcrop	NA	0.8	0.5
HPM	Hagenbarth	M	3.6	0.2
	Parkay	M	2.5	0.1
	Inclusion-clayey soils	NA	0.5	<0.1
	Inclusion-wet soils	M	0.5	<0.1
	Inclusion-Ponds	NA	0.1	<0.1
PCM	Parkcity	L	64.6	74.5
	Moonlight	L	13.8	16.0
	Inclusion-fine-loamy soils	M	4.6	5.3
	Inclusion-Parkay	L	3.7	4.3
	Inclusion-Hagenbarth	M	3.7	4.3
	Inclusion-rock outcrop	NA	1.8	2.1

Table 4.4-1 Surface Disturbances by Soil Map Unit

Map Unit Symbol	Component Name	General Erosion Hazard	Disturbed Acres	
			Proposed Action	RCA
RDX	Ireland	L	12.2	6.0
	Dipcreek	L	8.1	4.0
	Rock Outcrop	NA	4.1	2.0
	Inclusion-Xerorthents	L	1.4	0.7
	Inclusion-Deep soils	L	0.8	0.4
	Inclusion-Parkcity	L	0.5	0.3
RKO	Rock Outcrop	NA	0.4	<0.0
WSR	Woolsted	H	30.6	7.0
	Robana	H	24.9	5.6
	Inclusion-Hagenbarth	M	3.1	0.7
	Inclusion-Chubbflat	M	3.1	0.7

Notes:

NA = Not assessed because of lack of data (e.g., clayey soil inclusions) or general low erosion hazards (e.g., rock outcrops, ponds).

Groundwater monitoring access road not included in ARCADIS 2015e; other minor differences from acres presented in other sections may exist because of rounding and GIS data. Acreages based on component proportions in **Table 3.4-1**.

Sources: AECOM 2012, ARCADIS 2015e

4.4.1.1.2 Selenium and other Trace Elements

Given the natural oxidizing weathering processes that form and leach the existing Study Area soil profile slated for salvage, additional COPCs are not expected to be released from the same soils when placed for reclamation. This is illustrated for selenium by the analysis of Study Area soils (AECOM 2012) that found a maximum reported selenium value of 0.03 ppm. The use of salvaged soils for GM is not expected to cause adverse impacts on plant selenium concentrations or downstream water quality.

4.4.1.1.3 Reclamation Suitability and Quantity

Under the Proposed Action, areas disturbed by project activities would first be stripped of salvageable soils for future use as GM during reclamation. Under the Proposed Action, a total of approximately 0.93 million bank cubic yards (MBCY) of GM would be necessary to meet cover requirements for the pit and all other areas, including minimum GM depths of 24 inches for the pit and 12 inches for the external overburden piles, haul roads, and staging area as well as GM necessary to reclaim other features (ARCADIS 2015d). No soils from areas outside disturbed areas are proposed to be made available for use as GM.

As described in **Section 2.3.6.4**, all salvaged GM would be temporarily stored in stockpiles or directly placed. Because stockpiling reduces GM's re-vegetation viability over time as a result of reduced microbiological activity and nutrient cycling while stored, placement of GM as soon as practicable after salvage would reduce GM degradation. Because of the dynamic nature of reclamation and GM placement, the average time of GM storage in stockpiles cannot be determined. Erosion and transport of GM from stockpiles is expected to be negligible because storm water run-on would be diverted from GM stockpiles and runoff would be diverted through sediment control BMPs and a temporary sediment retention basin at the North GM Stockpile.

GM volume calculations were made assuming that dozers would push the soil into piles that are loaded onto trucks and hauled to concurrent reclamation areas for spreading or to storage (ARCADIS 2015e). Under this salvage scenario, equipment operators would first strip the upper

18 inches of material from all areas to maximize preservation of seedbed, organic microbes, and other beneficial components of the upper soil. Then, a second 18-inch layer of soil would be stripped and stockpiled. Depth to bedrock was factored into calculations. For each area of disturbance (e.g., pit, overburden piles), total acres of disturbance were converted to acres per soil component. Based on those acreages and depths of material presented in **Table 3.4-4**, the amounts of good, fair, and poor materials within each of the two stripping phases, as well as any remaining soils below the second phase, were calculated. Salvageable soil volumes were calculated for the map unit because they are expected to correspond to what the salvage operation would experience.

Calculations of available GM excluded certain soils because of soil properties that would inhibit salvage equipment operation. Soils with a combined total rock fragment content of greater than 50 percent were excluded (ARCADIS 2015e). For example, a soil with gravel content of 10 percent by weight, cobble content of 50 percent by weight, and stone content of 15 percent by weight would be classified as fair potential GM (ignoring all other criteria); however, in practice, this soil would be difficult to remove and would offer few beneficial reclamation properties. By excluding these types of soils, the first stripped layer would contain only soils classified as good (about 30 percent) or fair (about 70 percent) for use as GM. In addition, exclusion of rocky soils has the benefit of being a practicable exclusion during equipment operation (i.e., equipment operators should be able to effectively identify rocky soils during salvage).

Based on the criteria evaluated in ARCADIS (2015d, 2015e), approximately 2.08 MBCY of GM would be available for salvage under the Proposed Action, and approximately 1.57 MBCY would be salvaged in the first two lifts of stripping. Of the volume removed during the first two lifts of stripping, approximately 0.26 MBCY would be soils characterized as good for use as GM, 1.23 MBCY would be fair, and 0.08 MBCY would be poor. Calculations by ARCADIS (2015d) indicate that the Proposed Action cap and cover would require the use of approximately 0.55 MBCY of GM. A total of 0.69 MBCY are present within the pit, of which approximately 0.57 MBCY could be salvaged from the first two stripping lifts. Reclamation of other (non-cap and cover) areas would require approximately 0.40 MBCY of GM. Approximately 1.40 MBCY of GM would be available for that purpose, 1.00 MBCY of which could be salvaged from the first two stripping lifts. Any surplus GM beyond that required for minimum thickness of reclamation would either be placed to a thicker depth (other than cap-and-cover over backfill), or placed in GM stockpiles for later use. **Table 4.4-2** provides the estimated GM volumes required and available on-site under the Proposed Action.

Table 4.4-2 Estimated On-Site Growth Medium Volumes Required and Available under the Proposed Action

Description	Required (MBCY)	Available (MBCY)	Available in 1st Two Lifts (MBCY)
Cap and Cover	0.55		
Reclaim of other areas	0.40		
Total	0.95		
Pit		0.69	0.57
Other Areas		1.40	1.00
Total		2.08	1.57

Notes:
Volumes estimated by ARCADIS (2015d)
Abbreviations: MBCY = million bank cubic yard

For the Proposed Action, within the first two stripping phases, approximately 16 percent of soils available for salvage and use as GM are rated as good for use as GM, 78 percent are rated as

fair, and 5 percent as poor. Soils rated as good have no properties that are expected to limit their use as GM, whereas soils rated as fair have at least one property that somewhat limits their use. Soils rated as poor have at least one property that is limiting. Most fair soils that would be salvaged within the Study Area are somewhat limited by low (acidic) pH and low organic material content. Most soils available for reclamation that are rated as poor are limited by low organic material content or high clay content. Local soil conditions were incorporated into the selection of seed mixes proposed for reclamation; therefore, the need for soil amendments is not anticipated. The estimated volumes of available GM for the Proposed Action indicate that sufficient soils of adequate quality are present within the area to be disturbed to meet re-vegetation requirements established in the BLM ARMP and the CNF RFP.

4.4.1.2 Rasmussen Collaborative Alternative

The types of impacts to soils expected under the RCA would be the same as those described for the Proposed Action. The intensity of effects would be slightly different because of differences in the extents and locations of surface disturbances. The locations of surface disturbances and soil units affected under the RCA would be slightly different than those under the Proposed Action. Under the RCA, a total of approximately 400 acres of surface disturbance would occur, of which 381 acres would be reclaimed. Similar to the Proposed Action, 13.2 acres of pit walls and the 5.9 acres occupied by realigned county roads would be unreclaimed. Together, these unreclaimed areas would occupy approximately 19.1 acres under the RCA. Total disturbances are approximately 6 percent less than under the Proposed Action.

Under the RCA, approximately 25 acres of surface disturbance would occur on soils with high erosion hazard (**Table 3.4-5**) and 83 acres on soils with moderate erosion hazard. This represents a decrease compared to the Proposed Action, and the potential for erosion and transport of soils would also decrease. As for the Proposed Action, impacts from wind erosion are expected to be negligible for the RCA.

Because there would be less surface disturbance under the RCA, less GM would be available on site. Compared to the Proposed Action, less soil would be available for salvage and use as GM (1.62 MBCY), but reclamation would also require a smaller volume (0.63 MBCY). Overall percentages of available soils rated as good, fair, or poor for use as GM are similar to those with the Proposed Action but with slightly more soils rated as good or fair and less rated as poor. Fewer soils would be salvaged from low-lying areas (especially soil map units CFT and WSR), resulting in a decrease in total poor rated soils within the first two salvage lifts of approximately 0.06 MBCY.

A total of 0.68 MBCY of pit GM could be salvaged from the first two stripping lifts within the pit and overfill areas (ARCADIS 2015e). The RCA cap and cover would require the use of approximately 0.34 MBCY of pit GM (**Section 2.5.1.8.4**). Approximately 0.01 MBCY of pit GM is expected to be required for reclamation of the external borrow areas. The additional 0.33 MBCY of surplus pit GM would be available from the first two pit stripping lifts that would not be required for cap-and-cover construction or reclamation of external borrow areas (ARCADIS 2015e). Available quantities of pit GM required for cap-and-cover construction were estimated to be sufficient (BC 2015a).

A total of 1.34 MBCY of external combined GM/alluvium could be salvaged from the external borrow sites (ARCADIS 2015e). The RCA cap and cover would require the use of approximately 0.68 MBCY of external combined GM/alluvium. The material not required for the cap and cover would be left in place. Available quantities of external combined GM/alluvium required for cap-and-cover construction were estimated to be sufficient (BC 2015a).

A total of 3.17 MBCY of pit alluvium could be salvaged from the pit and overfill areas (ARCADIS 2015e). The RCA Cover would require the use of approximately 1.02 MBCY of pit alluvium. Available quantities of pit alluvium required for cap-and-cover construction were estimated to be sufficient (BC 2015a).

Reclamation of other (non-cap and cover) areas would require approximately 0.30 MBCY of GM. Approximately 0.48 MBCY of GM would be available for that purpose, 0.32 MBCY of which could be salvaged from the first two stripping lifts. Any surplus GM beyond that required for minimum thickness of reclamation would either be placed to a thicker depth (other than cap-and-cover over backfill), or placed in GM stockpiles for later use.

The estimated volumes of available GM for the RCA indicate that sufficient soils of adequate quality are present within the area to be disturbed to meet re-vegetation requirements in the PFO ARMP and the CNF RFP as shown in **Table 4.4-3**.

Table 4.4-3 Estimated On-Site Material Volumes Required and Available under the RCA

Description	GM Required (MBCY)	GM Available (MBCY)	GM Available in 1st Two Lifts (MBCY)	Pit Alluvium Required (MBCY)	Pit Alluvium Available (MBCY)	External Area Combined GM/Alluvium Required (MBCY)	External Area Combined GM/Alluvium Available (MBCY)
Cap and Cover	0.34[1]			1.02[1]		0.68[1]	
Reclaim of Other Areas[a]	0.30[b]						
Total	0.64			1.02		0.68	
Pit[b]		0.81	0.65		3.17		
External Borrow Areas		0.44	0.28				
Other Areas[a]		0.36	0.35				1.34
Total		1.61[2]	1.282		3.17[2]		1.34[2]

Notes:
a Other Areas includes all areas to be reclaimed outside of the cap and cover system.
b Pit includes pit footprint and overfill pile areas external to the pit footprint.
Source: 1= BC 2015a, 2=ARCADIS 2015e

Overall adverse effects to soils under the RCA would be less than under the Proposed Action and would be long-term and minor to moderate. As under the Proposed Action, much of the impact would reduce over time with the success of reclamation.

4.4.1.3 No Action Alternative

Under the No Action Alternative, existing soil resource trends within the Study Area would continue, and soil resources would remain in their natural condition. No direct or indirect impacts to soil resources would occur as a result of implementation of the No Action Alternative.

4.4.2 Irreversible and Irretrievable Commitment of Resources

Long-term loss of soils and irreversible commitments of soil resources would occur in portions of the analysis area where soil would not be replaced during reclamation (e.g., pit walls and steep slopes). The area of unreclaimed pit walls and county road realignments would be 17.3 acres for the Proposed Action and 19.1 acres for the RCA. Pit walls may eventually weather in place to form steep slopes capable of supporting soil development and vegetation. Restoration of soil characteristics, such as soil structures, infiltration, water-holding capacity, and vegetative

productivity, would gradually return through natural soil development processes over an extremely long period of time.

4.4.3 Unavoidable Residual Adverse Effects

Native soil conditions would be directly impacted during multiple phases of the Proposed Action or the RCA. Adverse impacts would include degradation of natural soil structures and microbiotic crusts (if present), microorganisms, and discontinuation of soil development. These residual effects would gradually lessen as natural soil development progresses following reclamation. Residual effects would occur in areas of pit walls where reclamation does not occur, natural soil development may take centuries, and where county roads are realigned and maintained. These residual effects are expected to affect approximately 17.3 acres for the Proposed Action and 19.1 acres for the RCA, but these values do not take into account that rock outcrops void of soil existed naturally within the pit footprint, and that these areas would be reclaimed and vegetated, thus helping mitigate the loss of soil areas on unreclaimed pit walls.

4.4.4 Mitigation Measures

Under the Proposed Action and the RCA, straw wattles, sediment fences, erosion matting, and other erosion control and sediment transport BMPs would be implemented to reduce, capture, and control soil movement (Agrium 2011). All slopes would be dragged, fertilized, and seeded on the contour as much as practical to reduce soil movement. Excess sediment transport by runoff would be contained by temporary sediment retention basins until vegetative controls are established. The EMP (**Appendix A**) outlines sampling and monitoring activities, including surface water and storm water monitoring, in further detail.

4.5 VEGETATION, RIPARIAN AREAS, AND WETLANDS

Issue: What is the potential for impacts to vegetative productivity?

Indicators:

- Changes in the local vegetation communities and relative success of reclamation including changes in cover percent and richness

Issue: What is the potential for impacts to vegetation patterns?

Indicators:

- Acres of disturbed area that are planned for reclamation, the types of vegetation that would be restored, and the number of years it would take for restoration to be completed and mature
- Potential for bioaccumulation of COPCs (including selenium) in the reclamation vegetation in excess of stated BLM Pocatello ARMP guidance or CNF RFP prescriptions for phosphate lease areas
- Acres of vegetation conversion from forest to non-forest cover and predicted re-establishment potential to return to forested condition over time
- Acres of snag habitat and old growth forest removed

Issue: What is the potential for the introduction or spread invasive, non-native, or noxious plant species?

Indicators:

- Acres of disturbed land potentially subjected to invasive plant species

Issue: What is the potential for construction and surface disturbance to impact WOUS including wetlands?

Indicators:

- Acres of direct impact to WOUS or change in function and value of wetlands disturbed by the mine and related facilities
- Change in water balance
- Changes in the concentrations of contaminants or sediments to WOUS, including wetlands

4.5.1 Direct and Indirect Impacts

4.5.1.1 Proposed Action

4.5.1.1.1 Vegetation

Over the life of proposed mining activities, the Proposed Action would remove about 399 acres of upland (non-wetland) vegetation and about 20.5 acres of wetland vegetation (which includes shrub/scrub wetland/seasonal mountain drainage [3 acres] and mesic emergent/ponded wetland [17 acres]). The vegetation types and associated acreages affected by the Proposed Action are summarized in **Table 4.5-1**.

Table 4.5-1 Vegetation Types and Estimated Affected Acreages under the Proposed Action

Vegetation Type	Acres*
Aspen Mature Dry Woodland	52
Aspen Mature	26
Aspen Old Growth	4
Aspen/Conifer Mix	0
Total Aspen	***83***
Big Sagebrush Rangeland	165
Silver Sagebrush Rangeland	34
Total Sagebrush*	***199***
High Elevation Rangeland	117
Shrub/Scrub Wetland/Seasonal Mountain Drainage	3
Mesic Emergent/Ponded Wetland	17
Total Acreage of Impacts to Vegetation	**419**
Reclaimed Acreage that would Recover to Big Sagebrush	**326**
Reclaimed Acreage that would Recover to High Elevation Rangeland	**89**
Total Reclaimed Vegetation Acreage	**415**

Notes:
* Acreages are rounded to nearest whole number
**Subcategories do not sum to totals in some cases due to rounding
***Approximately 4 acres of disturbed vegetation would remain unreclaimed as pit walls and portions of county road realignment

All vegetation would be removed within the vegetation types impacted by the Proposed Action. Reclamation would reseed these areas using the seed mixes shown in **Table 4.5-2**. The objectives addressed in the development of seed mixes are discussed in the following paragraphs. While vegetation would re-grow in these areas, the resulting species composition and community structure would be different than before disturbance; therefore, direct impacts to vegetation would be long-term.

Table 4.5-2 Proposed Reclamation Seed Mixes for Southwest and Northeast Slope Aspects

Southwest Aspects (drier sites)*	Pounds per Acre	Percentage of Seed Type	Northeast Aspects (moister sites)*	Pounds per Acre	Percentage of Seed Type
Grasses					
Bluebunch Wheatgrass (*Pseudoroegneria spicata*)	6.75	15	Mountain Brome (*Bromus marginatus*)	9.00	20
Western Wheatgrass (*Pascopyrum smithii*)	2.25	5	Bluejoint Grass (*Calamagrostis canadensis*)	6.75	15
Great Basin Wildrye (Leymus cinereus)	4.50	10	Redtop Bentgrass (*Agrostis stolonifera*)	2.25	5
Idaho Fescue (*Festuca idahoensis*)	4.50	10	Timothy (*Phleum pretense*)	2.25	5
Mountain Brome (*Bromus marginatus*)	6.75	15	Pine Reedgrass (*Calamagrostis rubescens*)	4.50	10
Big Bluegrass (*Poa secunda*)	4.50	10	Bluebunch Wheatgrass (*Pseudoroegneri a spicata*)	6.75	15
Green Needlegrass (*Nassella viridula*)	5.40	12	Slender Wheatgrass (*Elymus trachycaulus* ssp. *Trachycaulus*)	4.50	10
Slender Wheatgrass (*Elymus trachycaulus*)	4.50	10	June Grass (*Koeleria macrantha*)	4.50	10
Sterile Annual Rye (Quick Guard) (*Lolium multiflorum Lam.*)	2.25	5			
Forbs					
Western Yarrow (Achillea millefolium L. var. occidentalis)	0.90	2	Western Yarrow	0.90	2
Lewis Blue Flax (*Linum perenne var. lewisii*)	0.90	2	Lewis Blue Flax	0.90	2
Balsamroot (*Balsamorhiza sagittata*)	0.90	2	Mountain Snowberry (*Symphoricarpos*	0.90	2

Table 4.5-2 Proposed Reclamation Seed Mixes for Southwest and Northeast Slope Aspects

Southwest Aspects (drier sites)*	Pounds per Acre	Percentage of Seed Type	Northeast Aspects (moister sites)*	Pounds per Acre	Percentage of Seed Type
			oreophilus)		
Brush:					
Bitterbrush (*Purshia tridentata*)	0.90	2	Cinquefoil (*Potentilla*)	0.90	2
			Bitterbrush	0.90	2
Total	**45.0**	**100**	**Total**	**45.0**	**100**

Notes:

* The northeast aspect seed mix would be applied to reclaimed areas with aspects between 315 compass degrees clockwise to 135 compass degrees, and the southwest aspect seed mix would be applied to flat reclaimed areas as well as those with aspects between 135 compass degrees clockwise to 315 compass degrees.

Source: Agrium 2011

Approximately 99 percent (415 acres) of the disturbed vegetation would be reclaimed and re-vegetated. The remaining 1 percent (4 acres) would comprise bare pit walls remaining where pits are not backfilled crest-to-crest and unreclaimed realigned county roads. For the purposes of the Habitat Equivalency Analysis (HEA) and quantifying residual wildlife habitat service losses (habitat service lost after accounting for habitat service gained from reclamation), these areas were assumed to remain unvegetated into perpetuity (ARCADIS 2015a). Although the purpose of the HEA was to quantify wildlife habitat services lost and gained, because upland vegetation parameters were used to formulate the metric, the HEA is also useful for quantifying impacts and subsequent recovery of upland vegetation.

In order to determine the residual wildlife habitat service losses under the Proposed Action, the HEA required quantification of wildlife habitat services gained through reclamation. Published literature, data from other mines in the region, and the best professional judgement of ARCADIS and USFS botanists were used to develop recovery trajectories for reclaimed areas in terms of RICHCOVWET, which is the metric chosen to represent wildlife habitat services for the HEA using vegetation parameters including plant species richness, percent vegetation cover, and wetness. Change in the percent multi-layer cover (total percentage plant cover allowing for overlap of plants) and species richness (number of plant species) had to be predicted over time (recovery trajectories had to be developed for these parameters). The methodology and results for the development of recovery trajectories for reclaimed areas are presented in the Predictive Metrics Report (ARCADIS 2015a), and the results are summarized here. The HEA suggests that the percent multi-layer cover of the reclaimed area would reach 54 percent 9 years after reclamation and remain at 54 percent until 25 years after reclamation. In the long term, percent multi-layer cover of the areas reclaimed with the southwest aspects seed mix would return to the baseline multi-layer cover value for big sagebrush (127 percent). Over the long term, percent multi-layer cover of areas reclaimed with the northeast aspects seed mix would return to the baseline multi-layer cover value for high-elevation rangeland (149 percent). For the southwest aspects seed mix, plant species richness would start at 17 in the first year, drop to 16, and remain at that level for 110 years. For the northeast aspects seed mix, plant species richness would start at 14 in the first year and reach 23 by year 110.

Assumptions and literature used to develop the recovery trajectories are provided in ARCADIS (2014b).

According to the HEA, the Proposed Action would result in a total debit of approximately 7,258 discount service acre years (DSAYs) during mining and before reclamation. Reclamation would result in the long-term return of 3,979 DSAYs at the mine site, which equates to about 55 percent of the wildlife habitat services total debit under the Proposed Action. Therefore, under the Proposed Action, there would be a net debit of approximately 3,279 residual DSAYs of wildlife habitat services (ARCADIS 2015b). Without additional mitigation, this residual debit in wildlife habitat services would represent a long-term adverse impact of the Proposed Action on wildlife, and also on vegetation as measured by plant species richness, percent cover, and wetness.

Some plant species would be unlikely to re-establish in reclaimed areas because reclaimed areas would have different soil characteristics and would likely be drier than existing conditions. Aspen is a clonal species that primarily regenerates by sprouting from parent roots. These roots would be removed or destroyed in the mining process; therefore, without an existing root source, it would be unlikely to recover in areas where the soil had been removed (Schier et al. 1984). Therefore, the Proposed Action would result in the permanent loss of 83 acres of aspen, which includes 4 acres of old-growth aspen forest (3.6 acres on BLM land and 0.7 acre on private land). The 83 acres of aspen impacts includes 16 acres on BLM land, 2 acres on private land, 9 acres on state land, and 55 acres on USFS land.

This would also represent a permanent loss of 83 acres of snag producing forest habitat, which, through reclamation and succession, would be replaced with grassland and shrubland. The loss of these aspen stands would not adversely affect landscape-scale age class evenness of aspen forest because the stands that would be lost are all in old-mature age classes, which are over-represented on the landscape (ARCADIS 2014a).

The management of GM would be critical to the success of re-vegetation. All soil deemed suitable for a GM would be salvaged and stockpiled or placed directly on areas that are ready for reclamation (**Section 2.3.7.6**).

Appropriate BMPs to control invasive and noxious species would be implemented throughout the duration of the Proposed Action including pre-mining preparations and post-mining reclamation.

Some reclamation re-vegetation on historical southeastern Idaho phosphate mines have been found to accumulate selenium to levels detrimental to livestock foraging on the vegetation. Certain species, such as trees, legumes, and plants with deep roots and tap roots, are more susceptible to selenium accumulation (Mackowiak and Amacher 2003; Mackowiak et al. 2004; Zlatnik 1999; Ohlendorf 2003).

The Proposed Action cover would be designed to separate the re-vegetation roots from the selenium in the underlying Meade Peak-containing material, thus preventing the plant uptake of selenium exceeding the 5 mg/kg ARMP action level. All pit backfill would be covered with 3 feet of non-Meade-Peak-containing material, and then covered with no less than 2 feet of GM. This cover system is designed to ensure that selenium in reclamation vegetation would be below the action level of 5.0 mg/kg established in the ARMP, to limit the amount of meteoric water percolating through the cover, and to store moisture within the root zone for plants to transpire aiding in vegetation productivity. Given the moisture storage properties of the upper 2 feet of the Proposed Action store-and-release cover, it is expected that the large majority of the rooting mass for the selected species would be within the top 2 feet of the cover and above the underlying 3-foot layer of non-Meade-Peak-containing material.

The seed mixes have also been developed to avoid selenium accumulator or deep-rooted species. The seed mixes that would be used in the reclaimed areas do not contain any trees, legumes, or plants that would extend substantial root mass to depths below the cover. Seeds would be drilled or broadcast onto the area to be reclaimed. GM would be augmented with fertilizer based on soil analysis of the area. Seeding would typically take place during the fall, following preparation of the site.

There would be no uptake of selenium by vegetation that would exceed the 5 mg/kg ARMP action level for the Proposed Action reclaimed areas underlain by Meade Peak-containing material; thus, negligible impact is predicted and it would be long-term.

Table 4.5-3 summarizes compliance with the PFO ARMP with regard to vegetation resources under the Proposed Action.

Table 4.5-3 Compliance with Applicable PFO ARMP Goals, Objectives, and Actions for Vegetation Resources

Goal/Objective/Action	Compliance under Proposed Action
Action ME-2.1.4. Applicable Idaho Standards for Rangeland Health (BLM 1997) will be employed to determine the success of reclamation, rehabilitation, or restoration activities following major surface disturbances on public lands.	The Proposed Action would be consistent with this action because proposed reclamation activities are designed to comply and the seed mixtures selected for reclamation contain a variety of native grass, forb, and shrub species that could provide forage for livestock and wildlife. Additional native species are predicted to colonize reclaimed areas over time through natural successional processes. Over the long term, the reclaimed areas are anticipated to recover to the baseline habitat quality of big sagebrush and high-elevation rangeland on the mine site. Weed control would also be undertaken.
Action ME-2.2.1. Reclamation Plans for mineral development operations will be designed to attain and final reclamation will meet applicable standards (BLM 1997) consistent with the rehabilitation potential of the disturbed site.	The Proposed Action would be consistent with this action because proposed reclamation activities are designed to comply and the seed mixtures selected for reclamation contain a variety of native grass, forb, and shrub species that could provide forage for livestock and wildlife. Additional native species are predicted to colonize reclaimed areas over time through natural successional processes. Over the long term, the reclaimed areas are anticipated to recover to the baseline habitat quality of big sagebrush and high-elevation rangeland on the mine site. Weed control would also be undertaken.
Action ME-2.2.2. Operational Standard 9: Within development areas, soils and native vegetation will be retained undisturbed when disturbance of the site is not necessary for minerals development or safety.	This standard would be met under the Proposed Action. Disturbance would be limited to the minimum area necessary and areas would be reclaimed and re-vegetated when no longer needed for mining.
Action ME-2.2.2. Operational Guideline 1: Selection of plant species for establishment will reflect the surrounding ecosystem and post-development land use. Plant materials selected for reclamation use will be adapted to the climate of the site. Consideration and preference will be given to promoting natural succession, native plant species, and structural diversity.	This guideline would be met under the Proposed Action. Areas no longer needed for mining would be reclaimed with a variety of predominantly native plant species (**Table 4.5-2**) that are adapted to the local climate. The seed mixes include bunchgrasses, forbs, and shrubs for structural diversity. Reclaimed areas would be subject to natural succession and eventually recover to big sagebrush and high-elevation rangeland plant communities.

Table 4.5-3 Compliance with Applicable PFO ARMP Goals, Objectives, and Actions for Vegetation Resources

Goal/Objective/Action	Compliance under Proposed Action
Action ME-2.3.5. In reclamation activities, plant species known to reduce the risk of bioaccumulation of hazardous substances, such as selenium, will be used if such risk is present.	The Proposed Action would be consistent with this Action. Seed mixes were designed to include predominantly shallow-rooted species, and no selenium accumulator species were included in seed mixes. The 5-foot-deep cover is designed to eliminate adverse bioaccumulation of selenium.
Action ME-2.3.6. Prior to release of any performance bond or relinquishment of a mineral lease/permit, reclamation vegetation will be monitored for bio-accumulation of hazardous substances for a period of time to be determined appropriate by the Authorized Officer.	The Proposed Action would be consistent with this Action. Agrium would conduct monitoring consistent with the EMP (**Appendix A**).

Source: BLM 2012a

Table 4.5-4 summarizes compliance with applicable standards and guidelines from the CNF RFP (USFS 2003) with regard to vegetation resources under the Proposed Action.

Overall effects of the Proposed Action to upland vegetation would be long-term and minor. Reclamation would eventually re-establish vegetation cover, but the species composition and community structure would be different.

Table 4.5-4 Compliance with Applicable Caribou Forest Plan Standards and Guidelines for Vegetation Resources

Standard and Guideline	Compliance under Proposed Action
Vegetation Standard 2: In each 5th code HUC which has the ecological capability to produce forested vegetation, the combination of mature and old age classes (including old growth) shall be at least 20 percent of the forested acres. At least 15 percent of all the forested acres in the HUC are to meet or be actively managed to attain old growth characteristics (RFP 3-19).	Currently, 93 percent of the aspen stands in the 5th code HUC are in old/mature age classes based on USFS mapping. All of the aspen stands that would be impacted under the Proposed Action are in mature/old age classes. On-site inventory showed that no acres that currently meet Region Four "Old-growth" definitions will be impacted on USFS lands. Therefore, the Proposed Action would not negatively impact the distribution of aspen forest age classes, and would be consistent with maintaining at least 20 percent mature/old age classes in the 5th code HUC that encompasses the analysis area. Because of the prevalence of mature/old aspen stands on the landscape, it is likely that at least 15 percent of the aspen forest in the watershed would still remain to attain old-growth characteristics, even with the loss of 4 acres of old-growth aspen (on BLM and private land) under the Proposed Action.
Vegetation Guideline 1: Manage to reduce the decline of aspen and promote aspen regeneration and establishment. Provide protection from grazing where needed and consistent with management objectives.	The Proposed Action would not be in compliance with this guideline, as it would result in the permanent loss of 83 acres of aspen forest.
Vegetation Guideline 3: For aspen and conifer types, acres classified as mature and old growth should be in blocks over 200 acres in size unless the natural patch	The aspen forest in the Study Area is naturally patchy, with none of the individual aspen stands surpassing 200 acres in size (BC 2012c). The Proposed Action would

Table 4.5-4 Compliance with Applicable Caribou Forest Plan Standards and Guidelines for Vegetation Resources

Standard and Guideline	Compliance under Proposed Action
size is smaller (a block can consist of a combination of mature and old growth forest types). Within these blocks: • Maintain the dead and down woody material guidelines for wildlife. • Silvicultural techniques may be used to maintain or improve old growth and mature forest characteristics. • If a catastrophic event (such as fire) reduces the acres of old growth and mature forest below 20 percent of the forested acres in a principal watershed, identify replacement forested acres. When necessary, use silvicultural techniques to promote desired characteristics in the replacement acres.	result in a permanent loss of 83 acres of aspen forest. This would further reduce the size of mature and old-growth areas (blocks) in the Study Area and thus further reduce mature and old-growth forest availability for wildlife habitat management.
Plant Species Diversity Standard 1: Projects and activities shall be managed to avoid adverse impacts to sensitive plant species that would result in a trend toward federal listing or loss of viability.	There are no identified plant species listed as threatened, endangered, or proposed under the Endangered Species Act (ESA) in Caribou County (USFWS 2014). No CNF sensitive plant species or CNF Forest Watch rare plant species have been documented in the baseline studies. The Proposed Action is in compliance with this guideline.
Plant Species Diversity Guideline 1: Native plant species from genetically local sources should be used to the extent practical for erosion control, fire rehabilitation, riparian restoration, road rights-of-way seedings, and other re-vegetation projects.	Native plant species from genetically local sources will be used to the extent practicable. The Proposed Action is in compliance with this guideline.
Plant Species Diversity Guideline 2: Where practical, disturbed sites should be allowed to re-vegetate naturally where the seed source and soil conditions are favorable (e.g., low erosion potential, deeper soils) and noxious weeds are not expected to be a problem.	A Forest Botanist has reviewed the proposed seed mix for re-vegetation. The Proposed Action is in compliance with this guideline.
Plant Species Diversity Guideline 3: Known occurrences or habitat for rare plants on the "Forest Watch" list and rare or unique plant communities on the Forest should be maintained.	No CNF sensitive plant species or CNF Forest Watch rare plant species have been documented in the baseline studies. The Proposed Action is in compliance with this guideline.
Plant Species Diversity Guideline 4: Maintain, and where possible, increase unique or difficult-to-replace elements such as areas of high species diversity aspen, riparian areas, tall forbs, rare plant communities, etc.	The Proposed Action would not be in compliance with this guideline, as it would result in the permanent loss of 83 acres of aspen forest.
Plant Species Diversity Guideline 5: The Forest Botanist or Ecologist should review seed mixes used for re-vegetation to insure no adverse impacts to threatened, endangered, sensitive species, other species at risk and the overall native flora within the analysis area.	A Forest Botanist has reviewed the proposed seed mix for re-vegetation. The Proposed Action is in compliance with this guideline.
Drastically Disturbed Lands Standard 7: Reclamation vegetation shall be monitored for bio-accumulation of hazardous substances prior to release for multiple use management.	The EMP (**Appendix A**) identifies the environmental monitoring activities that would be undertaken at the mine to assure the effectiveness of BMPs and mitigation measures. The plan identifies which resources need to be

Table 4.5-4 Compliance with Applicable Caribou Forest Plan Standards and Guidelines for Vegetation Resources

Standard and Guideline	Compliance under Proposed Action
	monitored and describes monitoring and sampling locations, approved monitoring and sampling methods, duration and frequency of sampling, and data reporting requirements. The Proposed Action is in compliance with this guideline.
Drastically Disturbed Lands Standard 10: Within mine areas, native vegetation shall be retained undisturbed when disturbance of the site is not necessary for minerals development or safety.	Existing vegetation would be protected to the extent practicable by limiting surface disturbance to those areas needed for operations. The Proposed Action is in compliance with this guideline.
Drastically Disturbed Lands Guideline 2: Selection of plant species for establishment should reflect the surrounding ecosystem and post-remedial land use. Plant materials used should be adapted to the climate of the site. Consideration and preference should be given to promoting natural succession, native plant species, and structural diversity.	Agency-approved seed mixes containing native seeds would be applied. Two seed mixes would be used: one for drier sites and one for moister sites. The Proposed Action is in compliance with this guideline.
Drastically Disturbed Lands Guideline 3: Prescribe reclamation plant species known to reduce the risk of bioaccumulation of hazardous substances, if such risk is present.	Under the Proposed Action, seed mixes have been developed to encourage uptake of water from the upper soil horizon and avoid the use of selenium accumulator species. The seed mixes that would be used in the reclaimed areas do not contain any trees, legumes, or deep-rooted species, which typically accumulate selenium to a greater extent than grasses and shrubs (Mackowiak and Amacher 2003; Mackowiak et al. 2004). The Proposed Action is in compliance with this guideline.
Prescription 8.2.2 Goal 4: Emphasize the use of native plant species in reclamation but allow the use of nonnatives when natives will not achieve reclamation goals.	Agency-approved seed mixes containing native seeds would be applied. Two seed mixes would be used: one for drier sites and one for moister sites. The Proposed Action is in compliance with this guideline.

Source: USFS 2003

4.5.1.1.2 Wetlands and Riparian Areas

Executive Order (EO) 11990, Protection of Wetlands, requires that federal agencies "…avoid to the extent possible the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative." Under the Proposed Action, there would be approximately 20.5 acres of direct removal of wetlands and non-wetland WOUS. **Table 4.5-5** summarizes project components that would result in impacts to wetlands; these impacted areas are shown on **Figure 4.5-1**. Wetland assessment area and categories are described in **Section 3.5.2**. Wetland assessment areas are specific areas chosen to delineate and sample the functions of wetlands and thereby gage their quality. Impacts to fisheries and aquatic resources are discussed in **Section 4.7**.

Table 4.5-5 Direct Impacts to Wetlands

Project Component	Affected Wetland Assessment Area (WAA)	Wetland Category	Wetlands (acres)
Access Road	WAA 6	III	1.79
	WAA 8	III	1.5
	WAA 13	III	4.42
	WAA 14G	III	0.25
	WAA 12	III	0.25
	WAA 9	III	4.36
	WAA7	III	0.07
GM Stockpile	WAA14C	III	0.19
	WAA 13	III	1.55
	WAA9	III	1.35
Overburden Pile	WAA2	II	0.95
	Outside of wetland assessment area	III	0.15
	WAA 14C	III	0.21
Re-aligned County Road	Outside of wetland assessment area	III	0.04
Sediment Basin	WAA 13	III	0.09
	WAA 6	III	0.27
	WAA 9	III	0.03
	WAA 14C	III	0.03
Stockpile Area	WAA 14F	III	0.23
Temporary Overburden Pile	WAA 2	II	2.04
	WAA 14G	III	0.74
	Total		**20.51**

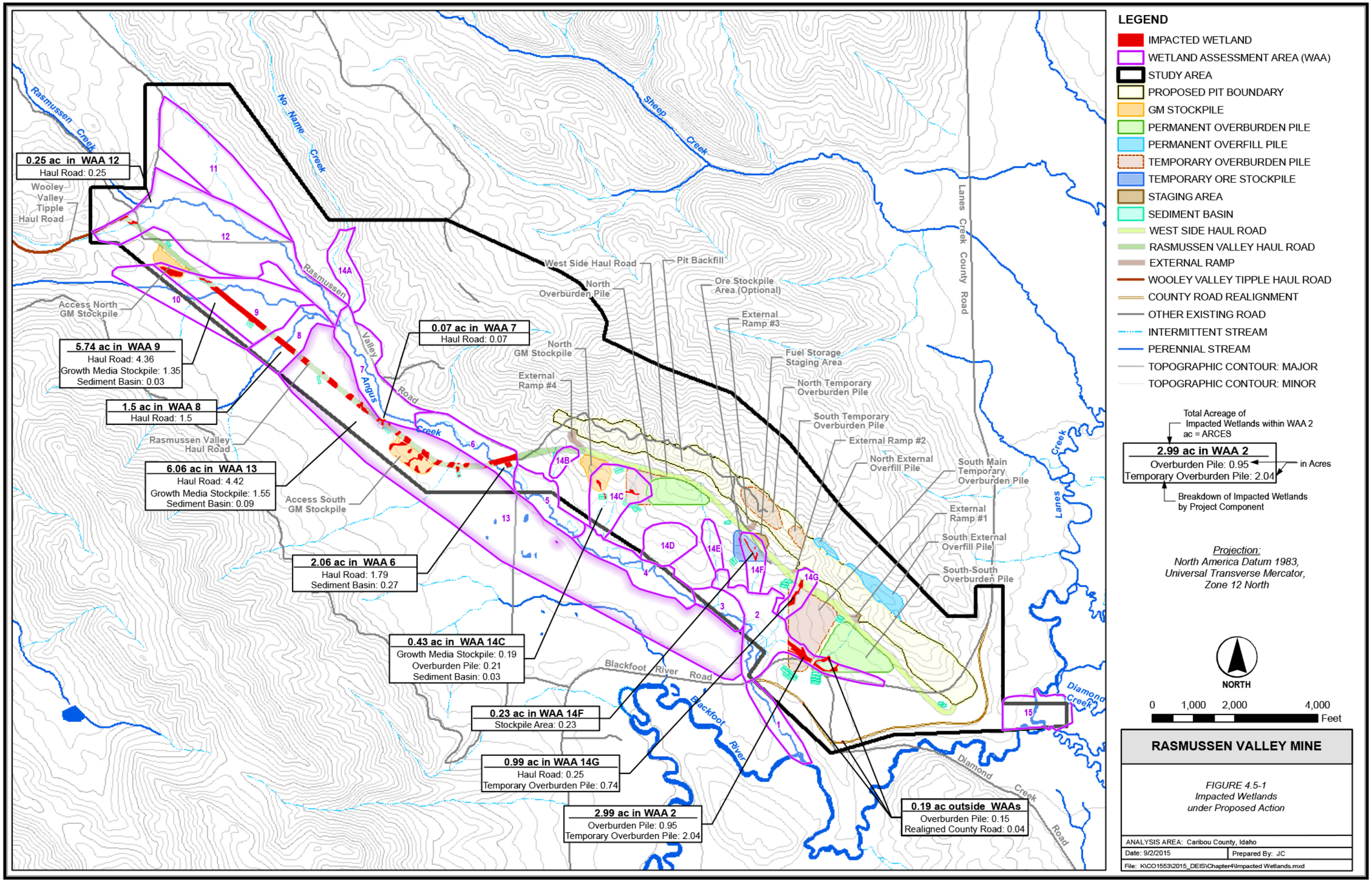
Source: BC 2012b

As shown in **Table 4.5-4**, the most wetland impacts (17.5 acres) would occur to Category III wetlands. These wetlands are more common than Category II wetlands, but are generally less diverse, and often smaller and more isolated than Category I or Category II wetlands. Category III wetlands provide many functions and values, although they may not be assigned high ratings for as many parameters as Category I or II wetlands.

In summary, the impacted wetland assessment areas are: 2, 6, 7, 8, 9, 12, 13, 14C, 14F, and 14G. The primary, moderate functions of these wetlands include general wildlife habitat, flood attenuation, short- and long-term surface water storage, sediment/nutrient/toxicant removal, and sediment/shoreline stabilization. Functional ratings for these wetlands were restricted by size, disturbance ratings, grazing, channel structure, and structural diversity. These functions would be reduced as a result of the Proposed Action.

As discussed in **Section 3.5.2**, the 2008 Montana Department of Transportation Montana Wetland Assessment Method (MWAM) was used to determine wetlands functions and values. The level at which affected wetlands provide ecological functions was estimated by deriving a functional index that reflects wetland functional parameters compared to an ideal condition. The functional index is a percentage of the level at which ecological functions are being delivered by the affected wetland. This index is multiplied by the acres of wetlands to derive “functional units,” which become the “currency” of impact determination and compensatory mitigation.

The Proposed Action would result in the loss of 11.99 functional units, as summarized in **Table 4.5-6**.



RASMUSSEN VALLEY MINE

FIGURE 4.5-1
Impacted Wetlands under Proposed Action

ANALYSIS AREA: Caribou County, Idaho
Date: 9/2/2015 | Prepared By: JC
File: K:\CO1553\2015_DEIS\Chapter4\Impacted Wetlands.mxd

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Table 4.5-6 Reduction in Wetland Functional Units as a Result of Dredging or Filling

Wetland Assessment Area	Functional Index (Percent)	Affected Acreage	Functional Unit Lost
2	72.7	2.99	2.17
6	59.5	2.06	1.22
7	47.3	0.07	0.03
8	54.5	1.50	0.80
9	60.5	5.74	3.47
12	53.2	0.25	0.13
13	56.4	6.06	3.41
14C	46.6	0.43	0.20
14F	46.6	0.23	0.10
14G	46.6	0.99	0.46
Not in WAA	not evaluated	0.19	cannot be calculated
	Total	**20.51**	**11.99**

Source: BC 2012b; Agrium 2011

The Proposed Action carries the potential to indirectly impact wetlands through the introduction of wind-borne and water-borne sediments into surface waters. Exposed areas of bare soil and the haul road could generate dust that could be carried into nearby waters by wind and settle on wetland vegetation. Dust would be mitigated or minimized by the application of water to the haul road and, as necessary, supplementation with dust suppressants such as magnesium chloride or calcium chloride. Areas of exposed soil would be minimized by re-vegetating disturbed areas as soon as they are no longer needed.

Sediments could also be carried into surface water by storm water runoff. BMPs would be designed and implemented to control storm water runoff and the resulting sediment load. During mining, precipitation falling on disturbed areas associated with the pit, stockpiles, and haul roads would infiltrate or be retained in sediment catchment and runoff retention basins. Runoff retention basins for runoff water and silt would be constructed at strategic locations before mining activities occur in that area to collect and contain water exposed to mining disturbances or overburden materials. Conveyance ditches constructed along the outer perimeters of the overburden pile and stockpile sites would transfer surface water runoff from these sites and carry it to runoff retention basins. Water control basins are designed at a minimum to capture runoff water from a 100-year, 24-hour storm event. The capture of runoff during active mining would minimize erosion and sedimentation at the Proposed Action to protect surface waters (and thus wetlands connecting to surface waters) in and around the Proposed Action. Additional erosion control measures would be used where needed to further reduce the potential for introduction of sediments into the watershed, including straw wattles and sediment fencing, to control water and soil movement from mining disturbances and the use of erosion matting on haul road fill slopes where appropriate to control soil movement into drainages. Brush barriers would be used to control runoff from overburden piles and GM stockpiles.

The capture of surface runoff during active mining would decrease the quantity of water in streams and wetlands downstream of the Study Area over the short term. As explained in **Section 4.3.1**, the area of captured runoff equates to approximately 4 percent of the Angus Creek-Blackfoot River sub-watershed and 0.03 percent of the Lower Lanes Creek sub-watershed. The reduced quantity of water may result in the localized drying of some wetlands downstream of the Study Area over the short term. Following reclamation, runoff to nearby streams and wetlands is predicted to be the same or greater compared to baseline conditions.

The Proposed Action carries the potential to impact water quality in Blackfoot River, Angus Creek, and springs and wetlands in the Study Area. Potential impacts to water quality include an increase in concentrations of COPCs listed in **Table 4.3-1**. These potential impacts to wetlands from COPCs are discussed in detail in **Section 4.3.1.5** Impacts to Surface Water Resources.

The Proposed Action would permanently affect 20.5 acres of wetlands of the 424.8 acres of wetlands delineated in the assessment areas. The Proposed Action could also indirectly impact wetlands near proposed activities. As a result of project design, use of BMPs, acreage, and similar functionality of wetlands not impacted in the assessment areas, the wetland impacts would be local, long-term, and moderate. Wetlands would be mitigated as required by the Clean Water Act (CWA) to compensate for this loss (**Section 4.5.4.2**).

Table 4.5-7 summarizes compliance with the PFO ARMP with regard to wetland and riparian resources under the Proposed Action. Applicable CNF RFP standards and guidelines for riparian resources are provided in **Table 4.7-2**.

Table 4.5-7 Compliance with Applicable PFO ARMP Goals, Objectives, and Actions for Wetland and Riparian Resources

Goal/Objective/Action	Compliance under Proposed Action
Action ME-2.3.7. Phosphate mine site plans will be designed to meet the following goals as identified in the Interagency Area-Wide Investigation of Phosphate Mine Contamination and Final Risk Management Plan (IPMP) (2004). Protect southeast Idaho's surface water resources. Protect wildlife habitat and ecological resources in southeast Idaho. Maintain and protect multiple beneficial uses of the southeast Idaho phosphate mining resource area. Protect southeast Idaho's ground water resources.	In regards to protecting wildlife habitat and ecological resources, the Proposed Action would be consistent with this action over the long term because the majority of disturbed areas would be reclaimed to grassland and shrubland, which would eventually recover to the baseline habitat quality of big sagebrush and high-elevation rangeland on the mine site. Over the short term, the Proposed Action would result in reduced habitat and forage for big game and other species.
Action ME-2.3.8. In order to achieve the goals identified in Action ME-2.3.7, the following action level for vegetation, surface waters and groundwater as identified in the current IPMP (Appendix F) and or future updates or revisions will be used to design mine and reclamation plans. In addition, these levels will be used in determining the success of phosphate mine reclamation, rehabilitation, or restoration activities.	The EMP (**Appendix A**) identifies the environmental monitoring activities that would be undertaken at the mine to assure the effectiveness of BMPs and mitigation measures. The plan identifies which resources need to be monitored and describes monitoring and sampling locations, approved monitoring and sampling methods, duration and frequency of sampling, and data reporting requirements. The Proposed Action is in compliance with this action.
Goal VE-1. Provide for the proper functioning condition (PFC) of riparian areas.	The Proposed Action would not meet Goal VE-1 because it would result in long-term removal of riparian habitat and contribute to further degradation of riparian areas through indirect impacts such as sedimentation and contribution of selenium and other COPCs into wetland and riparian areas. The 404 CWA permit would include mitigation for these impacts.
Objective VE-1.1. Maintain properly functioning riparian areas and restore or improve those areas that are not at PFC.	The Proposed Action would not meet Objective VE-1.1 because it would result in long-term removal of riparian habitat and contribute to further degradation of riparian areas through indirect impacts such as sedimentation and contribution of selenium and other COPCs into wetland and riparian areas. These impacts would be mitigated for

Table 4.5-7 Compliance with Applicable PFO ARMP Goals, Objectives, and Actions for Wetland and Riparian Resources

Goal/Objective/Action	Compliance under Proposed Action
	under the Section 404 permit.
Action VE-1.1.1. Appropriate management guidelines, techniques or practices will be implemented to control erosion, stabilize streambanks, shade/reduce water temperature, and encourage a diversity of desirable riparian vegetation.	Action VE-1.1.1 would be partially met under the Proposed Action. BMPs would be used to control erosion and combat streambank degradation, as described in **Section 4.3.4**. However, no steps would be taken to shade/reduce water temperature or encourage a diversity of desirable riparian vegetation.
Action VE-1.1.2. Idaho Standards for Rangeland Health (BLM 1997) will be implemented to maintain or improve riparian areas.	The Proposed Action would not meet Action VE-1.1.2 because it would result in long-term removal of riparian habitat and contribute to further degradation of riparian areas through indirect impacts such as sedimentation and contribution of selenium and other COPCs into wetland and riparian areas. These impacts would not be consistent with proper functioning of riparian areas as defined in the Idaho Standards for Rangeland Health (BLM 1997). These impacts would be mitigated for under the Section 404 permit.
Action VE-1.1.4. Stream crossings, if necessary, will be designed to minimize adverse impacts on soils, water quality and riparian vegetation.	Action VE-1.1.4 would be met under the Proposed Action. As described in **Section 4.3.4**, culverts would be appropriately sized and placed such that they would minimize impacts at stream crossings. These impacts would be mitigated for under the Section 404 permit.

Source: BLM 2012a

4.5.1.1.3 Noxious Weeds

EO 13112, Invasive Species, requires that a federal agency "…not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the U.S. or elsewhere unless, pursuant to guidelines it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm would be taken in conjunction with actions." The primary purpose of this EO is to reduce ecological and economic effects of invasive plant and animal species to agriculture, industry, recreation, and the environment.

The removal of native vegetation would increase the potential for expansion of non-native plants including noxious weeds. Non-native plants carry a potential to colonize disturbed areas and, once established, may reduce the diversity in native plant communities. However, because of the existing low occurrence of noxious weeds in the analysis area and incorporation of BMPs into the project design, the potential for the uncontrollable infestations of noxious weeds would be minimized and effects from noxious weeds would be short-term and minor. Project BMPs that would minimize noxious weed impacts include keeping active mining disturbances to a minimum for as short a timeframe as possible, with overburden areas and pit backfill advancing in concert with the active pit; monitoring and controlling noxious weed infestations; using certified weed-free seed, mulch, and straw; and implementing an annual noxious weed treatment plan.

Table 4.5-8 summarizes the goals, objectives, and actions of the PFO ARMP with regard to noxious weeds and invasive species. **Table 4.5-8** summarizes applicable CNF RFP Standards and Guidelines for Noxious Weeds. The Proposed Action would be in compliance with these

goals/objectives/actions and standards and guidelines by use of native seed mixtures that would be applied to complement the existing plant communities and the reclaimed areas and by actively controlling identified noxious weeds. Appropriate BMPs, in compliance with the goals/objectives/action and standards and guidelines listed in **Table 4.5-9**, would be implemented to control invasive and noxious species throughout the life of proposed mining activities. Examples of these BMPs include treatment of identified invasive species, using state-certified noxious weed free hay/straw when needed, use of a seed mix that is certified as weed-free, and monitoring for noxious weeds. There is a low occurrence of noxious weeds in the analysis area, and BMPs will be implemented to minimize their potential spread. Therefore, the effects of noxious weeds from the Proposed Action would be short-term and minor.

Table 4.5-8 PFO ARMP Goals, Objectives, and Actions for Noxious Weeds and Invasive Species

Goal/Objective/Action
Goal VE-2. Prevent the establishment of invasive species/noxious weed species.
Objective VE-2.1. Treat invasive species/noxious weeds to decrease or control the total number of acres occupied.
Action VE-2.1.1. Invasive species/noxious weeds will be treated based upon the following priority: 1. Idaho Noxious Weeds list 2. Invasive species/noxious weeds
Action VE-2.1.2. Priority treatment areas will be: • RNAs • Riparian areas • Springs/Seeps • Developed Recreation Sites/Campgrounds/Campsites • Heavily used roads/trails • Big game winter range • Special Status Species (flora habitat area) • Wildland Urban Interfaces (WUIs) • Mine reclamation sites • New areas identified: treat smallest populations first
Action VE-2.1.3. When authorizing new permitted/authorized activities, stipulations will be incorporated for the prevention and treatment of invasive species/noxious weeds as applicable. Examples of such stipulations to consider will promote: • The replacement of invasive species/noxious weeds by perennial plant cover which includes purchasing and planting of desirable seeds or plants. • The use of perennial green fire breaks when emergency stabilization and rehabilitation (ES&R) or restoration efforts are planned/implemented. • Invasive species/noxious weed management being integrated into any new or renewal of permitted/authorized activities resulting in major surface disturbance.
Action VE-2.1.4. As appropriate, chemical, biological, mechanical and manual methods will be used in treating invasive species/noxious weeds. The use of biological control agents will be promoted when reasonable as identified through current BLM policy.
Action VE-2.1.5. Herbicide use will be consistent with current BLM policy (e.g., Record of Decision. Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States. Programmatic Environmental Impact Statement. US Department of the Interior, Bureau of Land Management. September 2007.)
Action VE-2.1.6. Projects involving the application of herbicides, pesticides and insecticides that may affect Special Status Species will be analyzed at the project level and designed such that applications will support species conservation and recovery and minimize risks of exposure.
Action VE-2.1.7. Control of invasive species/noxious weeds will be coordinated with adjacent land owners and local governments through cooperative management programs.
Action VE-2.1.8. Fuels and restoration projects will be coordinated with other programs to reduce the risk of invasive species/noxious weeds.

Table 4.5-8 PFO ARMP Goals, Objectives, and Actions for Noxious Weeds and Invasive Species

Goal/Objective/Action
Action VE-2.1.9. Suppression equipment will be washed for invasive species/noxious weeds at designated sites.
Action VE-2.1.11. Where hay or straw will be used on public lands for permitted/authorized and internal BLM activities, state-certified noxious weed free hay/straw will be required.
Action VE-2.1.12. Integrated weed management strategies will be coordinated and developed with Tribal, Federal and State agencies and local governments at appropriate scales to restore affected BLM-administered public lands. Such strategies or actions may include but are not limited to: • coordination of treatment efforts; • identification of priority areas; • promote public awareness; and • develop educational material regarding control, prevention, etc.

Source: BLM 2012a

Table 4.5-9 Compliance with Applicable Caribou Forest Plan Standards and Guidelines for Noxious Weeds

Standard/Guideline
Noxious Weeds and Invasive Species Standard 1: Only weed-free hay, straw, pellets, and mulch shall be used on Forest.
Noxious Weeds and Invasive Species Standard 2: All seed used shall be certified to be free of noxious weed seeds from weeds listed on the current *All States Noxious Weeds List*.
Noxious Weeds and Invasive Species Standard 3: Gravel or borrow material sources shall be monitored for noxious weeds and other invasive species. Sources infested with noxious weeds shall be closed until the weeds are successfully controlled.
Noxious Weeds and Invasive Species Standard 4: Noxious weeds shall be aggressively treated throughout the Forest, unless specifically prohibited, following the Caribou Noxious Weed Strategy. Using Integrated Weed Management, methods of control and access shall be consistent with the goals of each prescription area.
Noxious Weeds and Invasive Species Guideline 1: Weed treatment projects, especially those using herbicides, should be timed to achieve desired effects on target vegetation, while having minimal effects on non-target vegetation.
Noxious Weeds and Invasive Species Guideline 3: Monitor, as needed, disturbed areas, such as landings, skid trails, roads, mines, burned areas, etc., for noxious weeds or invasive species and treat where necessary.
Noxious Weeds and Invasive Species Guideline 4: Evaluate the potential for invasion by noxious weeds into proposed vegetation units and wildland fire use plan areas and modify units or mitigate where necessary.

Source: USFS 2003

4.5.1.1.4 Fire Management

Under the Proposed Action, approximately 83 acres of aspen forest would be removed and replaced with a grass-dominated vegetation community following reclamation. This would shift some of the Proposed Action from an aspen fire regime (Fire Regime III) to a perennial grass fire regime (Fire Regime IV) (Hardy et al. 2001). The fire frequency would be similar under the two fire regimes, but Fire Regime IV is characterized by more severe, stand-replacing fires (in which more than 75 percent of the dominant overstory vegetation is replaced). The shift is expected to alter the fire regime by permanently removing a natural fire break (aspen forest stands) and increasing the size and connectivity of grass and shrubland patches.

Fuel loads in perennial grasslands range from 250 pounds per acre to more than 2,000 pounds per acre (BLM 2008). Perennial grasses reportedly exhibit good recovery after severe fire. Growth

points in these grasses are compressed near the ground at the base of shoots (e.g., root crowns in bunchgrasses and lateral shoots in sod-formers). Most perennial grasses respond by re-sprouting from these basal growing points following fire. The primary determinant of fire response in perennial grasslands is fire residence time. Fast-moving fires have a short residence time and seldom cause substantial mortality. Slow-moving fires, however, have longer residence times and impose greater severity. Mortality to perennial grasses is high under these conditions, as the fire spends more time in the vegetative base of the plant. With most natural ignitions, the predominant fire spread is a fast-moving fire. Because native grasslands are seral to sagebrush steppe, natural and historical fire rotations of 60 to 110 years (the same as for low-elevation shrub) would prevail (BLM 2008).

4.5.1.2 Rasmussen Collaborative Alternative

4.5.1.2.1 Vegetation

The types of vegetation impacts from the RCA would be similar to those described for the Proposed Action; however, the magnitude of impacts would be different for some vegetation types. The RCA would remove approximately 391 acres of vegetation, of which approximately 0.3 acre is wetland vegetation. This is 28 acres less than the vegetation that would be removed under the Proposed Action.

The vegetation types and associated acreages affected by the RCA are summarized in **Table 4.5-10**.

Table 4.5-10 Vegetation Types and Estimated Affected Acreages under the RCA

Vegetation Type	Acres
Aspen Mature Dry Woodland	72
Aspen Mature	29
Aspen Old Growth	2
Aspen/Conifer Mix	0
Total Aspen,***	*103*
Big Sagebrush Rangeland	130
Silver Sagebrush Rangeland	0
*Total Sagebrush****	*130*
High Elevation Rangeland	145
Shrub/Scrub Wetland/Seasonal Mountain Drainage	0.25
Mesic Emergent/Ponded Wetland	0
Previously Reclaimed	12
Total Disturbed Acreage	**391**
Total Reclaimed Acreage (would recover to High-Elevation Rangeland)**	**377**

Notes:

* Acreages are rounded to the nearest whole number, except for shrub/scrub wetland/seasonal mountain drainage.

**The RCA would also reclaim approximately 30 acres on the South Rasmussen Mine that would have otherwise gone unreclaimed. This area would also recover to high-elevation rangeland.

Source: BC 2012a, BC 2015c

The RCA would result in the residual net debit of 2,242 RICHCOVWET DSAYs (the units that represent wildlife habitat services in the HEA; ARCADIS 2015c). This means that the RCA would have a long-term net negative impact on wildlife habitat, as measured by the RICHCOVWET vegetation metric. However, compared to the Proposed Action, the RCA would result in

approximately 28 percent fewer net debit residual DSAYs. This would largely be the result of the use of a diverse reclamation seed mix designed to be adapted to the predicted post-mining site conditions that includes a variety of native shrubs and forbs, and greater plant available moisture provided by the store-and-release cap and cover, which would enhance vegetation recovery on reclaimed areas. Recovery trajectories developed for the HEA predict that it would take 110 years for reclaimed areas to exhibit plant species richness and vegetation cover similar to those of the baseline high-elevation rangeland habitat type (ARCADIS 2015b).

For the same reasons described in the Proposed Action (**Section 4.5.1.1**), the RCA would result in the permanent loss of 103 acres of aspen, of which 2 acres, located on BLM land, is old-growth aspen forest. This is 21 more acres of aspen impact and 2 less acres of old-growth aspen forest impact compared to the Proposed Action. The approximate 103 acres of impact to aspen forest consists of 80 acres on USFS land, 13 acres on BLM land, 10 acres on state land, and 0.4 acre on private land.

Under the RCA, the elimination of external overburden piles would address issues associated with mobilization of COPCs (including selenium) into surface waters. In contrast to the Proposed Action, under the RCA, there would be no measurable loading of COPCs into the Blackfoot River or its tributaries (or to adjacent wetlands). The RCA would also virtually eliminate the potential for adverse selenium uptake by reclamation vegetation because the RCA cover, Cover C, like the Proposed Action cover, is thick enough to separate the majority of the plant roots from the selenium that would be potentially present in the underlying overburden or backfill.

The ultimate vegetation disturbance resulting from the implementation of the RCA would total approximately 391 acres, of which approximately 377 acres (or 96 percent) would be reclaimed. The remaining 4 percent would consist of pit walls exposed in the partially backfilled areas and the unreclaimed disturbance associated with the county road realignments. The RCA would also reclaim approximately 30 acres of the South Rasmussen Mine that would have otherwise gone unreclaimed.

Similar to the Proposed Action, during reclamation activities, areas of vegetation impact would be reseeded as part of reclamation. The proposed seed mix for the RCA is different than the seed mix in the Proposed Action. Additional vegetation baseline studies of the analysis area further evaluated elevation, soil characteristics, and slope as controlling factors in existing plant communities (BC 2013a). The seed mix was refined based on these studies. Similar to the Proposed Action (**Section 4.5.1.1.1**), the seed mixes for the RCA were also developed to encourage uptake of water from the upper soil horizon and avoid the use of selenium accumulator species.

There are two seed mixes that would be used on reclaimed areas under the RCA. Appropriate substitutes of species in the mix may be made in the future if, for example, seed is unavailable or monitoring shows poor establishment. One seed mix (the Rasmussen Valley or RV Seed Mix) would be applied to areas on Agrium's leases (**Table 4.5-11**). A second seed mix (the P4 Seed Mix) is approved by the IDL for use on P4's State lease and would be applied to the RCA areas on the South Rasmussen Mine (**Table 4.5-12**). Both reclaimed areas would be managed to control invasive and noxious species and prevent their introduction.

Table 4.5-11 Rasmussen Valley Mine RCA Seed Mix (RV Seed Mix)

Scientific Name	Common Name	Pounds/Acre	Percent of Seed Mix
Grasses			
Bromus marginatus	Mountain Brome	2.00	5.3
Elymus elymoides	Bottlebrush Squirrel Tail	2.00	5.3
Elymus lanceolatus ssp lanceolatus	Thickspike Wheatgrass	1.00	2.6
Elymus lanceolatus ssp psammophilus	Streambank Wheatgrass	1.00	2.6
Elymus trachycaulus	Slender Wheatgrass	2.00	5.3
Festuca idahoensis	Idaho Fescue	1.00	2.6
Festuca ovina	Sheep Fescue	1.00	2.6
Koeleria macrantha	Prairie Junegrass	0.25	0.7
Leymus cinereus	Great Basin Wildrye	2.00	5.3
Pascopyrum smithii	Western Wheatgrass	1.50	4.0
Poa secunda ssp ampla	Big Bluegrass	0.75	2.0
Pseudoroegneria spicata	Bluebunch Wheatgrass	2.00	5.3
Triticum aestivum x Secale cereale	Quickguard	3.00	7.9
	Grass Totals per acre	**19.50**	**51.7**
Forbs			
Achillea millefolium var occidentalis	Western Yarrow	0.50	1.3
Heliomeris multiflora	Showy Goldeneye	0.50	1.3
Linum lewisii	Lewis Blue Flax	1.00	2.6
Lupinus argenteus	Silver Lupine	4.00	10.6
Penstemon palmeri	Palmer Penstemon	1.00	2.6
Penstemon strictus	Rocky Mountain Penstemon	1.00	2.6
	Forb Totals per acre	**8.00**	**21.2**
Shrubs			
Artemisia cana	Silver Sagebrush	0.15	0.4
Artemisia tridentata ssp vaseyana	Mountain Big Sagebrush	0.10	0.3
Ceanothus velutinus	Snowbrush Ceanothus	1.00	2.6
Krascheninnikovia lanata	Winterfat	0.50	1.3
Purshia tridentate	Bitterbrush	4.50	11.9
Rosa woodsia	Wood's Rose	1.00	2.6
Symphoricarpos oreophilus	Mountain Snowberry	3.00	7.9
	Shrub Totals per acre	**10.25**	**27.2**
	Overall Totals per acre	**37.75**	**100.0**

Source: Great Ecology 2015

Table 4.5-12 P4 South Rasmussen Mine RCA Seed Mix (P4 Seed Mix)

Scientific Name	Common Name	Pounds/Acre	Percent of Seed Mix
Grasses			
Bromus marginatus	Mountain Bromegrass	6.30	18.0
Leymus cinereus	Great Basin Wildrye	2.45	7.0
Pseudoroegneria spicata ssp spicata	Bluebunch Wheatgrass	2.63	7.5
Poa secunda ssp ampla	Big Bluegrass	0.35	1.0
Festuca idahoensis	Idaho Fescue	0.70	2.0
Festuca ovina	Sheep Fescue	0.44	1.3
Elymus lanceolatus ssp lanceolatus	Thickspike Wheatgrass	2.10	6.0

Table 4.5-12 P4 South Rasmussen Mine RCA Seed Mix (P4 Seed Mix)

Scientific Name	Common Name	Pounds/Acre	Percent of Seed Mix
Pascopyrum smithii	Western Wheatgrass	1.96	5.6
Thinopyrum intermedium ssp barbulatum	Pubescent Wheatgrass	2.80	8.0
Dactylis glomerata	Orchardgrass	0.61	1.8
Poa pratensis	Kentucky Bluegrass	0.12	0.4
Triticum aestivum x Secale cereale	Quickguard-Cover Crop	8.75	25.0
	Grass Totals per acre	**29.21**	**83.6**
Forbs			
Hedysarum boreale	Northern Sweetvetch	2.82	8.1
Penstemon strictus	Rocky Mtn Penstemon	0.25	0.7
Sanguisorba minor	Small Burnet	1.93	5.5
Linum lewisii	Lewis Blue Flax	0.35	1.0
Achillea millefolium var. occidentalis	Western Yarrow	0.02	0.1
Gaillardia aristata	Blanket Flower	0.44	1.3
	Forb Totals	**5.81**	**16.7**
	Overall Totals	**35.02**	**100.0**

Source: Guedes 2014

Under the RCA, a store-and-release cover would be applied to the backfill and overfill areas, a majority (59 percent) of the reclaimed acreage (BC 2015a) on the Rasmussen Valley Mine. Based on infiltration modeling, this store-and-release cover would retain slightly more moisture in the root zone for use by the reclamation vegetation compared with the Proposed Action (BC 2015a). This may result in a faster growth of vegetation and overall reclamation recovery than the Proposed Action.

Table 4.5-13 summarizes compliance with the PFO ARMP with regard to vegetation resources under the RCA. Overall, under the RCA, compliance is essentially the same as with the Proposed Action.

Table 4.5-13 Compliance with Applicable PFO ARMP Goals, Objectives, and Actions for Vegetation Resources

Goal/Objective/Action	Compliance under Proposed Action
Action ME-2.1.4. Applicable Idaho Standards for Rangeland Health (BLM 1997) will be employed to determine the success of reclamation, rehabilitation, or restoration activities following major surface disturbances on public lands.	The RCA would be consistent with this action because proposed reclamation activities are designed to comply and the seed mixtures selected for reclamation contain a variety of native grass, forb, and shrub species that could provide forage for livestock and wildlife. Additional native species are predicted to colonize reclaimed areas over time through natural successional processes. Over the long term, the reclaimed areas are anticipated to recover to the baseline habitat quality of high-elevation rangeland on the mine site. Weed control would also be undertaken.
Action ME-2.2.1. Reclamation Plans for mineral development operations will be designed to attain and final reclamation will meet applicable standards (BLM 1997) consistent with the rehabilitation potential of the disturbed site.	The RCA would be consistent with this action because proposed reclamation activities are designed to comply and the seed mixtures selected for reclamation contain a variety of native grass, forb, and shrub species that could provide forage for livestock and wildlife. Additional native species are predicted to colonize reclaimed areas over

Table 4.5-13 Compliance with Applicable PFO ARMP Goals, Objectives, and Actions for Vegetation Resources

Goal/Objective/Action	Compliance under Proposed Action
	time through natural successional processes. Over the long term, the reclaimed areas are anticipated to recover to the baseline habitat quality of high-elevation rangeland on the mine site. Weed control would also be undertaken.
Action ME-2.2.2. Operational Standard 9: Within development areas, soils and native vegetation will be retained undisturbed when disturbance of the site is not necessary for minerals development or safety.	This standard would be met under the RCA. Disturbance would be limited to the minimum area necessary and areas would be reclaimed and revegetated when no longer needed for mining.
Action ME-2.2.2. Operational Guideline 1: Selection of plant species for establishment will reflect the surrounding ecosystem and post development land use. Plant materials selected for reclamation use will be adapted to the climate of the site. Consideration and preference will be given to promoting natural succession, native plant species, and structural diversity.	This guideline would be met under the RCA. Areas no longer needed for mining would be reclaimed with a variety of predominantly native plant species (**Table 4.5-11** and **Table 4.5-12**) that are adapted to the local climate. The seed mixes include bunchgrasses, forbs, and shrubs for structural diversity. Reclaimed areas would be subject to natural succession and eventually recover to high-elevation rangeland plant communities.
Action ME-2.3.5. In reclamation activities, plant species known to reduce the risk of bioaccumulation of hazardous substances, such as selenium, will be used if such risk is present.	The RCA would be consistent with this Action. Seed mixes were designed to include predominantly shallow-rooted species, and no selenium accumulator species were included in seed mixes. The 6-foot-deep cover would also limit bioaccumulation of selenium.
Action ME-2.3.6. Prior to release of any performance bond or relinquishment of a mineral lease/permit, reclamation vegetation will be monitored for bio-accumulation of hazardous substances for a period of time to be determined appropriate by the Authorized Officer.	The RCA would be consistent with this Action. Agrium would conduct monitoring consistent with the EMP (**Appendix A**).

Source: BLM 2012a

Table 4.5-14 summarizes compliance with the CNF RFP with regard to vegetation resources under the RCA. Overall, under the RCA, compliance is essentially the same as with the Proposed Action.

Table 4.5-14 Compliance with Applicable Caribou Forest Plan Standards and Guidelines for Vegetation Resources

Standard/Guideline	Compliance under the RCA
Vegetation Standard 2: In each 5th code HUC which has the ecological capability to produce forested vegetation, the combination of mature and old age classes (including old growth) shall be at least 20 percent of the forested acres. At least 15 percent of all the forested acres in the HUC are to meet or be actively managed to attain old growth characteristics.	Currently, 93 percent of the aspen stands in the 5th code HUC are in old/mature age classes based on USFS mapping. All of the aspen stands that would be impacted under the RCA are in mature/old age classes. On-site inventory showed that no acres that currently meet Region Four "Old-growth" definitions would be impacted on USFS lands. Therefore, the RCA would not negatively impact the distribution of aspen forest age classes and would be consistent with maintaining at least 20 percent mature/old age classes in the 5th code HUC that encompasses the analysis area. Because of the prevalence of mature/old aspen stands on the landscape, it is likely that at least 15 percent of the aspen forest in the watershed would still remain to

Table 4.5-14 Compliance with Applicable Caribou Forest Plan Standards and Guidelines for Vegetation Resources

Standard/Guideline	Compliance under the RCA
	attain old-growth characteristics, even with the loss of 2 acres (on BLM land) of old-growth aspen under the RCA. The RCA is in compliance with this standard.
Vegetation Guideline 1: Manage to reduce the decline of aspen and promote aspen regeneration and establishment. Provide protection from grazing where needed and consistent with management objectives.	The RCA would not be in compliance with this guideline, as it would result in the permanent loss of 103 acres of aspen forest.
Vegetation Guideline 3: For aspen and conifer types, acres classified as mature and old growth should be in blocks over 200 acres in size unless the natural patch size is smaller (a block can consist of a combination of mature and old growth forest types). Within these blocks: • Maintain the dead and down woody material guidelines for wildlife. • Silvicultural techniques may be used to maintain or improve old growth and mature forest characteristics. • If a catastrophic event (such as fire) reduces the acres of old growth and mature forest below 20 percent of the forested acres in a principal watershed, identify replacement forested acres. When necessary, use silvicultural techniques to promote desired characteristics in the replacement acres.	The aspen forest in the analysis area is naturally patchy, with none of the individual aspen stands surpassing 200 acres in size (BC 2012c). The RCA would result in a permanent loss of 103 acres of aspen forest. This would further reduce the size of mature and old-growth areas (blocks) in the Study Area and thus further reduce mature and old-growth forest availability for wildlife habitat management. The RCA is not in compliance with this standard.
Plant Species Diversity Standard 1: Projects and activities shall be managed to avoid adverse impacts to sensitive plant species that would result in a trend toward federal listing or loss of viability.	There are no identified plant species listed as threatened, endangered, or proposed under the ESA in Caribou County (USFWS 2014). No CNF sensitive plant species or CNF Forest Watch rare plant species have been documented in the baseline studies. The RCA is in compliance with this standard.
Plant Species Diversity Guideline 1: Native plant species from genetically local sources should be used to the extent practical for erosion control, fire rehabilitation, riparian restoration, road rights-of-way seedings, and other re-vegetation projects.	Native plant species from genetically local sources will be used to the extent practicable. The RCA is in compliance with this guideline.
Plant Species Diversity Guideline 2: Where practical, disturbed sites should be allowed to re-vegetate naturally where the seed source and soil conditions are favorable (e.g. low erosion potential, deeper soils) and noxious weeds are not expected to be a problem.	A Forest Botanist has reviewed the proposed seed mix for re-vegetation. The RCA is in compliance with this guideline.
Plant Species Diversity Guideline 3: Known occurrences or habitat for rare plants on the "Forest Watch" list and rare or unique plant communities on the Forest should be maintained.	No CNF sensitive plant species or CNF Forest Watch rare plant species have been documented in the baseline studies. The RCA is in compliance with this guideline.
Plant Species Diversity Guideline 4: Maintain, and where possible, increase unique or difficult-to-replace elements such as areas of high species diversity aspen, riparian areas, tall forbs, rare plant communities, etc.	The RCA would not be in compliance with this guideline, as it would result in the permanent loss of 103 acres of aspen forest.
Plant Species Diversity Guideline 5: The Forest Botanist or Ecologist should review seed mixes used for re-vegetation to insure no adverse impacts to threatened, endangered, sensitive species , other species at risk and the overall native flora within the analysis area.	A Forest Botanist has reviewed the proposed seed mix for re-vegetation. The RCA is in compliance with this guideline.

Table 4.5-14 Compliance with Applicable Caribou Forest Plan Standards and Guidelines for Vegetation Resources

Standard/Guideline	Compliance under the RCA
Drastically Disturbed Lands Standard 7: Reclamation vegetation shall be monitored for bio-accumulation of hazardous substances prior to release for multiple use management.	The EMP (**Appendix A**) identifies the environmental monitoring activities that would be undertaken at the mine to assure the effectiveness of BMPs and mitigation measures. The plan identifies which resources need to be monitored and describes monitoring and sampling locations, approved monitoring and sampling methods, duration and frequency of sampling, and data reporting requirements. The RCA is in compliance with this standard.
Drastically Disturbed Lands Standard 10: Within mine areas, native vegetation shall be retained undisturbed when disturbance of the site is not necessary for minerals development or safety.	Existing vegetation would be protected to the extent practicable by limiting surface disturbance to those areas needed for operations. The RCA is in compliance with this standard.
Drastically Disturbed Lands Guideline 2: Selection of plant species for establishment should reflect the surrounding ecosystem and post remedial land use. Plant materials used should be adapted to the climate of the site. Consideration and preference should be given to promoting natural succession, native plant species, and structural diversity.	Agency-approved seed mixes containing native seeds would be applied. Two seed mixes would be used: one for drier sites and one for moister sites. The RCA is in compliance with this guideline.
Drastically Disturbed Lands Guideline 3: Prescribe reclamation plant species known to reduce the risk of bioaccumulation of hazardous substances, if such risk is present.	Under the RCA, seed mixes have been developed to encourage uptake of water from the upper soil horizon and avoid the use of selenium accumulator species. The seed mixes that would be used in the reclaimed areas do not contain any trees, legumes, or deep-rooted species, which typically accumulate selenium to a greater extent than grasses and shrubs (Mackowiak and Amacher 2003; Mackowiak et al. 2004). The RCA is in compliance with this guideline.
Prescription 8.2.2 Goal 5: Emphasize the use of native plant species in reclamation but allow the use of nonnatives when natives will not achieve reclamation goals.	Agency-approved seed mixes containing native seeds would be applied. Two seed mixes would be used: one for drier sites and one for moister sites. The RCA is in compliance with this goal.

Source: USFS 2003

Overall effects of the RCA to upland vegetation would be long-term and minor. Reclamation would eventually re-establish vegetation cover, but the species composition and community structure would be different.

4.5.1.2.2 Wetlands and Riparian Areas

The avoidance of riparian and wetland areas was a primary objective during the design of the RCA. Under the RCA, there would be 0.3 acre of direct removal of wetlands and non-wetland WOUS. This is approximately 20.5 acres of fewer impacts to wetlands and non-wetland WOUS than the Proposed Action. **Table 4.5-15** summarizes project components that would result in impacts to wetlands; these impacted areas are shown on **Figure 4.5-2**. Wetland assessment areas and categories are described in **Section 3.5.2**.

The proposed haul road for the RCA (HR-5) would result in 0.2 acre of unavoidable permanent impacts to wetlands associated with the West Side Haul Road immediately adjacent to the proposed pit. In addition, the realignment of portions of the County Roads would result in 0.04 acre of unavoidable permanent impacts to wetlands (**Figure 4.5-2**).

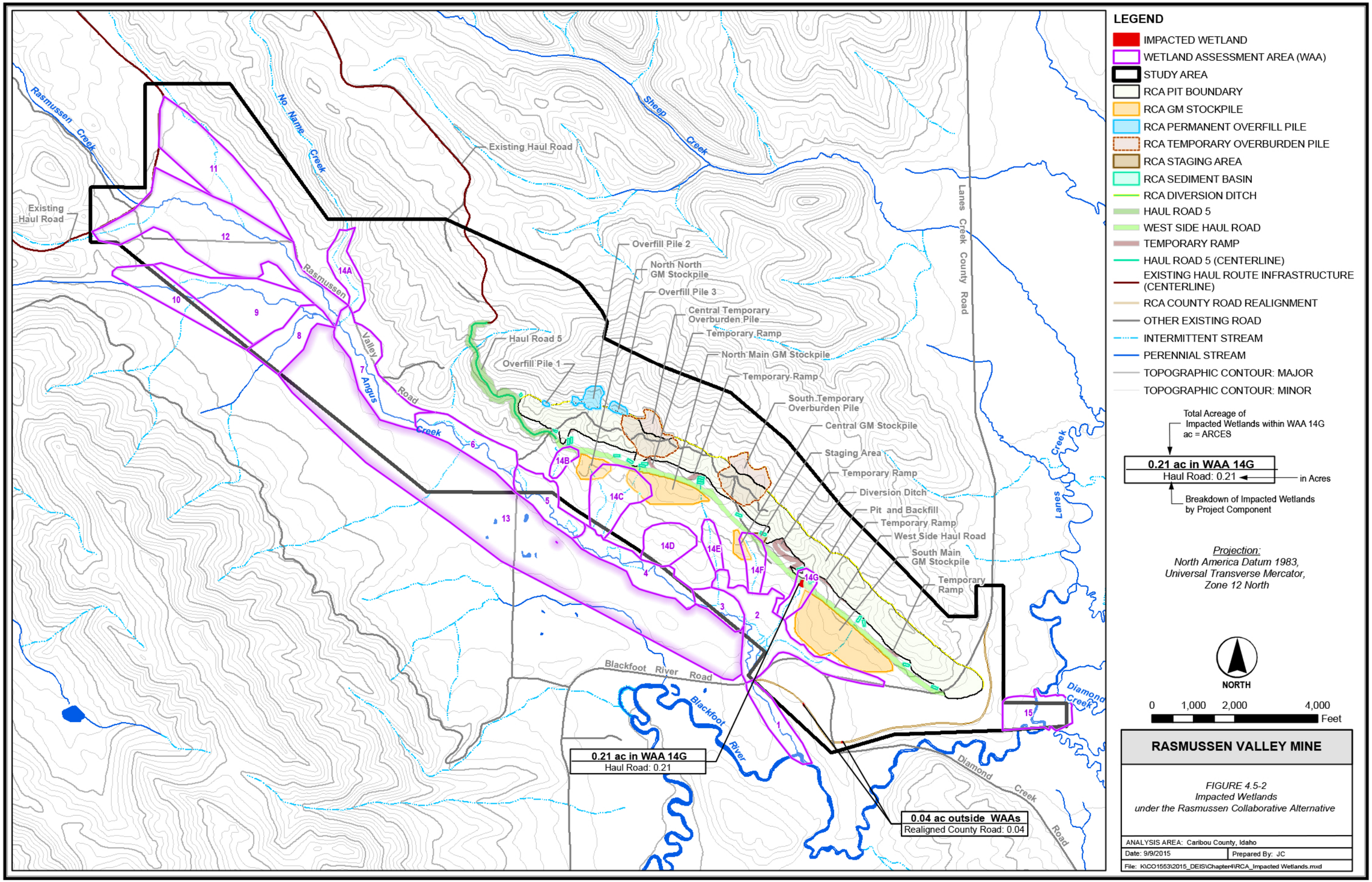
LEGEND
IMPACTED WETLAND
WETLAND ASSESSMENT AREA (WAA)
STUDY AREA
RCA PIT BOUNDARY
RCA GM STOCKPILE
RCA PERMANENT OVERFILL PILE
RCA TEMPORARY OVERBURDEN PILE
RCA STAGING AREA
RCA SEDIMENT BASIN
RCA DIVERSION DITCH
HAUL ROAD 5
WEST SIDE HAUL ROAD
TEMPORARY RAMP
HAUL ROAD 5 (CENTERLINE)
EXISTING HAUL ROUTE INFRASTRUCTURE (CENTERLINE)
RCA COUNTY ROAD REALIGNMENT
OTHER EXISTING ROAD
INTERMITTENT STREAM
PERENNIAL STREAM
TOPOGRAPHIC CONTOUR: MAJOR
TOPOGRAPHIC CONTOUR: MINOR
Total Acreage of Impacted Wetlands within WAA 14G ac = ARCES
0.21 ac in WAA 14G
Haul Road: 0.21
in Acres
Breakdown of Impacted Wetlands by Project Component
Projection:
North America Datum 1983,
Universal Transverse Mercator,
Zone 12 North
NORTH
0 1,000 2,000 4,000 Feet
RASMUSSEN VALLEY MINE
FIGURE 4.5-2
Impacted Wetlands
under the Rasmussen Collaborative Alternative
ANALYSIS AREA: Caribou County, Idaho
Date: 9/9/2015
Prepared By: JC
File: K:\CO1553\2015_DEIS\Chapter4\RCA_Impacted Wetlands.mxd
Rasmussen Creek
No Name Creek
Sheep Creek
Existing Haul Road
Existing Haul Road
Rasmussen Valley
Angus Creek
Road
Lanes Creek County Road
Lanes Creek
Diamond Creek
Overfill Pile 2
North North GM Stockpile
Overfill Pile 3
Central Temporary Overburden Pile
Temporary Ramp
North Main GM Stockpile
Temporary Ramp
South Temporary Overburden Pile
Central GM Stockpile
Staging Area
Temporary Ramp
Diversion Ditch
Pit and Backfill
Temporary Ramp
West Side Haul Road
South Main GM Stockpile
Temporary Ramp
Haul Road 5
Overfill Pile 1
Blackfoot River Road
Blackfoot River
Diamond Creek Road
1
2
3
4
5
6
7
8
9
10
11
12
13
14A
14B
14C
14D
14E
14F
14G
15
0.21 ac in WAA 14G
Haul Road: 0.21
0.04 ac outside WAAs
Realigned County Road: 0.04

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Table 4.5-15 Direct Impacts to Wetlands from the RCA

Project Component	Affected Wetlands Assessment Area (WAA)	Wetland Category	Wetlands (acres)
Haul Road	WAA 14G	III	0.21
County Road	Outside of Assessment Area	III	0.04
	Total		**0.25**

Source: BC 2012b; BC 2015c

As shown in **Table 4.5-15**, all wetland impacts (0.3 acre) would occur to Category III wetlands. These wetlands are more common than Category II wetlands, but are generally less diverse, and often smaller and more isolated than Category I or Category II wetlands. Category III wetlands provide many functions and values, although they may not be assigned high ratings for as many parameters as Category I or II wetlands.

WAA 14G consists of a seasonal mountain drainage along the western-facing slope of Rasmussen Ridge. The wetland is rated low for short- and long-term surface water storage and uniqueness, and moderate for Idaho special status species and general wildlife habitat, sediment/nutrient/toxicant removal, sediment/shoreline stabilization, production export/food chain support, and groundwater discharge/recharge (BC 2012b). These functions would be reduced as result of the RCA.

As discussed in **Section 3.5.2**, the MWAM was used to determine wetlands functions and values. As described under the Proposed Action, the level at which affected wetlands provide ecological functions was estimated by deriving a functional index that reflects wetland functional parameters compared to an ideal condition. The functional index is a percentage of the level at which ecological functions are being delivered by the affected wetland. This index is multiplied by the acres of wetlands to derive "functional units," which become the "currency" of impact determination and compensatory mitigation.

The RCA would result in the loss of 0.09 functional unit, as summarized in **Table 4.5-16**.

Table 4.5-16 Reduction in Wetland Functional Units as a Result of Dredging or Filling

Wetland Assessment Area	Functional Index (Percent)	Affected Acreage	Functional Unit Lost
14G	46.6	0.21	0.09
Not in WAA	not evaluated	0.04	cannot be calculated
	Total	**0.25**	**0.09**

Source: BC 2012b

Compared to the Proposed Action, the RCA would result in 20.4 fewer acres of permanent removal of wetlands and result in less functional loss (11.99 functional units compared to 0.9 functional unit).

The RCA would result in indirect impacts to wetlands similar to those of the Proposed Action, such as sedimentation by wind-borne and water-borne sediments and storm water runoff. BMPs described in **Section 4.5.1.1** to mitigate these indirect impacts would also be used in the RCA.

The use of water diversion structures under the RCA is unchanged from the Proposed Action. Retention basins, interceptor ditches, conveyance ditches, and culverts would be used in the RCA, similar to those proposed in the Proposed Action. However, the specific locations of

diversion structures would be affected by the change in mine pit dimensions and the haul road realignment. Overall, there would be fewer culverts and fewer sediment basins needed for the RCA. Because there is less capture and management of surface runoff under the RCA, there may be more surface water runoff available, compared to the Proposed Action, to percolate into wetlands and riparian areas. As a result, wetlands carry less potential for becoming drier under the RCA.

The RCA would eliminate the storage of overburden in locations downslope of and external to the mine pit, removing a potential source of selenium impacts to surface waters, and thus riparian areas and wetlands. In addition, the RCA would limit the quantity of selenium material that would be exposed throughout the life-of-mine through direct backfilling to the maximum extent practical and ensuring that the store-and-release cover system is properly constructed. Under the RCA, there would be no measureable loading of selenium or other COPCs to wetlands and riparian areas.

In summary, the RCA would permanently affect 0.3 acre of wetlands of the 424.8 acres of wetlands delineated in the assessment area. The RCA could also indirectly impact wetlands near proposed activities. As a result of project design, project lifetime use of BMPs, acreage and similar functionality of wetlands not impacted in the assessment area, the wetland impacts were determined to be local, long-term, and minor.

Table 4.5-17 summarizes compliance with the PFO ARMP with regard to wetland and riparian resources under the RCA. Applicable CNF RFP standards and guidelines for riparian resources are in **Table 4.7-4**. Greater compliance is achieved through the RCA, compared to the Proposed Action, because there are fewer riparian impacts.

Table 4.5-17 Compliance with Applicable BLM Pocatello ARMP Goals, Objectives, and Actions for Wetland and Riparian Resources

Goal/Objective/Action	Compliance under RCA
Goal VE-1. Provide for the proper functioning condition (PFC) of riparian areas.	The RCA would meet Goal VE-1 because it would not result in long-term removal of riparian habitat and would not directly contribute to degradation of riparian areas. BMPs would also minimize indirect impacts such as sedimentation at crossings of seasonal mountain drainages.
Objective VE-1.1. Maintain properly functioning riparian areas and restore/improve those areas that are not at PFC.	The RCA would meet Objective VE-1.1 because it would not result in long-term removal of riparian habitat and would not directly contribute to degradation of riparian areas. BMPs would also minimize indirect impacts such as sedimentation at crossings of seasonal mountain drainages.
Action VE-1.1.1. Appropriate management guidelines, techniques or practices will be implemented to control erosion, stabilize streambanks, shade/reduce water temperature, and encourage a diversity of desirable riparian vegetation.	Because the RCA was designed to avoid and minimize impacts to riparian habitats, it would not hinder riparian improvement goals including control of erosion, stabilization of stream banks, and maintaining desirable riparian vegetation. The RCA is in compliance with Action VE-1.1.1

Table 4.5-17 Compliance with Applicable BLM Pocatello ARMP Goals, Objectives, and Actions for Wetland and Riparian Resources

Goal/Objective/Action	Compliance under RCA
Action VE-1.1.2. Idaho Standards for Rangeland Health (BLM 1997) will be implemented to maintain or improve riparian areas.	The RCA would meet Action VE-1.1.2 because it would not result in long-term removal of riparian habitat and it would minimize degradation of riparian areas through indirect impacts such as sedimentation. It would also avoid the measureable loading of selenium and other COPCs into wetland and riparian areas.
Action VE-1.1.4. Stream crossings, if necessary, will be designed to minimize adverse impacts on soils, water quality and riparian vegetation.	Action VE-1.1.4 would be met under the RCA. Culverts on the seasonal mountain drainage would be installed to conform to the natural streambed and slope so that natural flows are not impeded. Adverse impacts on soils, water quality, and vegetation would be minimized.

Source: BLM 2012a

4.5.1.2.3 Noxious Weeds

Noxious weed control methods for the RCA are unchanged from those presented in the Proposed Action. The RCA would disturb approximately 28 fewer acres than the Proposed Action. Therefore, because there would be less removal of native vegetation, the potential is decreased under the RCA for non-native plants to colonize disturbed areas.

Similar to the Proposed Action, the RCA would be in compliance with the PFO ARMP noxious weeds and invasive species goals, objectives, and actions (**Table 4.5-9**) as well as the CNF RFP Standards and Guidelines for Noxious Weeds (**Table 4.5-9**). The effects of noxious weeds from the RCA would be short-term and minor.

4.5.1.2.4 Fire Management

Similar to the Proposed Action, following reclamation, the RCA would result in a shift of aspen forest (103 acres) to that of a grass-dominated vegetation community. Therefore, there would be alteration of the fire regime similar to that of the Proposed Action by permanently removing a natural fire break (aspen forest stands) and increasing the size and connectivity of grass and shrubland patches. More forest habitat (20 more acres) would be removed under the RCA.

4.5.1.3 No Action Alternative

Under the No Action Alternative, the federal phosphate leases would not be developed. The No Action Alternative would result in no new impacts to vegetation resources in the Study Area. The No Action Alternative would maintain the current status of vegetation resources in and around the Study Area. However, this does not preclude future development of the federal phosphate leases under a different mine plan.

4.5.2 Irreversible and Irretrievable Commitment of Resources

Under the Proposed Action and RCA, the loss of aspen and wetland/riparian vegetation is considered an irreversible commitment of resources. Although the Mine and Reclamation Plan would re-establish upland grassland and shrub vegetation in disturbed areas after mining

operations end, it is not anticipated that aspen would re-establish in the foreseeable future because the existing rootstock would be removed. Impacted wetland and riparian areas would be re-seeded with upland vegetation, and while off-site mitigation would be required to offset wetland impacts under the CWA, the loss of wetland and riparian habitat within the Study Area would be irreversible. Additionally, while the wetland areas would be reclaimed to baseline elevation and similar hydrologic conditions (therefore, a wetland area may develop), it is anticipated that the wetland functions and values would be different from those of the original wetland.

Long-term loss of vegetation would occur in areas where pit walls are not reclaimed. Over a very long time, exposed pit walls would ultimately weather to a reduced slope configuration conducive to supporting vegetative communities. Therefore, the pit walls would be considered an irreversible or irretrievable commitment of resources.

Under the Proposed Action, irretrievable changes in groundwater quality under and downgradient of the overburden piles would occur affecting the water quality of wetlands along Angus Creek and the Blackfoot River. This would be an irreversible and irretrievable commitment of resources under the Proposed Action. In contrast, the RCA would not result in measurable loading of selenium or other COPCs to wetlands, so this irreversible and irretrievable commitment of resources would not exist under the RCA.

4.5.3 Unavoidable Residual Adverse Effects

For the Proposed Action and RCA, an unavoidable residual adverse impact would occur if existing vegetation were not eventually replaced through reclamation and subsequent natural succession. Agrium would be required to stabilize and re-vegetate disturbed areas in accordance with their approved Mine and Reclamation Plan. Performance bonds would be held by regulatory agencies to ensure that the site is reclaimed to land use plan standards and other established requirements. Despite reclamation efforts, the Proposed Action and RCA would have a long-term residual adverse effect on vegetation communities, as some vegetation types (such as aspen and wetlands) may never recover to baseline conditions. These residual impacts on vegetation are reflected in the HEA results, which are based on vegetation metrics.

Based on the HEA, the Proposed Action would result in a net debit of 3,279 residual DSAYs of wildlife habitat services. The RCA would result in the net debit of 2,242 residual DSAYs of wildlife habitat services (ARCADIS 2015c). This means that either alternative would have a long-term net negative impact on wildlife habitat, as measured by the RICHCOVWET vegetation metric. This debit in wildlife habitat services would constitute an unavoidable residual adverse effect of either alternative. However, the RCA would result in a net debit of approximately 32 percent fewer residual DSAYs compared with the Proposed Action. This would largely be a result of the use of a more diverse reclamation seed mix that includes a variety of native shrubs and forbs, as well as greater plant available moisture provided by the store-and-release cover, which would enhance vegetation recovery on reclaimed areas (ARCADIS 2015b).

4.5.4 Mitigation Measures

Agrium's Mine and Reclamation Plan intends to keep mining disturbances to a minimum and for as short a timeframe as possible with overburden areas and pit backfill advancing in sequence with the active pit. Additionally, the cover would be constructed incrementally as mining advances, which would also help minimize impacts. The reclamation activities for the Proposed Action are described in **Section 2.3.6,** and the reclamation activities for the RCA are described in **Section 2.5.1.8**. The mine schedule is provided on **Figure 2.5-2**.

4.5.4.1 Vegetation

No mitigation measures for vegetation above and beyond what Agrium has proposed in the Mine and Reclamation Plan have been determined to be necessary. Agrium has voluntarily proposed mitigation for upland wildlife habitat that would also potentially benefit vegetation communities. This proposed mitigation is further described in **Section 4.6.4**.

Impacts to vegetation resources would be partially offset through implementation of the Mine and Reclamation Plan. Under the Proposed Action, approximately 415 acres (or 99 percent of the area of disturbed vegetation) would be reclaimed. Under the RCA, approximately 377 acres (or 96 percent of the area of disturbed vegetation) would be reclaimed.

As mining progresses, reclamation would begin on the mined-out areas. Through progressive open pit backfilling and concurrent reclamation, the area of unreclaimed pit disturbance at any one time would be minimized. The Proposed Action pit would be backfilled, capped with a minimum of 3 feet of non-Meade-Peak-containing material, and followed by covering with a minimum of 2 feet of GM. The cover would be sloped to direct drainage of surface water off the reclaimed pit and onto native ground.

The three layers of the RCA store-and-release cover (Cover C) to be placed on the backfill and overburden would retard and store infiltrated precipitation that is percolating through the cover. This retained precipitation could be used as needed by the reclamation vegetation. As under the Proposed Action, the cover would be sloped to direct drainage of surface water off the reclaimed pit and onto native ground.

Existing vegetation would be protected to the extent feasible by limiting surface disturbance to those areas needed for operations. To the extent possible, GM removed from its original location would be placed directly on reclamation areas. The immediate use of GM in reclamation promotes continued growth of vegetative matter and preserves existing seeds in the GM. Some GM would need to be stockpiled because reclamation areas would not always be available at the time that GM must be removed. Agency-approved seed mixes would be used on reclaimed areas (**Table 4.5-2**), and the reclaimed areas would be managed to control invasive and noxious species and prevent their introduction.

4.5.4.2 Wetlands

Agrium would submit a Section 404 permit application to the U.S. Army Corps of Engineers (USACE) for the direct disturbance of wetlands and other WOUS. This EIS constitutes the primary impact analysis that the USACE would use to assess the application. As part of the application, and in compliance with the Final Rule, Compensatory Mitigation for Losses of Aquatic Resources (33 CFR Parts 325 and 332, and 40 CFR Part 230), Agrium would submit a Compensatory Mitigation Plan that identifies potential compensatory mitigation for the USACE to consider in replacement of wetlands and lost functions and values. This may include, but not be limited to, off-site replacement of wetland functions and values through restoration or enhancement of degraded wetlands or waters. The primary goal of compensatory wetland mitigation for the Proposed Action would be to replace or enhance wetland functions to maintain no net loss. The amount of wetland mitigation required would be determined based on the functional assessment conducted for projected levels of ecological functions.

Agrium would implement BMPs to control erosion, sedimentation, and the release of COPCs at the project to protect surface waters, including wetlands, in and around the Proposed Action or RCA. In addition, Agrium would limit the surface area of Meade Peak overburden that would be

exposed at any given time through direct backfilling and, under the Proposed Action, ensuring that a minimum cap thickness of non-Meade-Peak-containing material (3 feet) and a minimum cover of GM (2 feet) are used over any backfill. Under the RCA, the 6-foot thick Cover C would be placed over backfill and overburden. In addition, surface water drainage diversion structures could be constructed prior to initiating each mining phase to intercept runoff before it reaches the pit, thereby reducing runoff water contact with Meade Peak-containing material.

Dust would be mitigated or minimized by surface application of water and, as necessary, supplemented with dust suppressants such as magnesium chloride or calcium chloride. Storm water control structures would include several types of designs to reduce or eliminate risk of surface water contamination. Runoff retention basins for runoff water and silt would be constructed at strategic locations before mining activities occur in that area to collect and contain water exposed to mining disturbances or overburden materials. Conveyance ditches constructed along the outer perimeters of the stockpile sites would transfer surface water runoff from these sites and carry it to runoff retention basins. Culverts would be constructed to convey natural drainages under potential linear obstructions, such as haul roads or county roads, to prevent impacts from stream crossings. Stockpiles would be stabilized with vegetation, straw wattles, and silt fences to minimize erosion.

Surface water control structures would include several types of designs to reduce or eliminate risk of surface water contamination. Runoff retention basins for runoff water and silt would be constructed at strategic locations before mining activities occur in that area to collect and contain water exposed to mining disturbances or overburden materials. Conveyance ditches constructed along the outer perimeters of the stockpile sites would transfer surface water runoff from these sites and carry it to runoff retention basins. Culverts would be constructed to convey natural drainages under potential linear obstructions, such as haul roads or county roads, to prevent impacts from stream crossings. Stockpiles would be stabilized with vegetation, straw wattles, and silt fences to minimize erosion.

In accordance with (laws/regulations), an SPCC Plan would be developed prior to construction and operations, providing direction for preventing and controlling potential spills; describing the aboveground tanks and secondary containment structures for bulk petroleum products, solvents, and antifreeze; identifying the routine monitoring requirements; and describing BMPs established to prevent releases of the pollutants of concern.

Agrium has prepared an EMP (**Appendix A**) identifying a groundwater and surface water monitoring network to monitor compliance with IDEQ water quality standards.

4.5.4.3 Noxious Weeds

To limit the potential expansion of noxious weeds within the Study Area, Agrium would monitor for and treat noxious weeds in reclaimed areas for the duration of the Proposed Action including pre-mining preparation and post-mining reclamation. Agrium would also follow the applicable actions, standards, and guidelines from the PFO ARMP and the CNF RFP for the monitoring and control of noxious weeds, as listed in **Table 4.5-8** and **Table 4.5-9**. No further mitigation measures have been determined to be necessary for noxious weeds.

4.6 TERRESTRIAL WILDLIFE

Issue: What is the potential to impact wildlife through mortality and displacement?

Indicators:

- Increase in mining and transportation-related noise levels in wildlife habitat
- Increased wildlife mortality through vehicle and power line collisions
- Disruption and displacement of wildlife from high value habitats (e.g., movement corridors, wintering areas, calving areas, nest sites, wetland and riparian habitats)

Issue: What is the potential to impact wildlife through habitat removal and alteration?

Indicators:

- Acres of different wildlife habitats physically disturbed and reclaimed
- Changes in predator/prey interactions and species composition of wildlife community

Issue: What is the potential for toxicity to wildlife from selenium or other COPCs?

Indicators:

- Wildlife exposure through uptake of selenium or other COPCs in vegetation
- Wildlife exposure through release of selenium or other COPCs into surface waters

Issue: What is the potential to impact migratory birds?

Indicators:

- Reduction in the quality or quantity of habitats used by migratory birds
- Direct mortality of migratory birds
- Disturbance to migratory birds from noise and mining activity

4.6.1 Direct and Indirect Impacts

4.6.1.1 Proposed Action

Impacts of the Proposed Action on terrestrial wildlife would include: 1) immediate, direct effects in terms of wildlife mortality, disturbance, and displacement; and 2) changes in wildlife behavior and composition associated with long-term changes in land cover and reclamation.

Under the Proposed Action, one potential direct impact on terrestrial wildlife would be mortality, particularly when species are not mobile enough to avoid mining equipment or vehicles. Although small mammals and ground-nesting birds are more likely to experience these types of mortalities, mortalities of large and intermediate-sized wildlife (e.g., coyote, big game, raptors) may occur because of vehicle and power line collisions or electrocutions in the Study Area. Mortalities are likely to occur on an individual, short-term, and localized scale. The impact of these mortalities at the population or community level is, therefore, expected to be negligible. Direct impacts on large and mobile terrestrial wildlife may include disturbance and displacement. These impacts are expected to have a greater effect on intermediate- and large-sized mammals (e.g., coyote and

big game) and birds. These wildlife groups may be disturbed by human presence and noise, which could lead to stress and behavior modifications that could ultimately impact reproductive success and survivorship. As mining proceeds, terrestrial wildlife may also displace into adjacent areas to establish temporary or long-term territories and home ranges. Displacement to already occupied habitats would likely result in increased competition for available resources. Depending on the season and species, overall disturbance and displacement impacts would be short-term and negligible to minor.

Wildlife may also be indirectly affected by exposure to COPCs including selenium in vegetation and surface water. An effective cap-and-cover design over backfill and overburden and the use of seed mixes with species that are relatively shallow rooted and not selenium accumulators would address issues associated with adverse COPC concentrations in reclamation vegetation. The seed mixes developed for the Proposed Action and the RCA both use species that are relatively shallow rooted and are not selenium accumulators. Therefore, vegetation growing on the reclaimed areas would not create a selenium exposure pathway for wildlife.

The potential also exists for wildlife to have access to contaminated water. As described in **Section 4.3.1**, shallow groundwater percolating through overburden piles is predicted to introduce COPCs into downgradient surface waters (including Angus Creek and the Blackfoot River). However, increased COPC concentrations in downstream surface waters would still be lower than surface water standards (**Table 4.3-11** and **Table 4.3-12**), and exposure to COPCs through drinking water is considered less of a risk to wildlife than exposure via bioaccumulation through the food chain (ITRC 2011). Wildlife that consume aquatic insects, plants, and fish, and those that prey upon wildlife consuming these foods, may therefore be most at risk of toxicity associated with exposure to COPCs within and around the Study Area. These effects would be long-term and negligible depending on a wide range of factors including the mobility of the affected species, the percentage of time spent in the vicinity of the Study Area, the susceptibility of the species to toxicity effects, the concentration of COPCs in surface waters/vegetation, and the abundance or rarity of the species.

Indirect effects to terrestrial wildlife populations from habitat alteration and reclamation would generally be localized and long-term. As described in **Section 4.5**, the Proposed Action would result in the loss of approximately 419 acres of primarily forested and shrubland wildlife habitat. This includes 399 acres of disturbance to upland habitats and 20.5 acres of disturbance to wetland and riparian habitats, which are particularly high-value wildlife habitats. Although wetlands only comprise 1 percent of Idaho's land area, more than 75 percent of Idaho's wildlife species depend on them during some part of their life cycle (IDFG 2004). Therefore, disturbance to wetlands resulting from the Proposed Action may have a disproportionately greater impact on wildlife than disturbance to upland habitats.

Approximately 99 percent of disturbed habitat would be reclaimed with grasses and shrubs. Over the long term, reclaimed areas would likely regain the level of wildlife habitat services provided by the baseline on-site big sagebrush and high-elevation rangeland habitat types. However, even after reclamation, the Proposed Action would result in the net debit of 3,279 RICHCOVWET DSAYs (units that represent wildlife habitat services in the HEA; ARCADIS 2015c). This means that the Proposed Action would have a long-term net negative impact on wildlife habitat. Aspen forest habitats are unlikely to re-establish in reclaimed areas because of different soil characteristics and drier conditions, as well as removal of aspen root systems from the soil. As such, reclamation would result in a shift in some areas from forest to perennial grasses and shrubs and, therefore, would contribute to long-term fragmentation of formerly forested areas. Also, the shift in vegetation community from forest to grasses and shrubs in some reclaimed areas could change the species composition of the wildlife community as forest-dependent species (e.g.,

woodpeckers, martens) locally decline in abundance while grassland, shrub, and generalist species (e.g., meadowlarks, coyotes) locally increase in abundance in the Study Area.

4.6.1.1.1 Mammals

Direct impacts on mammals would be similar to those described for terrestrial wildlife in general. Small mammals may be crushed or trampled by mine equipment or vehicles. Large- and intermediate-sized mammals may be killed by moving vehicles along haul roads. Mortalities are expected to occur on a short-term, individual, and localized scale; therefore, population- or community-level impacts on wildlife from mortalities would likely be negligible.

Direct impacts to mammals may also occur from selenium in water sources. However, big game and intermediate-sized mammals (e.g., coyote) tend to range over large areas, and their behavior would tend to reduce their risk of chronic effects of selenium uptake and bioaccumulation from water. Small mammals could also be susceptible to selenium bioaccumulation from water if local populations spend a significant amount of time in the analysis area; however, these affects would be localized and negligible.

In terms of indirect impacts, habitat alteration, disturbance, and displacement from mine activities would affect mammals. Habitat structure and composition determine the current diversity of species in the analysis area. The landscape alteration would cause some large mammals to displace to surrounding habitats, potentially increasing competition for resources with other wildlife already occupying those habitats. However, some species (such as coyote) may acclimate to human presence and disturbances and may continue using resources in the analysis area.

Over the long term, reclaimed areas are anticipated to recover to big sagebrush and high-elevation rangeland habitat types. Aspen forest habitats are unlikely to re-establish in reclaimed areas because of different soil characteristics and drier conditions, as well as removal of aspen root systems from the soil. As such, reclamation would result in a shift in some areas from forest to perennial grasses and shrubs. This shift in the plant community could change the species composition of the mammalian community as forest-dependent species locally decline in abundance while grassland, shrub, and generalist species locally increase in abundance in the Study Area. Because of the localized scale of landscape alteration, overall indirect impacts on mammals are expected to be long-term and negligible to minor.

Direct and indirect impacts on individual groups of mammals are analyzed below. Note that the impacts generally described for mammals apply to all groups discussed in the following paragraphs. Therefore, only those impacts unique to each individual mammal group are discussed.

<u>Big Game</u>

Preliminary IDFG data indicate that elk and moose winter range minimally overlaps but is present all around the Study Area (Wackenhut 2014), and observations made by TRC during baseline studies for the Proposed Action verify this information (TRC 2012b). Based on where winter range is expected to occur in comparison to the facilities layout for the Proposed Action, some IDFG-mapped elk and moose winter range would be directly impacted. Furthermore, the Proposed Action facilities overlap with approximately 47 acres of elk and mule deer winter range as mapped in the CNF RFP (USFS 2003). This area would be stripped of vegetation and would therefore be unusable as winter range by big game during active mining. Winter range is especially important for big game, as it provides valuable food and thermal cover that allows these species to conserve energy during severe weather conditions (USFS 2003). Therefore, the temporary loss of winter range would have a long-term and minor effect on big game survivorship, at least until it was

reclaimed and again supported vegetation of sufficient density and cover to provide food and shelter.

Although winter range habitat impacted by the Proposed Action would be reclaimed, the successional stages of grassland habitat to shrubland would take a number of years. Until it had fully recovered, the habitat would not provide the same structure and complexity as it did prior to disturbance. Increased human presence associated with the mine and reduction in cover may also intensify the potential for wildlife-human interactions.

Preliminary IDFG data suggest that mule deer summer range overlaps the entire Study Area and broadly surrounds it (Wackenhut 2014). Mule deer are dependent on shrublands for browse and cover (Cox et al. 2009), so the initial loss of shrubs from the impacted areas is likely to adversely affect mule deer in the Study Area over the short term. Over the long term, as reclaimed areas return to shrubland through succession, these areas would once again become suitable mule deer foraging habitat.

Noise and human presence associated with the mine would interrupt big game movement corridors and displace some big game into adjacent habitat. Mule deer have been found to avoid heavily disturbed areas at mines during migration (Merrill et al. 1994; Blum et al. 2015). In addition to affecting movement corridors, there would likely be at least some displacement of big game from parturition and winter ranges over the short term. Noise and disturbance during the calving/fawning season may cause pregnant elk and mule deer and those with young calves/fawns to vacate the area, which could negatively impact calf and fawn survivorship. Human-related disturbances on winter ranges can cause big game to burn necessary fat reserves that help them survive the winter. Any extra activity or unnecessary movements, such as running from the sound of a vehicle, could affect survivorship, as could the need to travel farther to alternate areas of crucial range (Canfield et al. 1999; Lutz et al. 2011).

A study of elk calf response to human activity and simulated mine noises in southeastern Idaho found that calves exposed to disturbance moved farther, used larger areas, and used less favorable habitat than calves not exposed to disturbance (Kuck et al. 1985). However, if a resource in the disturbance area is of high quality, or there is no suitable alternative habitat, then big game may not flee (Frid and Dill 2002). In addition, there are existing active mines in the vicinity (e.g., Rasmussen Ridge), and it is possible that some individual big game may have become habituated to noise, disturbance, and human presence associated with mining activities in the area.

Overall, impacts to big game would be long-term and moderate under the Proposed Action. The effects of noise and disturbance would be short-term but would occur over a relatively wide area, whereas the effects of habitat removal would be localized to the mine footprint but would be long-term.

Bats

Mining activities could disturb bat roosts and result in the long-term loss of bat foraging habitat. Undocumented bat roosts and habitat could be directly impacted under the Proposed Action through removal of trees (primarily aspen trees). Bats may also collide with vehicles and mine equipment, particularly when they are most active at night during the summer. Because no mine shafts or caves have been identified within the Study Area, the Proposed Action is most likely to affect small numbers of individual bats that may be roosting in trees or rock crevices and is unlikely to have population-level impacts because of the lack of significant roosts or hibernacula identified

in the Study Area. Overall, impacts to bats are expected to be minor, as they would occur on an individual and localized scale.

4.6.1.1.2 Birds

Upland Game Birds

The Proposed Action would result in the permanent loss of approximately 83 acres of forested habitat for dusky and ruffed grouse. Indirect impacts from loss of habitat would be long-term because final reclamation would emphasize establishment of communities dominated by perennial grasses and shrubs. Although grouse would probably migrate to other suitable habitats outside the disturbed area, they may in the short term be subject to increased predation by raptors and other predators as a result of a reduction in vegetative cover. The power line that would be constructed under the Proposed Action may provide a perching platform for raptors and make it easier for them to prey on grouse over the short term. Because of the localized scale of land disturbance, overall impacts on upland game birds are expected to be minor. Impacts to greater sage-grouse and Columbian sharp-tailed grouse are discussed in **Section 4.8**.

Migratory Birds

The Proposed Action would result in the short-term loss of 419 acres of migratory bird habitats. Most of these areas would be reclaimed, but the post-reclamation habitat structure and composition would change toward a grassland-dominated community (initially), which would develop into upland shrubland over the long term. Birds that use shrubland, riparian, and forest communities would likely decrease in abundance in the Study Area after mining, whereas those that are generalist species or that use grasslands may remain at levels similar to baseline or increase in abundance. Bird species associated with aspen, sagebrush, high-elevation rangeland, and riparian/wetland habitats would be affected the most.

Potential direct effects would include direct mortality (trampling, vehicle collision, power line collision), forced movement, and stress related to increased noise and human activity. Agrium would plan ground-clearing activities during the non-nesting season to minimize potential impacts to nesting birds. Indirect effects could include increased competition between displaced individuals and resident birds.

Many species of migratory birds are susceptible to collision with power lines, especially during inclement weather, when the lines may be harder to see (Loss et al. 2014; Manville 2005). A recent study estimated that there is an average of 29.6 collision-caused avian mortalities per km of power line per year in the U.S. (though this collision rate varies widely depending on a number of factors such as habitat and the species involved; Loss et al. 2014). Assuming Agrium's 0.7-mile-long power line is in place for 5 years, this would equate to roughly 167 avian mortalities caused by the power line over the life-of-mine. This would be a short-term, negligible to moderate impact on local migratory bird populations, depending on the species involved (species with large, increasing or stable populations are less likely to be adversely impacted by localized individual mortalities, whereas species with small or declining populations are more likely to be adversely impacted).

The Proposed Action would also result in habitat fragmentation: the division of blocks of contiguous habitat into smaller, isolated patches. The effects of habitat fragmentation on bird communities may depend on the scale of analysis (Fahrig 2003). On a landscape scale, fragmentation of shrub steppe habitats in the Intermountain West has been linked to range-wide declines in several bird species, including Brewer's sparrows, western meadowlarks, and horned larks (Knick and Rotenberry 2002). However, on a more localized scale (such as the Study Area),

vegetation characteristics within habitats seem to have a larger influence on productivity and survival of individual birds than the juxtaposition of those habitats on the landscape (Knick and Rotenberry 2002). Also, evidence suggests that birds breeding in naturally patchy landscapes may be relatively tolerant of habitat fragmentation (Berry and Bock 1998). The habitats in the Study Area are naturally patchy; therefore, the effects from additional fragmentation caused by the Proposed Action are anticipated to be minor.

Studies have shown that bird populations, particularly breeding bird populations, may be negatively impacted by elevated noise levels (Reijnen and Foppen 2006; Bayne et al. 2008; Ortega 2012). Increased visual stimuli may also affect bird populations at relatively short distances, but the effects of noise appear to be the most critical factor for birds. Traffic and noise from mining activities could affect bird populations in a number of ways.

Acoustic interference from noise could hamper the detection of mating songs, making it more difficult for birds to establish and maintain territories, attract mates, or maintain pair bonds (Reijnen and Foppen 1994, Habib et al. 2007, Swaddle and Page 2007 as cited in Reijnen and Foppen 2006; Ortega 2012). Thus, noisy habitats may reduce breeding success. When begging for food, nestlings may also need to call louder to elicit the desired response from their parents (Leonard et al. 2005 as cited in Reijnen and Foppen 2006; Ortega 2012). As a result, the energetic cost of obtaining food may increase and fitness may decrease (Schroeder et al. 2012). High levels of traffic noise may also interfere with the detection of alarm calls, such as those signaling the presence of predators, which could lead to higher rates of predation (Parris and Schneider 2008; Ortega 2012).

Because birds may avoid areas close to noise sources, noise may effectively extend habitat disturbance beyond the actual facility footprint. The effects of traffic noise on nesting birds may extend more than 300 m on both sides of roadways (Ortega 2012). McClure et al. (2013) found a negative relationship between recorded traffic noise and the abundance of 13 species of migratory birds at a site in Idaho. In a study of songbirds near energy facilities in Alberta, Canada, songbird density was 1.5 times higher near noiseless facilities than near noise-producing facilities (Bayne et al. 2008), indicating that birds avoided the noisy areas. Francis et al. (2009) found fewer species of birds nesting near natural gas wells with noise-producing compressors than at noiseless control sites.

The effects of noise are species-specific, with some species (e.g., black-chinned hummingbirds and house finches) seeming to prefer noisy sites in the Francis et al. (2009) study and others (e.g., mourning dove and black-headed grosbeak) avoiding these sites. Several species (e.g., gray flycatchers, gray vireos, black-throated gray warblers, and spotted towhees) avoided placing their nests near noise sources in the Francis et al. (2009) study, and the authors concluded that the effects of noise on the breeding bird community were predominantly negative. Similar conclusions were reached in a study of the impacts of traffic noise on bird communities in Puerto Rico, where bird species richness and occurrence were lower at sites near highways with noise exceeding 60 dBA than at sites with noise levels below 60 dBA (Herrera-Montes and Aide 2011). A New Mexico study found that impacts of gas well compressor noise on breeding songbird populations in pinyon-juniper habitat were strongest in areas where noise levels were greater than 50 dBA (LaGory et al. 2001). However, moderate noise levels (40 to 50 dBA) also had some effect on bird densities in this study (LaGory et al. 2001).

Migratory birds using the Study Area could be subject to indirect impacts of selenium, which include impaired reproduction and survivorship. However, significant population-level effects of COPCs on migratory birds have not been observed for birds in the Idaho phosphate patch, even

at historical mines that were constructed without a cap and cover. In 1999 and 2000, Ratti et al. (2006) tested selenium levels in 544 bird eggs from mine and reference sites in southeastern Idaho, and in 2001 the authors monitored the nest success of 623 American robin and red-winged blackbird nests at these sites. The authors concluded, "On a population level, American robin and red-winged blackbird reproductive success in southeastern Idaho was not impaired by existing levels of selenium in avian eggs. Based on our multi-species data . . . and more-specific data on American robins and red-winged blackbirds, we conclude that there are no negative effects on reproductive success of the general avian community at this time." The authors go on to acknowledge that negative effects may be occurring in some bird species immediately adjacent to some historical mine sites, where high selenium concentrations (>10 micrograms per gram [µg/g]) were observed in eggs (Ratti et al. 2006).

Under the Proposed Action, the potential exposure pathway would be through downstream surface waters and the aquatic food chain; however, risk of exposure through this pathway would be low because the predicted increased selenium concentrations in downstream surface waters are still below surface water standards.

Overall, impacts of the Proposed Action on migratory birds would be long-term and minor.

Raptors

Raptors that occur in the Study Area could be directly and indirectly affected by the Proposed Action. Raptors could be subject to mortality and could be directly disturbed by noise and activity associated with the mine and proposed 0.7-mile-long power line. Raptors are sensitive to noise and human presence near their nests and may become agitated and ultimately abandon nests located near disturbance. The distance at which raptors are sensitive to disturbance varies by species, habitat, topography, and even the habituation of individual birds to humans (Richardson and Miller 1997). To minimize impacts to nesting raptors, Agrium would implement appropriate mitigation measures, such as buffer zones around occupied nests, during the nesting season.

Raptors often perch and nest on power line poles and could be at risk of electrocution. To address this issue, Agrium would implement Avian Power Line Interaction Committee (APLIC) design measures that reduce the risk of electrocution, which may include, but would not be limited to, a 60-inch separation between conductors or grounded hardware as well as the use of insulating or cover-up materials for perch management. Raptors may also collide with the power line. As described above under migratory birds, the Proposed Action power line may result in roughly 167 avian mortalities over the duration of the Proposed Action, based on the nationwide average collision rate (Loss et al. 2014). At least some of these mortalities may be raptors, because raptors are known to be vulnerable to power line collision (Manville 2005).

Indirect disturbances would include loss of foraging habitat, reduction or alteration of prey base, and loss of nesting habitat. Over the short term, the Proposed Action would reduce habitat for a number of prey species, including mice, voles, ground squirrels, and rabbits. However, abundant foraging habitat exists adjacent to the Study Area, which would limit the potential effects of the Proposed Action. In addition, reduced plant cover on disturbed areas following reclamation may make prey species that colonize those areas more visible to raptors.

With implementation of buffer zones around active raptor nests and use of APLIC measures on the power line, overall impacts on raptors under the Proposed Action are expected to be short-term and minor.

Passerines and Small Birds

Passerines and small birds (PSBs) would be directly and indirectly affected by the Proposed Action as described above under migratory birds. PSBs and their nests could be directly trampled by mining equipment and vehicles, they could collide with mine facilities, and they could be disturbed by noise and activities associated with construction and mine operation. Indirect disturbances would include loss of foraging habitat, cover, and nesting habitat as well as exposure to COPCs including selenium. Impacts to PSBs are expected to be long-term and negligible. Measures discussed above generally for migratory birds would be implemented to minimize impacts to nesting PSBs.

Water Birds

Water birds would be subject to impacts similar to those described more generally for migratory birds. Water birds are particularly sensitive to the removal and degradation of riparian and wetland habitats, as they depend on these habitats to a greater degree than upland birds. In addition, water birds are particularly sensitive to power line collision, especially where power lines cross wetland and water habitats. Water birds tend to be large bodied and less maneuverable than other groups of birds. Relatively large numbers of cranes, herons, swans, and pelicans are known to be killed in areas where power lines cross wetlands (Manville 2005). The Proposed Action power line would cross the Blackfoot River, where it has the potential to cause disproportionately high mortality of water birds over the short term.

Impacts to surface water quality from chemical loading of COPCs could degrade habitat for water birds. As discussed in **Section 4.3**, additional loading of COPCs to water resources downgradient of the Study Area, including Angus Creek and the Blackfoot River is predicted. Therefore, water birds using these habitats may be exposed to selenium when they forage on fish, aquatic plants, and aquatic invertebrates. However, these impacts would be negligible, as the predicted increased selenium concentrations in downstream surface waters would be lower than surface water standards. These impacts would be long-term.

Studies suggest that a relationship may exist between selenium sensitivity and salt tolerance among water bird species. For example, sea birds (e.g., gulls) seem to tolerate much higher selenium exposures without apparent ill effect than do freshwater birds. In contrast, freshwater ducks are among the bird species most sensitive to selenium (Hamilton 2004). Therefore, if the Proposed Action were to release selenium into the environment, freshwater ducks may potentially be vulnerable to indirect mortality and reproductive impacts associated with selenium toxicity. Symptoms of selenium toxicity in aquatic birds include embryo deformities, decreased growth and survival of hatchlings, impairment of immune function, lesions, and mortality of adults (Spallholz and Hoffman 2002). The potential for these effects to occur is long-term and negligible given the predicted small increases in selenium in downstream surface waters under the Proposed Action.

Overall, impacts to water birds as a result of the Proposed Action are expected to be long-term and minor. Implementation of BMPs to minimize COPCs in the watershed, and the measures that would be implemented to reduce impacts to migratory birds more generally, would help to alleviate adverse effects.

Table 4.6-1 summarizes compliance with the PFO ARMP with regard to wildlife resources under the Proposed Action. The following actions pertaining to wildlife were also reviewed and found to be not applicable to a mining project:

- Actions FW-1.1.2 through 1.1.8
- Actions FW-1.1.9 through 1.1.10
- Actions FW-2.1.1 through 2.1.3

Table 4.6-1 Compliance with PFO ARMP Goals, Objectives, and Actions for Wildlife Resources

Goal/Objective/Action	Compliance under Proposed Action
Goal FW-1. Manage wildlife habitats so vegetation composition and structure assures the continued presence of fish and wildlife as part of an ecologically healthy system.	The Proposed Action would be consistent with this goal because the majority of disturbed areas would be reclaimed to grassland and shrubland, which would eventually recover to the baseline habitat quality of big sagebrush and high-elevation rangeland on the mine site. However, losses of aspen and wetland/riparian habitats within the mine footprint would likely be permanent.
Objective FW-1.1. Maintain and improve wildlife habitats to support IDFG management objectives.	The Proposed Action would be consistent with this objective over the long term because the majority of disturbed areas would be reclaimed to grassland and shrubland, which would eventually recover to the baseline habitat quality of big sagebrush and high-elevation rangeland on the mine site. Over the short term, the Proposed Action would result in reduced habitat and forage for big game and other species.
Action FW-1.1.1. As appropriate and practicable, elk and deer habitat on public lands will be managed as identified below in order to generally support IDFG management objectives for southeast (SE) Idaho management units. Riparian areas will be managed for habitat and population linkage areas by applying appropriate management techniques that may include but are not limited to: • Fencing, • Providing adjacent cover strips, and • Controlling noxious weeds. Aspen will be treated by applying appropriate management techniques that may include but are not limited to: • Removing encroaching conifer in Aspen clones. • Slashing old age aspen clones while leaving snags and some live trees. • Fencing degraded aspen clones. • Pursuing the use of prescribed fire. • Plowing Aspen roots to release clones. Degraded riparian areas will be restored.	The Proposed Action would be inconsistent with maintaining/improving riparian and aspen habitats, because it would result in the permanent loss of approximately 20.5 acres of riparian/wetland habitats and 83 acres of aspen forest. Mitigation for wetland impacts would be implemented in accordance with CWA requirements. Agrium has also proposed voluntary mitigation for upland wildlife habitat impacts, as described in **Section 4.6.4**.
Goal FW-2. Provide for the diversity of native and desired non-native species as part of an ecologically healthy system.	The Proposed Action would be consistent with this goal because the majority of disturbed areas would be reclaimed with a mixture of native and desirable non-native grass, forb, and shrub species. Plant species richness on reclaimed areas is anticipated to be similar to baseline species richness. Over the long term, reclaimed areas are predicted to recover to the baseline habitat quality of big sagebrush and high-elevation rangeland on the mine site. However, the Proposed Action may result in localized declines in abundance of wildlife species that are dependent on aspen, riparian, and wetland communities, as it would result in permanent losses of these habitats within the mine footprint.
Objective FW-2.1. Maintain or improve native and	The Proposed Action would be consistent with this

Table 4.6-1 Compliance with PFO ARMP Goals, Objectives, and Actions for Wildlife Resources

Goal/Objective/Action	Compliance under Proposed Action
desired non-native species habitat and the connectivity among habitats.	objective because the majority of disturbed areas would be reclaimed with a mixture of native and desirable non-native grass, forb, and shrub species. Reclaimed areas would eventually return to baseline level of wildlife habitat service provided by the on-site big sagebrush and high-elevation rangeland habitats. While wildlife may avoid the project during active mining, the habitats in the Study Area are naturally patchy, and the Proposed Action is not anticipated to significantly disrupt habitat connectivity over the long term.

Source: BLM 2012a

Table 4.6-2 summarizes compliance with the CNF RFP with regard to wildlife resources under the Proposed Action. The following standards and guidelines pertaining to wildlife were also reviewed and found to be not applicable to the Proposed Action, as they relate to other types of forest management practices (e.g., timber harvest, grazing) and not to a mining project:

- Dead and Down Material Guideline 1
- Snag/Cavity Nesting Habitat Standards 1 through 3 and Guidelines 1 through 5
- Big Game Guideline 3
- Landbirds Guideline 4

Table 4.6-2 Compliance with Applicable Caribou Forest Plan Standards and Guidelines for Wildlife Resources

Standard/Guideline	Compliance under Proposed Action
Big Game Guideline 1: Provide for vegetation buffers of at least one sight distance (Thomas 1979) around big game concentration/use areas, such as wallows and mineral licks. Sight distance is the distance at which 90 percent of a deer or elk is hidden from an observer. This will vary depending on site specific stand conditions.	No big game concentration areas, such as wallows or mineral licks, have been identified in the Study Area.
Big Game Guideline 2: Provide for security or travel corridors near created openings.	Over the short term, this guideline would not be met under the Proposed Action. As a result of noise and human presence, it is likely that wildlife such as big game would avoid a larger area than the actual disturbance footprint, reducing the amount of security habitat and potentially disrupting local travel corridors in the vicinity of the Proposed Action. However, the relatively small area of disturbance under the Proposed Action is not anticipated to impact security or travel corridors on a Forest-wide scale.
Landbirds Guideline 1: Stands of mature trees (including snags and dead-topped trees) should be maintained next to wet meadows.	The Proposed Action would not remove any stands of mature trees adjacent to wet meadows (the wet meadows in the Study Area are adjacent to sagebrush rangelands; see **Figure 3.5-1**).

Table 4.6-2 Compliance with Applicable Caribou Forest Plan Standards and Guidelines for Wildlife Resources

Standard/Guideline	Compliance under Proposed Action
Landbirds Guideline 2: Where feasible, maintain 30 to 50 percent of the sagebrush habitat in a 5th code HUC in contiguous blocks greater than 320 acres to support sagebrush obligate species.	The Proposed Action would be consistent with this guideline because it would not reduce any contiguous blocks of big sagebrush habitat to less than 320 acres.
Landbirds Guideline 3: Practices which stabilize or increase native grass and forbs cover in sagebrush habitats with 5% to 25% sagebrush canopy cover should be implemented.	The Proposed Action would be consistent with this guideline over the long term (though approximately 199 acres of sagebrush habitat would be removed during the Proposed Action). A variety of native and desirable non-native grass and forb species would be used in the seed mixes. Areas reclaimed with the southwest slope aspects seed mix are predicted to achieve 3 percent cover of big sagebrush by year 25 and 14.5 percent cover of big sagebrush by year 50. At year 25, forb cover is anticipated to total 10 percent, and grass cover is anticipated to total 40 percent in these areas. At year 50, forb cover is anticipated to total 13 percent and grass cover is anticipated to total 42 percent in these areas (ARCADIS 2015a).
Prescription 8.2.2 Wildlife Guideline 1: Mining operations should be designed to accommodate big game migration	No major big game migration corridors have been identified within the analysis area; however, because of the presence of fawning/calving habitat and winter range in and around the Study Area, it is likely that the Proposed Action would disrupt big game movements, at least during the short-term period of active mining. Following final reclamation and cessation of human disturbance, it is anticipated that big game would no longer avoid the area.
Prescription 8.2.2 Wildlife Guideline 2: Reclamation should be designed to minimize wildlife exposure to hazardous substances	The Proposed Action cover system is designed to prevent the bioaccumulation of selenium and other COPCs by reclamation vegetation.
Prescription 8.2.2 Wildlife Guideline 3: Consider vegetation species that contribute to wildlife habitat needs when developing reclamation plans and create wildlife structures (slash piles, logs, rock piles) using native vegetation and materials to provide habitat diversity in created openings, where possible.	This guideline would be met under the Proposed Action. A variety of native and desirable non-native grasses, forbs, and shrubs would be used in the seed mixes for reclamation to promote post-reclamation use by wildlife. Reclamation plans do not specifically incorporate the use of wildlife structures, such as slash piles, logs, and rock piles; however, these structures may be used as appropriate in accordance with this guideline.
Prescription 8.2.2 Wildlife Guideline 4: Encourage construction of ledges on suitable pit walls to accommodate cliff-dwelling species.	This guideline would be met under the Proposed Action. The remaining pit walls and benches would be available for cliff-dwelling species.

Source: USFS 2003

4.6.1.2 Rasmussen Collaborative Alternative

The types of potential impacts on terrestrial wildlife resulting from the RCA would be similar to those described in **Section 4.6.1.1** for the Proposed Action. The total acreage of wildlife habitat loss would be smaller by about 28 acres. In addition, the RCA would directly disturb approximately 20.5 fewer wetland acres compared with the Proposed Action and would avoid the construction

of a haul road through the wet meadows and riparian habitats in Rasmussen Valley. Use of an existing haul road and previously disturbed areas under the RCA would consolidate disturbance on the landscape and result in less habitat fragmentation compared with the Proposed Action.

The RCA would result in the permanent loss of approximately 20 more acres of aspen habitat compared with the Proposed Action. Therefore, impacts of habitat loss would be reduced for some species (e.g., those that use wetlands and riparian habitats) compared with the Proposed Action, but would potentially be greater for species that use aspen forests. It is not anticipated that aspen would re-establish because the existing root stock would be removed as a result of mine disturbance. Reclaimed areas would likely recover to high-elevation rangeland habitat over the long term, which would favor shrubland wildlife species. Therefore, the RCA may result in a localized shift in wildlife community composition from forest-dependent to shrubland species over the long term, and this shift may be slightly more pronounced compared with the Proposed Action.

Compared with the Proposed Action, the RCA would remove approximately 69 fewer acres of sagebrush habitat and approximately 28 more acres of high-elevation rangeland habitat. Therefore, the RCA would result in relatively less habitat loss and displacement of sagebrush-dependent species but more habitat loss and displacement of species that use high-elevation rangeland habitat. Total acreage that would be reclaimed would be similar under the RCA and the Proposed Action. The RCA would reclaim approximately 30 acres of the South Rasmussen Mine pit, which would have gone unreclaimed under P4's current reclamation plan. These reclaimed acres would initially support grasses that could be used as forage by wildlife and eventually return to high-elevation rangeland habitat through succession.

Under the RCA, approximately 96 percent of disturbed habitat would be reclaimed with grasses and shrubs. Over the long term, reclaimed areas would likely regain the level of wildlife habitat services provided by the baseline on-site high-elevation rangeland habitat type. However, even after reclamation, the RCA would result in the net debit of 2,242 RICHCOVWET DSAYs (units that represent wildlife habitat services in the HEA; ARCADIS 2015c). This means that the RCA would have a long-term net negative impact on wildlife habitat. However, the RCA would result in a net debit of approximately 32 percent fewer residual DSAYs compared with the Proposed Action. This would largely be a result of the use of a more diverse reclamation seed mix that includes a variety of native shrubs and forbs, and greater plant-available moisture provided by Cover C, which would enhance vegetation recovery on reclaimed areas (ARCADIS 2015c).

The RCA would eliminate the need to construct an overhead power line, therefore eliminating potential avian mortality that could occur along this line under the Proposed Action. This would also eliminate potential perching by predators such as raptors and ravens.

The potential for wildlife to be affected by COPCs in surface waters that could result from the mining at Rasmussen Valley was addressed by eliminating the downslope external overburden piles overlying the shallow alluvial aquifer that could carry COPC seepage from the piles into the downgradient surface waters. Therefore, the potential for wildlife exposure to COPCs from the mine would be virtually eliminated under the RCA compared with the Proposed Action.

Overall, impacts to wildlife under the RCA would be reduced compared with the Proposed Action. Depending on the season and species, overall disturbance and displacement impacts would be long-term and range from negligible to minor.

4.6.1.2.1 Mammals

Big Game

Impacts to big game under the RCA would be similar in type to those that would occur under the Proposed Action, and include direct, long-term habitat loss in elk and moose winter range and elk and mule deer parturition habitat, as well as short-term disturbance to individual animals from noise and human presence. The RCA facilities overlap with approximately 70 acres of elk and mule deer winter range as mapped in the CNF RFP (USFS 2003; 23 more acres than under the Proposed Action). This area would be stripped of vegetation and would therefore be unusable as winter range by big game during active mining. Relative to the Proposed Action, the RCA would result in fewer acres of direct loss of wetland/riparian habitat and more acres of direct loss of aspen habitat. Both habitat types are important for big game. Because the RCA would use an existing haul road and consolidate some disturbance in previously disturbed areas on the South Rasmussen Mine, net impacts to big game would likely be reduced compared with the Proposed Action because there would be less fragmentation of the wet meadow habitats in Rasmussen Valley. Similar to the Proposed Action, most directly disturbed acres would be reclaimed and would eventually recover to high-elevation rangeland that could provide cover and forage. Overall, impacts to big game are anticipated to be long-term and moderate under the RCA.

Bats

Impacts to bats under the RCA would be similar to those under the Proposed Action. Relative to the Proposed Action, the RCA would likely carry greater potential to remove trees that could be used by roosting bats because there would be a larger area of direct disturbance to aspen habitat. However, the RCA would have a smaller area of direct disturbance to wetland and riparian habitats, which are potentially important foraging areas for bats. Overall, impacts to bats would be long-term and minor, as they would occur on an individual and localized scale.

4.6.1.2.2 Birds

Upland Game Birds

Compared with the Proposed Action, the RCA would result in the permanent loss of approximately 20 more acres of forested habitat for dusky and ruffed grouse. The RCA would lack an overhead power line; therefore, the potential for avian predator perching on the power line would be eliminated. Because of the localized scale of land disturbance, overall impacts on upland game birds would be long-term and minor. Impacts to greater sage-grouse and Columbian sharp-tailed grouse are discussed in **Section 4.8**.

Migratory Birds

Compared with the Proposed Action, the RCA would directly remove approximately 28 fewer acres of migratory bird habitats overall. There would be 20.5 fewer acres of direct loss of wetland habitats and 20 more acres of direct loss of aspen habitats under the RCA. Therefore, impacts on species using wetland and riparian habitats would be reduced compared with the Proposed Action, whereas impacts on species such as woodpeckers using aspen forest would be greater. Compared with the Proposed Action, the RCA would remove approximately 69 fewer acres of sagebrush habitat and approximately 28 more acres of high-elevation rangeland habitat. Therefore, the RCA would carry less potential to impact sagebrush-obligate species (such as Brewer's sparrows) and more potential to impact species that are commonly found in high-elevation rangeland (such as green-tailed towhees).

Potential direct effects to migratory birds would be similar to those under the Proposed Action.

These include direct mortality (e.g., trampling of nests, vehicle collision), displacement, and stress related to increased noise and human activity. There would be no potential for power line-related mortality of migratory birds under the RCA. Agrium would plan ground-clearing activities during the non-nesting season to minimize potential impacts to nesting birds. Indirect effects could include increased competition between displaced individuals and resident birds.

The RCA would result in less habitat fragmentation compared with the Proposed Action because the haul road would be consolidated with existing disturbance on the South Rasmussen Mine rather than constructed through Rasmussen Valley. The RCA would also eliminate the potential traffic noise effects to breeding birds on the valley floor; however, noise and human activity would be greater in high-elevation areas around the South Rasmussen Mine. These areas are already disturbed and subject to regular human activity, and it is possible that nesting birds in this area are already acclimated to noise.

The potential for migratory birds to be exposed to selenium and other COPCs would be reduced compared with the Proposed Action because of the elimination of external overburden piles downslope of the mine. Overall, impacts on migratory birds would be long-term and minor under the RCA.

Raptors

The type of impacts that could occur to raptors under the RCA would be similar to those under the Proposed Action. There would not be an overhead power line under the RCA; therefore, there would be no potential for raptor mortality, perching, or nesting on a power line. There would potentially be more long-term loss of nesting habitat and greater short-term direct disturbance to nesting raptors from noise and activity because the RCA would directly disturb more forested habitat compared with the Proposed Action. Agrium would implement appropriate mitigation measures, such as buffer zones around occupied nests during the nesting season, to minimize these potential impacts. With implementation of buffer zones around active raptor nests, overall impacts on raptors under the RCA would be long-term and minor.

Passerines and Small Birds

PSBs would be directly and indirectly affected by the RCA as described above under migratory birds. Effects would generally be similar to those under the Proposed Action, except that long-term habitat loss would affect more aspen and high-elevation rangeland habitat and less wetland, riparian, and sagebrush habitat. Therefore, forest-dwelling PSB species (such as woodpeckers and chickadees) would likely be at greater risk of nest destruction, displacement, habitat loss, and noise disturbance, whereas riparian-dwelling species (such as willow flycatchers and Lincoln's sparrows) would be at little risk of these impacts. In addition, compared with the Proposed Action, PSBs would be at less risk of exposure to COPCs including selenium because of the elimination of external overburden piles downslope of the mine. Overall, impacts to PSBs are expected to be long-term and minor under the RCA. Measures discussed above generally for migratory birds would be implemented to minimize impacts to nesting PSBs.

Water Birds

Water birds are particularly sensitive to the removal and degradation of riparian and wetland habitats, as they depend on these habitats to a greater degree than upland birds. Therefore, impacts to water birds under the RCA would be reduced compared with the Proposed Action, as the RCA would avoid the construction of a haul road through the wetland and riparian habitats in Rasmussen Valley. The RCA would directly disturb approximately 20.5 fewer acres of wetland habitat compared with the Proposed Action. This would help to maintain the integrity of aquatic

habitats used by water birds in Rasmussen Valley. In addition, the RCA would also eliminate the use of an overhead power line, which would eliminate the potential collision risk associated with the power line under the Proposed Action.

Under the RCA, there would be no potential for water birds to be exposed to selenium and other COPCs in surface waters because of the elimination of external overburden piles downslope of the mine. Overall, impacts to water birds as a result of the RCA would be long-term and minor.

Table 4.6-3 summarizes compliance with the PFO ARMP with regard to wildlife resources under the RCA. The following actions pertaining to wildlife were also reviewed and found to be not applicable to a mining project:

- Actions FW-1.1.2 through 1.1.8
- Actions FW-1.1.9 through 1.1.10
- Actions FW-2.1.1 through 2.1.3

Table 4.6-3 Compliance with BLM Pocatello ARMP Goals, Objectives, and Actions for Wildlife Resources under the RCA

Goal/Objective/Action	Compliance under RCA
Goal FW-1. Manage wildlife habitats so vegetation composition and structure assures the continued presence of fish and wildlife as part of an ecologically healthy system.	The RCA would be consistent with this goal because the majority of disturbed areas would be reclaimed to grassland and shrubland, which would eventually recover to the baseline habitat quality of high-elevation rangeland on the mine site. However, loss of aspen habitat within the mine footprint would likely be permanent.
Objective FW-1.1. Maintain and improve wildlife habitats to support IDFG management objectives.	The RCA would be consistent with this objective over the long term because the majority of disturbed areas would be reclaimed to grassland and shrubland, which would eventually recover to the baseline habitat quality of high-elevation rangeland on the mine site. Over the short- term, the RCA would result in reduced habitat and forage for big game and other species.
Action FW-1.1.1. As appropriate and practicable (see **Action ME-2.2.1)**, elk and deer habitat on public lands will be managed as identified below in order to generally support IDFG management objectives for southeast (SE) Idaho management units. Riparian areas will be managed for habitat and population linkage areas by applying appropriate management techniques that may include but are not limited to: • Fencing, • Providing adjacent cover strips, and • Controlling noxious weeds. Aspen will be treated by applying appropriate management techniques that may include but are not limited to: • Removing encroaching conifer in Aspen clones. • Slashing old age aspen clones while leaving snags and some live trees. • Fencing degraded aspen clones. • Pursuing the use of prescribed fire. • Plowing Aspen roots to release clones. • Degraded riparian areas will be restored. During travel management planning, give special consideration (e.g., timing of use, number of roads/trails, road	These actions will be met as appropriate and practicable at a phosphate mining site. The proposed reclamation plan has been designed to incorporate wildlife habitat needs as well as installation of a cover on backfill and overburden that eliminates wildlife exposure to COPCs. Reclamation proposed by Agrium would provide a long-term wildlife habitat, although there would be habitat conversion from baseline. This tends to meet the land use plan requirement as practicable at the reclaimed mine site that has potential water quality issues as well as wildlife habitat issues. Additional mitigation that may come from the HEA would further help meet this land use plan directive. Agrium has proposed voluntary mitigation for upland wildlife habitat impacts, as described in **Section 4.6.4**. The RCA was designed to minimize both physical and COPC impacts to wetlands and riparian habitats. There would only be 0.3 acre of direct impact to riparian habitats compared with 20.5 acres under the Proposed Action.

Table 4.6-3 Compliance with BLM Pocatello ARMP Goals, Objectives, and Actions for Wildlife Resources under the RCA

Goal/Objective/Action	Compliance under RCA
locations) for reducing impacts on big game winter range.	
Goal FW-2. Provide for the diversity of native and desired non-native species as part of an ecologically healthy system.	The RCA would be consistent with this goal because the majority of disturbed areas would be reclaimed with a mixture of native grass, forb, and shrub species. Plant species richness on reclaimed areas is anticipated to be similar to baseline species richness. Over the long term, reclaimed areas are predicted to recover to the baseline habitat quality of high-elevation rangeland on the mine site. However, the RCA may result in localized declines in abundance of wildlife species that are dependent on aspen forest, as it would result in permanent loss of this habitat type within the mine footprint.
Objective FW-2.1. Maintain or improve native and desired non-native species habitat and the connectivity among habitats.	The RCA would be consistent with this objective because the majority of disturbed areas would be reclaimed with a mixture of native grass, forb, and shrub species. Reclaimed areas would eventually return to baseline level of wildlife habitat service provided by the on-site high-elevation rangeland habitat. While wildlife may avoid the project during active mining, the habitats in the Study Area are naturally patchy, and the RCA is not anticipated to significantly disrupt habitat connectivity over the long term.

Source: BLM 2012a

Table 4.6-4 summarizes compliance with the CNF RFP with regard to wildlife resources under the RCA. The following standards and guidelines pertaining to wildlife were also reviewed and found to be not applicable to the RCA because they relate to other types of forest management practices (e.g., timber harvest, grazing) and not to a mining project:

- Dead and Down Material Guideline 1
- Snag/Cavity Nesting Habitat Standards 1 through 3 and Guidelines 1 through 5
- Big Game Guideline 3
- Landbirds Guideline 4

Table 4.6-4 Compliance with Applicable Caribou Forest Plan Standards and Guidelines for Wildlife Resources under the RCA

Standard/Guideline	Compliance under RCA
Big Game Guideline 1: Provide for vegetation buffers of at least one sight distance (Thomas 1979) around big game concentration/use areas, such as wallows and mineral licks. Sight distance is the distance at which 90 percent of a deer or elk is hidden from an observer. This will vary depending on site specific stand conditions.	No big game concentration areas, such as wallows or mineral licks, have been identified in the Study Area.
Big Game Guideline 2: Provide for security or travel corridors near created openings.	Over the short term, this guideline would substantively be met under the RCA. As a result of noise and human presence, it is likely that wildlife such as big game would avoid a larger area than the actual disturbance footprint, reducing the amount of security habitat and potentially disrupting local travel corridors in the vicinity of the RCA.

Table 4.6-4 Compliance with Applicable Caribou Forest Plan Standards and Guidelines for Wildlife Resources under the RCA

Standard/Guideline	Compliance under RCA
	However, the relatively small area of disturbance under the RCA is not anticipated to impact security or travel corridors on a Forest-wide scale.
Landbirds Guideline 1: Stands of mature trees (including snags and dead-topped trees) should be maintained next to wet meadows.	The RCA would not remove any stands of mature trees adjacent to wet meadows (the wet meadows in the Study Area are adjacent to sagebrush rangelands; **Figure 3.5-1**).
Landbirds Guideline 2: Where feasible, maintain 30 to 50 percent of the sagebrush habitat in a 5th code HUC in contiguous blocks greater than 320 acres to support sagebrush obligate species.	The RCA would be consistent with this guideline because it would not reduce any contiguous blocks of big sagebrush habitat to less than 320 acres.
Landbirds Guideline 3: Practices which stabilize or increase native grass and forbs cover in sagebrush habitats with 5% to 25% sagebrush canopy cover should be implemented.	The RCA would be consistent with this guideline over the long term (though approximately 130 acres of sagebrush habitat would be removed in the short term). A variety of native and desirable non-native grass and forb species would be used in the seed mixes. Reclaimed areas are predicted to achieve 6 percent cover of big sagebrush by year 90, at which point, forb cover is predicted to range from 36 to 42 percent and grass cover is predicted to range from 23 to 31 percent (ARCADIS 2015b).
Prescription 8.2.2 Wildlife Guideline 1: Mining operations should be designed to accommodate big game migration	No major big game migration corridors have been identified within the Study Area; however, because of the presence of fawning/calving habitat and winter range in and around the Study Area, it is likely that the RCA would disrupt local movements of individual deer, elk, and moose, at least during the short-term period of active mining. Following final reclamation and cessation of human disturbance, it is anticipated that big game would no longer avoid the area.
Prescription 8.2.2 Wildlife Guideline 2: Reclamation should be designed to minimize wildlife exposure to hazardous substances	This guideline would be met under the RCA, which would eliminate external overburden piles downslope of the mine and use a store-and-release cap-and-cover system to address issues of COPC transport. In contrast to the Proposed Action, there would be no measureable loading of COPCs to downstream surface waters. The deeper 6-foot cover would also minimize the potential for uptake of COPCs in vegetation.
Prescription 8.2.2 Wildlife Guideline 3: Consider vegetation species that contribute to wildlife habitat needs when developing reclamation plans and create wildlife structures (slash piles, logs, rock piles) using native vegetation and materials to provide habitat diversity in created openings, where possible.	This guideline would be met under the RCA. A variety of native and desirable non-native grasses, forbs, and shrubs would be used in the seed mixes for reclamation, to promote post-reclamation use by wildlife. Reclamation plans do not specifically incorporate the use of wildlife structures, such as slash piles, logs, and rock piles; however, these structures may be used as appropriate in accordance with this guideline.
Prescription 8.2.2 Wildlife Guideline 4: Encourage construction of ledges on suitable pit walls to accommodate cliff-dwelling species.	This guideline would be met under the RCA. The remaining pit walls and benches would be available for cliff-dwelling species.

Source: USFS 2003

4.6.1.3 No Action Alternative

Under the No Action Alternative, the federal phosphate leases would not be developed. The No Action Alternative would result in no new impacts to wildlife in the Study Area. The No Action Alternative would maintain the current status of terrestrial wildlife and terrestrial wildlife populations in and around the Study Area. However, this does not preclude future development of the federal phosphate leases under a different mine plan.

4.6.2 Irreversible and Irretrievable Commitment of Resources

Under the Proposed Action, the loss of aspen and wetland/riparian habitat is considered an irreversible commitment of resources and would have long-term impacts on wildlife species using those habitats. Under the RCA, this loss would primarily be limited to aspen habitat, as there would only be 0.3 acre of direct impacts to wetlands. Although the Mine and Reclamation Plan would re-establish upland grassland and shrub vegetation in disturbed areas after mining operations end, it is not anticipated that aspen would re-establish because the existing root stock would be removed. Impacted wetland and riparian areas would be re-seeded with upland vegetation, and while off-site mitigation would be required to offset wetland impacts under the CWA, the loss of wetland and riparian habitat within the Study Area would be considered irreversible. As a result of the loss of habitat, wildlife species that use aspen and wetland/riparian habitats may locally decline in abundance, while other species that use grassland and shrubland habitats may locally increase following reclamation. This small-scale shift in wildlife community composition in the Study Area would also be considered an irreversible commitment of resources.

It is possible that some terrestrial wildlife may be adversely affected by elevated selenium concentrations in plants growing on the reclaimed area over the duration of the Proposed Action. These impacts are anticipated to be limited in magnitude and areal extent and, therefore, represent a minor irretrievable commitment of resources. The potential for this is much less under the RCA, which would include a deeper cover.

4.6.3 Unavoidable Residual Adverse Effects

Based on the HEA, reclamation would offset about 55 percent of the wildlife habitat services lost under the Proposed Action, with a net debit of 3,279 residual DSAYs of lost wildlife habitat services (ARCADIS 2015c). This loss of wildlife habitat services would be an unavoidable residual adverse effect of the Proposed Action. The net residual DSAY debit under the RCA would be less than that of the Proposed Action, at 2,242 DSAYs, with reclamation offsetting about 69 percent of the wildlife habitat services lost.

4.6.4 Mitigation Measures

To minimize noise and disturbance impacts to nesting raptors, Agrium would apply species-specific raptor nest buffers as detailed in Table B-2 of Appendix B of the ARMP.

In addition, Agrium would plan ground-clearing activities during the non-nesting season to minimize potential impacts to nesting birds. Under the Proposed Action, Agrium would implement APLIC raptor-friendly design measures on the 0.7-mile overhead power line that would be constructed. These may include, but would not be limited to, a 60-inch separation between conductors or grounded hardware as well as the use of insulating or cover-up materials for perch management.

On-site reclamation would partially offset the loss of wildlife habitat in the project footprint. Under the Proposed Action, 415 acres (or 99 percent) of the total disturbed area would be reclaimed. Based on HEA results, this reclamation would result in the long-term credit of 3,979 DSAYs at the mine site. This means that reclamation would offset about 55 percent of the wildlife habitat services lost under the Proposed Action, with a net debit of 3,279 residual DSAYs.

Under the RCA, 362 acres (or 96 percent of the disturbed acreage) on the Rasmussen Valley Lease would be reclaimed. In addition, Agrium would reclaim 84 acres on the South Rasmussen Mine, for a total reclaimed acreage of 446 acres. Based on HEA results, this reclamation would result in the long-term credit of 5,045 DSAYs at the mine site. This means that reclamation would offset about 69 percent of the wildlife habitat services lost under the RCA, with a net debit of 2,242 residual DSAYs. As described in **Section 2.3.6.10**, Agrium has voluntarily proposed to use a hypothetical mitigation project to calculate an in-lieu-fee amount for mitigating some or all of the DSAY debit from the RCA. Because the selected alternative would not be known until publication of the Final EIS and Record of Decision (ROD), the project and cost estimate would be described in a Wildlife Habitat Mitigation Plan prepared by Agrium after the Draft EIS is published, but before the ROD is signed. This document would include five components: 1) details of the hypothetical mitigation project(s); 2) the gain in DSAY values from the project and assumptions; 3) a calculation of the total cost to offset the selected alternative DSAY debit using the hypothetical mitigation project as a basis; 4) description of the provisions of the corresponding in-lieu fee to a third party; and 5) fulfillment of the voluntary mitigation.

The cost of the final hypothetical mitigation actions would be calculated in coordination with the Agencies. The BLM, Agrium, and other stakeholders would identify a third-party recipient of the in-lieu fee and confirm that the fee would be spent in accordance with the wildlife habitat mitigation objectives. After the ROD is signed, Agrium would provide the in-lieu fee to the third party.

4.7 FISHERIES AND AQUATIC RESOURCES

Issue: What is the potential to impact aquatic habitats and aquatic species?

Indicators:

- The length of intermittent and perennial stream channels directly affected by road fill and associated culverts, and comparison with the undisturbed lengths of these stream channels in the analysis area
- Quantities of suspended sediment and COPCs in fishery resources in the area, with emphasis on compliance with applicable aquatic life water quality standards
- High selenium or other COPC levels in macroinvertebrates, amphibians, and fish
- Compliance with the applicable PFO ARMP and CNF RFP Standards and Guidelines

Issue: What is the potential for impacts to the aquatic influence zone (AIZ)?

Indicators:

- Reduction in the size of AIZ (acres)
- Reduction in the quality of the AIZ such that there is a detrimental effect on aquatic resources

4.7.1 Direct and Indirect Impacts

4.7.1.1 Proposed Action

4.7.1.1.1 Aquatic Habitat

The Proposed Action is anticipated to result in the direct loss of 20.5 acres of wetland habitat (**Section 4.5**) and would directly impact 0.4 mile of intermittent and perennial stream channel in the Study Area through installation of culverts at road crossings. Aquatic habitats within and adjacent to the Study Area may also be indirectly affected by the Proposed Action. If not controlled, clearing vegetation within the Study Area could contribute to increased soil erosion, leading to increased amounts of siltation in local drainages. An increase in the amounts of suspended sediment in runoff could alter stream morphology, choke out aquatic plants, and alter communities of fish and aquatic invertebrates (Gray and Ward 1982; Wood and Armitage 1997; Shaw and Richardson 2001; Gleason et al. 2003). Implementation of the proposed BMPs, including construction of water control ponds and use of erosion control measures, would help to prevent sediment and runoff water from flowing into streams. Because of the incorporation of BMPs into the design of the Proposed Action, indirect impacts to aquatic habitats from sedimentation are expected to be minor and short-term.

The capture of surface runoff during active mining would decrease the quantity of water in streams and wetlands downstream of the Study Area over the short term. As explained in **Section 4.3.1.1.4**, the area of captured runoff equates to approximately 4 percent of the Angus Creek-Blackfoot River sub-watershed and 0.03 percent of the Lower Lanes Creek sub-watershed. The reduced quantity of water may result in the localized drying of some aquatic habitats downstream of the Study Area over the short term. Following reclamation, runoff to nearby streams and wetlands is predicted to be the same as under baseline conditions.

The Proposed Action would also result in direct impacts to approximately 80 acres of AIZ. Because AIZs typically encompass riparian areas, the removal of vegetation in AIZs may indirectly lead to: 1) increases in water temperature from the loss of shade, 2) decreases in natural sediment filtration capabilities and increases in substrate sedimentation, 3) potential changes in channel morphology resulting from the stream bank destabilization, 4) loss of potential instream wood recruitment, and 5) decreases in inputs of organic matter (leaf litter) as energy. The loss of stream habitat and AIZ function would result in direct and indirect impacts to cutthroat trout and other native fishes that would be potentially long-term, local, and moderate (**Section 4.7.1.1.3**).

4.7.1.1.2 Macroinvertebrates

Macroinvertebrates have the potential to be impacted by sedimentation and changes to the AIZ, which change the physical characteristics of the aquatic environment. Sedimentation may alter the substrate composition of aquatic habitats, thereby reducing or increasing the suitability of the substrate for particular macroinvertebrate taxa. It may cause some species to “drift” out of the benthos and into the water column. Sediment may also clog the respiratory or feeding structures of some species, resulting in mortality and declines in abundance. The ultimate result of these effects is that releases of sediment may alter macroinvertebrate community composition, with some species temporarily increasing in abundance while others that are less tolerant of turbidity decrease (Gray and Ward 1982; Wood and Armitage 1997; Shaw and Richardson 2001).

Removal of vegetation in the AIZ may further impact macroinvertebrate community composition. Presence of riparian vegetation providing shade has been correlated with abundance of *Ephemera, Plecoptera*, and *Trichoptera* (EPT) taxa (which are typically more sensitive to

disturbance than other macroinvertebrate taxa) (Barbour et al. 1999; Rios and Bailey 2006). In addition, some macroinvertebrate species depend on leaf litter that falls into streams as a food source, and reduction or removal of streamside vegetation has the potential to result in a decline of these species (Cummins et al. 1989). As species that are sensitive to sedimentation, disturbance, and warmer water temperatures decline, disturbance-tolerant taxa may increase in abundance. In general, mayflies, caddisflies, and stoneflies are considered relatively intolerant of human disturbance and would decline in areas impacted by sedimentation and removal of riparian vegetation. On the other hand, Diptera (fly larvae) and Chironomidae (midge larvae), which are generally more tolerant of disturbance, may increase in impacted areas (Barbour et al. 1999).

The Proposed Action is predicted to result in measurable loading of selenium into the watershed as a result of leaching of COPCs out of the downslope external overburden piles and into shallow groundwater and downstream surface waters via the shallow alluvial groundwater. Existing baseline selenium levels, coupled with any potential selenium increases, can reside in streambed sediments and the water column to be taken up directly by rooted aquatic plants, plankton, aquatic insects, and fish. Selenium released into the watershed under the Proposed Action may have long-term effects on local populations of macroinvertebrates in Angus Creek and associated tributaries and downstream waters.

The Proposed Action would result in inputs of water with selenium concentrations in excess of 0.005 mg/L, for a predicted peak in-stream increase in concentration of 0.0004 mg/L in Angus Creek and 0.0001 mg/L in the Blackfoot River (**Section 4.3.1.1.2**). Added to baseline selenium concentrations for these streams, these increases would equate to a selenium concentration of 0.0014 mg/L for Angus Creek and 0.0011 mg/L for the Blackfoot River (**Table 4.3-11** and **Table 4.3-12**). A bioaccumulation factor of 1,000 (Conley et al. 2009) was applied to predict how these increases in water-borne selenium might increase algal selenium concentrations downstream of the Proposed Action. At a water selenium concentration of 0.0014 mg/L (**Section 4.3.1.1.2**), a bioaccumulation factor of 1,000 could result in algal selenium concentration of 1.4 micrograms per gram (µg/g) in Angus Creek. This is not much higher than baseline periphyton selenium concentrations determined from sampling in Angus Creek in September 2014. These sampled concentrations of selenium ranged from 0.2 µg/g dw at BAC-1 to 1.3 µg/g dw (estimated) at BAC-3 (GEI 2015). Under the Proposed Action, macroinvertebrates with a bioaccumulation factor of 2 (as observed in the Conley et al. 2009 study) feeding on algae with a selenium concentration of 1.4 µg/g could reach tissue concentrations of 2.8 µg/g, which is within the range of 2009 selenium concentrations (2.48 to 7.57 µg/g) documented in macroinvertebrates in Angus Creek at baseline (GEI 2012). This is higher than the 2014 selenium concentrations observed in Angus Creek (0.6 to 1.7 µg/g dw; GEI 2015). Therefore, the Proposed Action carries the potential to slightly elevate the selenium concentration in macroinvertebrates higher than the most recently sampled (2014) baseline condition, but is not anticipated to increase concentrations higher than the range of baseline conditions observed in past years (2009). Effects of increased selenium in the Blackfoot River would be lower in magnitude than for Angus Creek because the incremental increase in selenium would be one fourth that predicted for Angus Creek.

Effects of selenium on macroinvertebrates have not been widely studied and are uncertain; rather, most research has focused on macroinvertebrates as an exposure pathway for transfer of selenium to higher organisms, such as fish and birds. There is some evidence suggesting that elevated concentrations of selenium impair larval growth and fecundity of aquatic invertebrates (Conley et al. 2009). Macroinvertebrate taxa vary in their tolerance to pollutants. Fish and bird species, even those that are closely related, differ in their selenium sensitivity, and it is likely that macroinvertebrate species do as well (Hamilton 2004). Slightly elevated levels of selenium in macroinvertebrates downgradient of the analysis area may result in reduced growth and

reproduction for some species but not others. This may cause a shift in the composition of the local macroinvertebrate communities.

Overall, the Proposed Action would have a long-term, minor impact on aquatic macroinvertebrates in wetlands and waters downstream of the Study Area. Impacts would be minor because the use of BMPs as described in **Section 4.5.1.1.2** and the low concentration of COPCs expected to enter the surface waters from the down slope external overburden piles would help to minimize impacts on streams and wetlands.

4.7.1.1.3 Fish

Surface water would be conveyed underneath the Rasmussen Valley Haul Road, the West Side Haul Road, and the county road realignment through culverts at 18 locations, summarized in **Table 2.3-6**. Culverts would be installed to conform to the natural streambed and slope so that a minimum depth of water is always available in the culvert for fish passage. Thus, the Proposed Action would comply with BLM and USFS standards and guidelines requiring the maintenance of instream flows and would not fragment fish habitats or prevent fish migration.

Displacement and erosion of sediment in the stream bank during culvert installation would create short-term pulses of turbidity that could cause temporary gill irritation to individual fish immediately downstream of the culvert. Sedimentation could also diminish the suitability of stream habitat for many aquatic organisms and native fishes, including spawning areas for cutthroat trout in Angus Creek. Major additional sedimentation into analysis area streams is not expected because of the implementation of BMPs and Proposed Action design features, including dust suppression and control of storm water runoff (**Section 4.5.1.1.2**). Indirect impacts to native fishes via sedimentation would be short-term (for the duration of the Proposed Action), local, and minor.

As discussed in **Section 4.3.1.1.2**, the Proposed Action has the potential to increase selenium concentrations in the watershed to higher than the baseline condition by leaching from overburden piles to shallow alluvial groundwater. The predicted peak in-stream increase in selenium concentration would be 0.0004 mg/L in Angus Creek and 0.0001 mg/L in the Blackfoot River (**Table 4.3-11** and **Table 4.3-12**). A bioaccumulation factor of 1,900, based on Muscatello (2009), USEPA (2004), and Lemly (1999), was used to predict how this increase in water-borne selenium could affect fish tissue concentrations under the Proposed Action. Using this bioaccumulation factor, a water selenium concentration of 0.0014 mg/L (as predicted for Angus Creek; see **Section 4.3.1.1.2**) would equate to a fish tissue concentration of 2.7 µg/g, which (coupled with 2013 and 2014 fish tissue concentrations for a potential cumulative body burden of around 5.4 µg/g) is still lower than the USEPA draft fish whole-body criterion of 8.0 µg/g (USEPA 2015) in drainages near the Study Area.

Under the Proposed Action, at a whole-body selenium concentration of 5.4 µg/g (using the bioaccumulation factor explained above), deformities in up to 4 percent of adult and juvenile fish and 8 percent of larvae and fry may occur, based on the relationships described by Lemly (1997). This would result in mortality rates of approximately 10 percent and 70 percent, respectively, for the deformed fish, which would equate to overall population-level mortality of 0.4 percent and 6 percent, respectively (Lemly 1997). Lemly (1997) classified selenium impacts as negligible if they are anticipated to result in less than 5 percent population mortality and slight to moderate if they are anticipated to result in 5 to 20 percent population mortality.

A study of effects of accumulated selenium on the reproductive success and larval development of westslope cutthroat trout collected from a site of active coal mining in British Columbia demonstrated that eggs with selenium concentrations higher than 86.3 µg/g dw were not

successfully fertilized or were non-viable at fertilization, while eggs with concentrations higher than 46.8 and less than 76.4 µg/g dw were fertilized but did not produce viable fry. In this study, a positive relationship between egg selenium concentrations and fry mortality was observed (Rudolph et al. 2008). The authors also described the relationship between egg selenium concentration and fish muscle tissue concentration. Assuming that the egg concentration/tissue concentration relationship that Rudolph et al. (2008) described holds true for the Upper Blackfoot watershed, tissue concentrations of 5.4 µg/g (the potential Proposed Action cumulative body burden described above) could equate to egg selenium concentrations of 10.8 µg/g. According to Rudolph et al. (2008), this egg concentration is below the level that would be expected to result in significant mortality of eggs or larval fish. This further supports the conclusion that the Proposed Action would be unlikely to have population-level effects of selenium on fish in the streams downgradient of the Study Area.

Hardy et al. (2010) completed a 2.5-year feeding trial where cutthroat trout were fed dietary selenium supplied as up to 10 µg/g of selenomethionine, a dominant form found in algae and in the aquatic food chain. The results of the study suggest that cutthroat trout are not as sensitive to intake of dietary selenium as fish in other studies, such as the Ruldolph et al. (2008) study. Hardy et al. (2010) found that egg selenium concentrations were not consistently higher or lower than fish whole-body tissue concentrations, but were higher in some treatment groups and lower in others. Results also found no differences in growth, feed intake, survival, or egg hatchability between dietary groups when concentrations of selenium in whole fish and eggs were increased in proportion to dietary selenium intake. The results suggest differences in response to selenium exposure among fish species. DeForest et al. (2012) reviewed a number of studies on the effects of selenium on Canadian fish species and determined that sensitivity to selenium varies by species and even by subspecies (in general, suckers and minnows seem to be more sensitive than trout; westslope cutthroat trout seem to be more sensitive than Yellowstone cutthroat trout).

The data presented here are based on averages and representative of the overall “fish population” of the streams downgradient of the Study Area. It is likely that selenium affects some species or individuals more than others. It is also possible that short-term high inputs of selenium could be more of a limiting factor to aquatic resources than long-term, averaged inputs. Because evidence suggests that aquatic populations have already accumulated selenium from inputs into the watershed, additional input of selenium under the Proposed Action would be an additional impact and would be negligible over both the short and the long term.

In addition to selenium, the Proposed Action would contribute zinc, manganese, and nickel to Angus Creek and the Blackfoot River. Concentrations for all COPCs would be lower than surface water standards (**Table 4.3-11** and **Table 4.3-12**). Relative to selenium, fewer studies have examined the potential population-level effects of these other metals on fish. Adverse effects have been observed in rainbow trout when exposed to a zinc concentration of 0.01 mg/L (USDI 1998). The concentration predicted under the Proposed Action would be much lower at 0.0004 mg/L for Angus Creek and 0.0001 mg/L for the Blackfoot River. Nickel is known to be toxic to fish at high (>12 mg/L) concentrations (Ololade and Oginni 2010; Svecevicius 2010) and to inhibit growth at slightly lower (>10 mg/L) concentrations (Javed 2006), but effects at low (<2 mg/L) concentrations (such as those anticipated to occur under the Proposed Action) are unclear. Zinc and nickel are known to bioaccumulate in aquatic food chains similar to selenium (McGeer et al. 2003; USDI 1998). Manganese has been shown to have adverse sub-lethal effects on the blood cells of fish at concentrations as low as 0.64 mg/L (Sharma and Langer 2014) and to inhibit growth at high (>25 mg/L) concentrations (Javed 2006). Overall, impacts of non-selenium COPCs on fish would be long-term and would likely be negligible due to the low concentrations that would enter downstream waters (**Table 4.3-11** and **Table 4.3-12**).

Overall, impacts to fish under the Proposed Action would be long-term and moderate.

4.7.1.1.4 Amphibians and Reptiles

The Proposed Action would result in permanent loss of 20.5 acres of wetland and riparian habitat within the Study Area. Direct mortalities to amphibians and reptiles may occur in wetland, stream, and riparian areas that would be disturbed, as well as on the haul road as individuals disperse between wetland habitats. The placement of culverts and mine runoff could introduce sediments into habitats used by amphibians and reptiles. Increased sediment loads that could affect amphibians and reptiles are expected to be minimal as a result of BMPs that would be implemented. Indirect effects could also adversely affect amphibian populations including localized drying of wetlands as a result of the capture of surface runoff during active mining and increased concentrations of selenium and other COPCs in drainages downstream of the analysis area.

Amphibians are similar to fish in their susceptibility to selenium toxicity (Ohlendorf 2003). There is evidence that amphibians accumulate selenium, that females transfer selenium to their eggs, and that egg selenium concentration is negatively correlated with reproductive success (Metts et al. 2013; Bergeron et al. 2010; Hopkins et al. 2006). Because inputs of selenium into downstream waters would be well below the surface water standard under the Proposed Action, the Proposed Action is unlikely to contribute to adverse population-level effects on amphibians in receiving waters (Angus Creek) but could contribute to adverse effects downstream of the Study Area (Blackfoot River). Selenium bioaccumulation has also been demonstrated for reptiles; however, reptiles appear to be less sensitive to selenium than amphibians, as fewer studies have found adverse biological effects (Hopkins et al. 2005; Ohlendorf 2003).

Similar to fish, amphibians could be exposed to zinc, nickel, and manganese under the Proposed Action. Amphibians show serious adverse effects at water-borne zinc concentrations in excess of 1.5 mg/L (USDI 1998), which is much higher than the concentrations of 0.0001 to 0.0004 mg/L predicted under the Proposed Action (**Table 4.3-11** and **Table 4.3-12**). Nickel has been shown to be lethal to frog embryos at low concentrations (<1 mg/L; Sztrum et al. 2011). There is a lack of research on the effects of these COPCs on reptiles. Given that the concentrations of these COPCs in Angus Creek and the Blackfoot River would be well below surface water standards (**Table 4.3-11** and **Table 4.3-12**), population-level effects of COPCs on amphibians and reptiles are unlikely. Overall, impacts of the Proposed Action on amphibians and reptiles would be long-term and moderate.

Table 4.7-1 summarizes compliance with the PFO ARMP with regard to fisheries and aquatic resources under the Proposed Action.

Table 4.7-1 Compliance with Applicable PFO ARMP Goals, Objectives, and Actions for Fisheries and Aquatic Resources

Goal/Objective/Action	Compliance under Proposed Action
Action SW-2.1.4. Stream crossings, if necessary, will be designed to minimize adverse impacts on soils, water quality, and riparian vegetation and provide for fish passage as appropriate.	Culverts would be installed to conform to the natural streambed and slope so a minimum depth of water is always available in the culvert for fish passage. Thus, the Proposed Action would comply with BLM and USFS standards and guidelines requiring the maintenance of instream flows and would not fragment fish habitats or prevent fish migration.
Action SW-2.1.5. As appropriate, new or existing roads and trails adjacent to streams or riparian areas that	The Proposed Action would not conform to this action. Roads constructed under the Proposed Action are not

Table 4.7-1 Compliance with Applicable PFO ARMP Goals, Objectives, and Actions for Fisheries and Aquatic Resources

Goal/Objective/Action	Compliance under Proposed Action
impact water quality may be redesigned, repaired, maintained, or re-located to a location not impacting the water quality.	anticipated to significantly impact water quality because of the implementation of BMPs to control sedimentation and runoff. However, there would still likely be some localized impacts to water quality from the haul road through Rasmussen Valley.
Action ME-2.2.2. The following operation standards and guidelines would be applied as appropriate to reduce environmental impacts from mineral exploration and development operations: **Operational Standards:** 1. Locate surface disturbing activities, including support facilities, outside riparian zones (e.g., riparian habitat conservation areas (RHCAs) or areas where surface disturbance will impact the PFC of the riparian areas) and fish bearing waters. Cutthroat trout guidance will be considered as identified in Appendix C of the ARMP. Where no feasible alternative site exists, operate and construct facilities in ways that will avoid or reduce impacts on riparian zone attributes.	This action would not be met under the Proposed Action. There would be 80 acres of direct impacts to the AIZ and a loss of 20.5 acres of riparian/wetland habitat.

Source: BLM 2012a

Table 4.7-2 summarizes compliance with the CNF RFP with regard to fisheries and aquatic resources under the Proposed Action. The following standards and guidelines pertaining to aquatic resources were also reviewed and found to be not applicable to the Proposed Action:

- Prescription 2.8.3 (AIZ) Fire/Fuels Guidelines 1 through 5
- Prescription 2.8.3 (AIZ) Lands Standard 2
- Prescription 2.8.3 (AIZ) Lands Guidelines 2 through 5
- Prescription 2.8.3 (AIZ) Minerals/Geology Guidelines 2 through 3 and 5
- Prescription 2.8.3 (AIZ) General Riparian Area Management Standard 1
- Prescription 2.8.3 (AIZ) Fisheries Guidelines 2 through 3
- Prescription 2.8.3 (AIZ) Wildlife Standard 1
- Prescription 2.8.3 (AIZ) Access Standard 1
- Prescription 2.8.3 (AIZ) Fisheries Guidelines 2 through 3
- Prescription 2.8.3 (AIZ) Recreation Standards 1 and 2 and Guideline 1
- Prescription 2.8.3 (AIZ) Grazing Management Standards 1 and 2 and Guidelines 1 and 2
- Prescription 2.8.3 (AIZ) Timber Standard 1 and Guidelines 1 and 2

Table 4.7-2 Compliance with Applicable Caribou Forest Plan Standards and Guidelines for Fisheries and Aquatic Resources

Standard/Guideline	Compliance under Proposed Action
Amphibian Guideline 3: Maintain amphibian habitats when developing and modifying springs and wetlands.	This guideline would not be met under the Proposed Action, as the Proposed Action would result in the long-term removal of 20.5 acres of wetland and riparian amphibian habitat.
Prescription 2.8.3 Lands Standard 1: Special use authorizations for new projects involving instream facilities shall maintain minimum instream flows to maintain or improve desired AIZ attributes.	Culverts would be installed to conform to the natural streambed and slope so a minimum depth of water is always available in the culvert for fish passage. Thus, the Proposed Action would comply with BLM and USFS standards and guidelines requiring the maintenance of instream flows and would not fragment fish habitats or prevent fish migration.
Prescription 2.8.3 Minerals/Geology Guideline 1: Locate new structures, support facilities, and roads outside AIZs. Where no alternative to siting facilities in AIZs exists, locate and construct the facilities in ways that avoid or reduce impacts to desired AIZs attributes. Where no alternative to road construction exists, keep roads to the minimum necessary for the approved mineral activity.	This guideline would not be met under the Proposed Action. There would be 80 acres of direct impacts to the AIZ and a loss of 20.5 acres of riparian/wetland habitat.
Prescription 2.8.3 Minerals/Geology Guideline 4: Do not locate debris, mine overburden, excess material, leaching pads, and other facilities within Aquatic Influence Zones, unless no other alternatives are available. If no other alternative exists, ensure that safeguards are in place to prevent release or drainage of toxic or other hazardous materials onto these lands.	This guideline would not be met under the Proposed Action. There would be 80 acres of direct impacts to the AIZ.
Prescription 2.8.3 General Riparian Area Management Guideline 1: Felled trees should remain on site when needed to meet woody debris objectives and desired AIZ attributes.	This guideline would not be met under the Proposed Action. Agrium has no plans to use felled trees to meet woody debris objectives in AIZs.
Prescription 2.8.3 General Riparian Area Management Guideline 2: Use herbicides, pesticides, and other toxicants and chemicals only as needed to maintain desired AIZ attributes.	This guideline would be met under the Proposed Action. Agrium would adhere to federal and state requirements for herbicide and pesticide use and use these chemicals only where necessary.
Prescription 2.8.3 General Riparian Area Management Guideline 3: Avoid storage of fuels and other toxicants or refueling within AIZs unless there are no other alternatives. Any refueling sites within an AIZ should have an approved spill containment plan.	This guideline would be met under the Proposed Action. The fuel storage area would be located outside of the AIZ, and Agrium would implement spill control and containment measures specified in the SPCC Plan that would be prepared for the Proposed Action.
Prescription 2.8.3 Fisheries Guideline 1: Where feasible, restore connectedness of disjunct populations and enhance fish passage for native fish.	Culverts would be installed to conform to the natural streambed and slope so a minimum depth of water is always available in the culvert for fish passage. Thus, the Proposed Action would comply with BLM and USFS standards and guidelines requiring the maintenance of instream flows and would not fragment fish habitats or prevent fish migration.
Prescription 2.8.3 Roads and Trails Standard 1: All new and replaced culverts, both permanent and temporary, shall be designed and installed to meet desired conditions for riparian and aquatic species.	Culverts would be installed to conform to the natural streambed and slope so a minimum depth of water is always available in the culvert for fish passage. Thus, the Proposed Action would comply with BLM and USFS

Table 4.7-2 Compliance with Applicable Caribou Forest Plan Standards and Guidelines for Fisheries and Aquatic Resources

Standard/Guideline	Compliance under Proposed Action
	standards and guidelines requiring the maintenance of instream flows and would not fragment fish habitats or prevent fish migration.
Prescription 2.8.3 Roads and Trails Guideline 1: Avoid constructing roads within the AIZ unless there is no practical alternative.	This guideline would not be met under the Proposed Action. The proposed haul road would impact 28 acres of AIZ.
Prescription 2.8.3 Roads and Trails Guideline 2: Culverts (permanent and temporary) should be sized so that the probability of flow exceedance is 50 percent or less during the time the culvert is expected to be in place. Consider bedload and debris when sizing culverts.	Culverts would be installed to conform to the natural streambed and slope so a minimum depth of water is always available in the culvert for fish passage. Culverts would be designed to accommodate 100-year, 24-hour or 50-year, 24-hour flow conditions, as detailed in **Table 2.3-6** and would follow the requirements of the Federal Highway Administration Design Manual for high standard roads on federal lands.
Prescription 2.8.3 Roads and Trails Guideline 3: When feasible, use bridges, arches, and open-bottom culverts in fish-bearing streams.	This guideline would not be met under the Proposed Action. Culvert design would follow the requirements of the Federal Lands Highway Project Development and Design Manual for high standard roads on federal lands (FHWA 2014). Culverts would be designed to maintain stream flows but would not necessarily be constructed with open bottoms.
Prescription 2.8.3 Roads and Trails Guideline 4: Avoid placing ditch relief culverts where they may discharge onto erodible slopes or directly into streams.	This guideline would be met under the Proposed Action.
Prescription 2.8.3 Roads and Trails Guideline 5: Where feasible, install cross-drainage above stream crossings to prevent ditch sediments from entering streams.	This guideline would be met under the Proposed Action.
Prescription 2.8.3 Roads and Trails Guideline 6: New or reconstructed roads and trails should cross the AIZ riparian areas as perpendicular as possible.	This guideline would not be met under the Proposed Action. The proposed haul road would impact 28 acres of AIZ, and part of the haul road would run parallel to Angus Creek.
Prescription 2.8.3 Roads and Trails Guideline 7: Avoid making channel changes on streams or drainages.	This guideline would be met under the Proposed Action.
Prescription 2.8.3 Roads and Trails Guideline 8: Design and install drainage crossings to reduce the chances of turning stream flows down the road prism in case of a blocked or overflowing culvert.	This guideline would be met under the Proposed Action.
Prescription 2.8.3 Roads and Trails Guideline 9: Road drainage patterns should avoid disruption of natural hydrologic flow paths.	This guideline would be met under the Proposed Action.

Source: USFS 2003

4.7.1.2 Rasmussen Collaborative Alternative

4.7.1.2.1 Aquatic Habitat

The RCA would directly impact approximately 20 fewer acres of wetland habitat and 0.4 fewer mile of intermittent and perennial stream channel compared with the Proposed Action. Because the majority of project disturbance, including the haul road, would occur in upland habitats under

the RCA, direct and indirect impacts to aquatic habitat would be minimal and include approximately 0.3 acre of direct impact to seasonal mountain drainages and minor amounts of siltation to these drainages. Implementation of erosion control measures would help to prevent sediment and runoff water from flowing into streams. Because of the incorporation of BMPs (**Section 4.5.1.1.2**) into the design of the RCA, and avoidance of most direct impacts, overall impacts to aquatic habitats would be negligible under the RCA.

The capture of surface runoff during active mining would decrease the quantity of water in streams and wetlands downstream of the Study Area over the short term. As explained in **Section 4.3.1**, the area of captured runoff equates to approximately 4 percent of the Angus Creek-Blackfoot River sub-watershed and 0.03 percent of the Lower Lanes Creek sub-watershed. The reduced quantity of water may result in the localized drying of some aquatic habitats downstream of the Study Area over the short term. Following reclamation, runoff to nearby streams and wetlands is predicted to increase relative to pre-mining conditions as a result of the cap and cover design that increases runoff.

The RCA would also result in direct impacts to approximately 11 acres of AIZ, which is 69 fewer acres than under the Proposed Action. The minimal loss of stream habitat and AIZ function would result in direct and indirect impacts to cutthroat trout and other native fishes that would be potentially long-term, local, and negligible (**Section 4.7.1.2.3**).

4.7.1.2.2 Macroinvertebrates

Impacts to macroinvertebrates under the RCA would be reduced compared with those under the Proposed Action. Macroinvertebrates have the potential to be impacted by sedimentation and changes to the AIZ, which change the physical characteristics of the aquatic environment. There would only be 11 acres of direct impacts to the AIZ under the RCA, compared with 80 acres under the Proposed Action.

In contrast to the Proposed Action, the RCA would result in no measureable loading of selenium and other COPCs into surface waters because of the elimination of external overburden piles downslope of the mine. Exposure of macroinvertebrates to selenium or other COPCs is not anticipated under the RCA. Overall, the RCA would have a long-term, negligible impact on aquatic macroinvertebrates in wetlands and waters downstream of the Study Area.

4.7.1.2.3 Fish

The two differences between the Proposed Action and the RCA that would affect fisheries and aquatic resources are:

- The elimination of all external overburden piles downslope from the pit would eliminate the potential for COPC loading to surface water.
- The elimination of the Proposed Action haul road across the Rasmussen Valley would eliminate eight surface water crossings and there would only be 2 acres of direct impacts to AIZ under the RCA, compared with 28 acres under the Proposed Action.

The RCA would eliminate the use of external overburden piles downslope of the mine pit. Source of loading of COPCs via shallow groundwater migration under the Proposed Action is the seepage from the external overburden piles. Eliminating all external overburden stockpiles downslope of the Rasmussen Valley Mine pit would eliminate the source of COPCs in shallow groundwater; hence, there would be no impacts to surface water quality from COPC loading under the RCA.

Based on the modeling results, all COPC concentrations in groundwater prior to mixing with surface water features are predicted to meet applicable surface water standards. Therefore, exposure of fish to selenium or other COPCs is not anticipated under the RCA.

No crossings of fish-bearing streams would be required under the RCA. Several seasonal mountain drainages would be crossed by the haul road, and culverts would be constructed at these crossings to maintain surface flows and minimize sedimentation to the watershed. Thus, the RCA would comply with BLM and USFS standards and guidelines requiring the maintenance of instream flows and would not fragment fish habitats or prevent fish migration.

Overall, the RCA would have a short-term, negligible impact on fish populations in wetlands and waters downstream of the Study Area.

4.7.1.2.4 Amphibians and Reptiles

Due to the avoidance of most wetland and aquatic habitat under the RCA, impacts on amphibians and reptiles would be negligible. Over the short term, direct mortalities to individual amphibians and reptiles may occur on the haul road as individuals disperse between wetland habitats. The placement of culverts and mine runoff into seasonal mountain drainages could introduce sediments into habitats used by amphibians and reptiles. Compared with the Proposed Action, long-term impacts of sedimentation would be more localized and less severe because the RCA would avoid crossings of perennial water bodies that support amphibian populations and would directly impact approximately 20.5 fewer wetland acres.

Indirect effects could also adversely affect amphibian populations including short-term localized drying of wetlands as a result of capture of surface runoff during active mining. Compared with the Proposed Action, the RCA would carry no potential to affect amphibian and reptile populations through the introduction of COPCs into the watershed. Impacts on amphibians and reptiles from the RCA would be long-term and negligible.

Table 4.7-3 summarizes compliance with the PFO ARMP with regard to fisheries and aquatic resources under the RCA.

Table 4.7-3 Compliance with Applicable PFO ARMP Goals, Objectives, and Actions for Fisheries and Aquatic Resources under the RCA

Goal/Objective/Action	Compliance under RCA
Action SW-2.1.4. Stream crossings, if necessary, will be designed to minimize adverse impacts on soils, water quality, and riparian vegetation and provide for fish passage as appropriate.	No crossings of fish-bearing streams would be necessary under the RCA. Culverts on seasonal mountain drainages would be installed to conform to the natural streambed and slope so that natural flows are not impeded. Thus, the RCA would comply with BLM and USFS standards and guidelines requiring the maintenance of instream flows and would not fragment fish habitats or prevent fish migration.
Action SW-2.1.5. As appropriate, roads and trails adjacent to streams or riparian areas that impact water quality may be redesigned, repaired, maintained, or re-located to a location not impacting the water quality.	The RCA would conform to this action. The RCA would avoid perennial stream crossings and would minimize impacts to wetlands and riparian areas. Roads constructed under the RCA are not anticipated to significantly impact water quality because of the implementation of BMPs to control sedimentation and runoff.
Action ME-2.2.2. The following operation standards and	This action would be met under the RCA, as this

Table 4.7-3 Compliance with Applicable PFO ARMP Goals, Objectives, and Actions for Fisheries and Aquatic Resources under the RCA

Goal/Objective/Action	Compliance under RCA
guidelines would be applied as appropriate to reduce environmental impacts from mineral exploration and development operations: **OPERATIONAL STANDARDS:** 1. Locate surface disturbing activities, including support facilities, outside riparian zones (e.g., riparian habitat conservation areas (RHCAs) or areas where surface disturbance will impact the PFC of the riparian areas) and fish bearing waters. Cutthroat trout guidance will be considered as identified in Appendix C of the ARMP. Where no feasible alternative site exists, operate and construct facilities in ways that will avoid or reduce impacts on riparian zone attributes.	alternative was designed, in part, to minimize impacts to streams and wetlands. The vast majority of project disturbance under the RCA would occur in upland habitats. There would be 11 acres of direct impacts to the AIZ and a loss of 0.3 acre of riparian/wetland habitat.

Source: BLM 2012a

Table 4.7-4 summarizes compliance with the CNF RFP with regard to fisheries and aquatic resources under the RCA. The following standards and guidelines pertaining to aquatic resources were also reviewed and found to be not applicable to the RCA:

- Prescription 2.8.3 (AIZ) Fire/Fuels Guidelines 1 through 5
- Prescription 2.8.3 (AIZ) Lands Standard 2
- Prescription 2.8.3 (AIZ) Lands Guidelines 2 through 5
- Prescription 2.8.3 (AIZ) Minerals/Geology Guidelines 2 through 3 and 5
- Prescription 2.8.3 (AIZ) General Riparian Area Management Standard 1
- Prescription 2.8.3 (AIZ) Fisheries Guidelines 2 through 3
- Prescription 2.8.3 (AIZ) Wildlife Standard 1
- Prescription 2.8.3 (AIZ) Access Standard 1
- Prescription 2.8.3 (AIZ) Fisheries Guidelines 2 through 3
- Prescription 2.8.3 (AIZ) Recreation Standards 1 and 2 and Guideline 1
- Prescription 2.8.3 (AIZ) Grazing Management Standards 1 and 2 and Guidelines 1 and 2
- Prescription 2.8.3 (AIZ) Timber Standard 1 and Guidelines 1 and 2

Table 4.7-4 Compliance with Applicable Caribou Forest Plan Standards and Guidelines for Fisheries and Aquatic Resources under the RC

Standard/Guideline	Compliance under Proposed Action
Amphibians Guideline 3: Maintain amphibian habitats when developing and modifying springs and wetlands.	This guideline would be met under the RCA, as the RCA was designed to avoid most impacts to wetland and riparian habitat.
Prescription 2.8.3 Lands Standard 1: Special use authorizations for new projects involving instream facilities shall maintain minimum instream flows to maintain or	No crossings of fish-bearing streams would be necessary under the RCA. Culverts on seasonal mountain drainages would be installed to conform to the natural

Table 4.7-4 Compliance with Applicable Caribou Forest Plan Standards and Guidelines for Fisheries and Aquatic Resources under the RC

Standard/Guideline	Compliance under Proposed Action
improve desired AIZ attributes.	streambed and slope so that natural flows are not impeded. Thus, the RCA would comply with BLM and USFS standards and guidelines requiring the maintenance of instream flows and would not fragment fish habitats or prevent fish migration.
Prescription 2.8.3 Minerals/Geology Guideline 1: Locate new structures, support facilities, and roads outside AIZs. Where no alternative to siting facilities in AIZs exists, locate and construct the facilities in ways that avoid or reduce impacts to desired AIZs attributes. Where no alternative to road construction exists, keep roads to the minimum necessary for the approved mineral activity.	This guideline would be met under the RCA, as this alternative was designed, in part, to minimize impacts to streams and wetlands. The vast majority of project disturbance under the RCA would occur in upland habitats. There would be 11 acres of direct impacts to the AIZ and a loss of 0.3 acre of riparian/wetland habitat.
Prescription 2.8.3 Minerals/Geology Guideline 4: Do not locate debris, mine overburden, excess material, leaching pads, and other facilities within Aquatic Influence Zones, unless no other alternatives are available. If no other alternative exists, ensure that safeguards are in place to prevent release or drainage of toxic or other hazardous materials onto these lands.	This guideline would be met under the RCA. There would be 11 acres of direct impacts to the AIZ.
Prescription 2.8.3 General Riparian Area Management Guideline 1: Felled trees should remain on site when needed to meet woody debris objectives and desired AIZ attributes.	This guideline would not be met under the RCA. Agrium has no plans to use felled trees to meet woody debris objectives in AIZs.
Prescription 2.8.3 General Riparian Area Management Guideline 2: Use herbicides, pesticides, and other toxicants and chemicals only as needed to maintain desired AIZ attributes.	This guideline would be met under the RCA. Agrium would adhere to federal and state requirements for herbicide and pesticide use and use these chemicals only where necessary.
Prescription 2.8.3 General Riparian Area Management Guideline 3: Avoid storage of fuels and other toxicants or refueling within AIZs unless there are no other alternatives. Any refueling sites within an AIZ should have an approved spill containment plan.	This guideline would be met under the RCA. The fuel storage area would be located outside of the AIZ, and Agrium would implement spill control and containment measures specified in the SPCC Plan that would be prepared for the RCA.
Prescription 2.8.3 Fisheries Guideline 1: Where feasible, restore connectedness of disjunct populations and enhance fish passage for native fish.	No crossings of fish-bearing streams would be necessary under the RCA. Culverts on seasonal mountain drainages would be installed to conform to the natural streambed and slope so that natural flows are not impeded. Thus, the RCA would comply with BLM and USFS standards and guidelines requiring the maintenance of instream flows and would not fragment fish habitats or prevent fish migration.
Prescription 2.8.3 Roads and Trails Standard 1: All new and replaced culverts, both permanent and temporary, shall be designed and installed to meet desired conditions for riparian and aquatic species.	No crossings of fish-bearing streams would be necessary under the RCA. Culverts on seasonal mountain drainages would be installed to conform to the natural streambed and slope so that natural flows are not impeded. Thus, the RCA would comply with BLM and USFS standards and guidelines requiring the maintenance of instream flows and would not fragment fish habitats or prevent fish migration.
Prescription 2.8.3 Roads and Trails Guideline 1: Avoid constructing roads within the AIZ unless there is no	This guideline would be met under the RCA. The proposed haul road would impact 2 acres of AIZ.

Table 4.7-4 Compliance with Applicable Caribou Forest Plan Standards and Guidelines for Fisheries and Aquatic Resources under the RC

Standard/Guideline	Compliance under Proposed Action
practical alternative.	
Prescription 2.8.3 Roads and Trails Guideline 2: Culverts (permanent and temporary) should be sized so that the probability of flow exceedance is 50 percent or less during the time the culvert is expected to be in place. Consider bedload and debris when sizing culverts.	This guideline would be met under the RCA. Culverts would be designed to accommodate 100-year, 24-hour or 50-year, 24-hour flow conditions, as detailed in **Table 2.3-6** and would follow the requirements of the Federal Highway Administration Design Manual for high standard roads on federal lands.
Prescription 2.8.3 Roads and Trails Guideline 3: When feasible, use bridges, arches, and open-bottom culverts in fish-bearing streams.	This guideline would be met under the RCA. No crossings of fish-bearing streams would be necessary under this alternative.
Prescription 2.8.3 Roads and Trails Guideline 4: Avoid placing ditch relief culverts where they may discharge onto erodible slopes or directly into streams.	This guideline would be met under the RCA.
Prescription 2.8.3 Roads and Trails Guideline 5: Where feasible, install cross-drainage above stream crossings to prevent ditch sediments from entering streams.	This guideline would be met under the RCA.
Prescription 2.8.3 Roads and Trails Guideline 6: New or reconstructed roads and trails should cross the AIZ riparian areas as perpendicular as possible.	This guideline would be met under the RCA. The proposed haul road would impact 2 acres of AIZ.
Prescription 2.8.3 Roads and Trails Guideline 7: Avoid making channel changes on streams or drainages.	This guideline would be met under the RCA.
Prescription 2.8.3 Roads and Trails Guideline 8: Design and install drainage crossings to reduce the chances of turning stream flows down the road prism in case of a blocked or overflowing culvert.	This guideline would be met under the RCA.
Prescription 2.8.3 Roads and Trails Guideline 9: Road drainage patterns should avoid disruption of natural hydrologic flow paths.	This guideline would be met under the RCA.

Source: USFS 2003

4.7.1.3 No Action Alternative

Under the No Action Alternative, the federal phosphate leases would not be developed. The No Action Alternative would result in no new impacts to aquatic resources in the Study Area. The No Action Alternative would maintain the current status of aquatic resources and populations in and around the Study Area. However, this does not preclude future development of the federal phosphate leases under a different mine plan.

4.7.2 Irreversible and Irretrievable Commitment of Resources

Under the Proposed Action, the loss of wetland/riparian vegetation and alteration of AIZ is considered a long-term, irreversible commitment of aquatic habitat resources. Impacted wetlands, riparian areas, and AIZ would be re-seeded with upland vegetation, and while off-site mitigation may be required to offset wetland impacts under the CWA, the loss of wetland and riparian habitat and conversion of AIZ to upland habitat within the analysis area would be considered irreversible. This long-term, irreversible commitment of resources would be much less under the RCA, as there would only be 0.3 acre of direct disturbance to wetlands and 11 acres of direct disturbance

to AIZ, compared with 20.5 acres and 80 acres, respectively, under the Proposed Action. The irreversible and irretrievable alteration of aquatic habitat would affect fish-bearing streams (Angus Creek and tributaries) under the Proposed Action but not under the RCA. Therefore, the RCA would not have any irreversible or irretrievable effects on fish populations.

4.7.3 Unavoidable Residual Adverse Effects

Unavoidable residual adverse effects of the Proposed Action and RCA would include the long-term loss of wetland and riparian habitat and alteration of AIZ vegetation within the Study Area. The residual loss of aquatic habitat would be greater under the Proposed Action, which would directly impact more wetland and riparian habitat and AIZ than the RCA.

4.7.4 Mitigation Measures

Agrium would design and implement BMPs to control erosion, sedimentation, and the release of COPCs to protect surface waters in and around the Proposed Action, as described in **Section 4.3.4**. Agrium would limit the surface area of Meade Peak overburden that would be exposed at any given time through direct backfilling. Under the Proposed Action, Agrium would cap backfilled areas with a 5-foot thick store-and-release cover. Under the RCA, a 6-foot thick store-and-release cover would be used on backfilled areas that would further limit percolation of precipitation. This cap and cover would consist of 1 foot of pit GM overlying 2 feet of combined alluvium/GM, which in turn would overlie 3 feet of pit alluvium. Additionally, surface water drainage diversion structures could be constructed prior to initiating each mining phase to intercept runoff before it reaches the pit, thereby avoiding runoff water contact with Meade Peak-containing material. Dust would be mitigated or minimized by the application of water and, as necessary, supplemented with dust suppressants such as magnesium chloride or calcium chloride. Collectively, these measures would limit inputs of sediment and COPCs into Angus Creek and the Blackfoot River, which would minimize the potential for degradation of aquatic habitat.

Culverts would be constructed to convey natural drainages under potential linear obstructions, such as haul roads or county roads, to limit impacts from stream crossings. Under the Proposed Action, this would maintain passage for aquatic species, including fish and amphibians. No crossings would be constructed across fish-bearing streams under the RCA.

A SPCC Plan would be developed prior to construction and operations, providing direction for preventing and controlling potential spills; describing the aboveground tanks and secondary containment structures for bulk petroleum products, solvents, and antifreeze; identifying the routine monitoring requirements; and describing BMPs for the COPCs. The SPCC Plan would help to minimize the potential for releases of petroleum products into downstream waters and thus help to protect aquatic habitat.

The surface water monitoring network to monitor compliance with IDEQ water quality standards is discussed in the EMP (**Appendix A**). As part of the EMP, Agrium would monitor water quality to determine whether mine-related increases in COPCs were occurring in downstream waters. The EMP would provide flexibility for Agrium to conduct additional macroinvertebrate or fish sampling, if determined to be necessary based on water sampling results, and to employ mitigation measures if determined to be necessary in the future.

4.8 THREATENED, ENDANGERED OR SENSITIVE SPECIES

Issue: What is the potential for impact to threatened, endangered, or sensitive species through mortality and displacement?

Indicators:

- Disruption of movement corridors between habitat areas
- Disruption and displacement of threatened, endangered, or sensitive species at lek, nest, or roost sites
- Disturbance to threatened, endangered, or sensitive species from noise and mining activity
- Mortality of threatened, endangered, and sensitive species through vehicle and power line collisions

Issue: What is the potential to impact threatened, endangered, or sensitive species through habitat removal and alteration?

Indicators:

- Acres of habitats for threatened, endangered, or threatened species physically disturbed and reclaimed
- Changes in predator/prey interactions for threatened, endangered, or sensitive species

Issue: What is the potential exposure to toxic substances such as selenium or other COPCs to threatened, endangered, or sensitive species?

Indicators:

- Exposure to uptake of selenium or other COPCs in vegetation
- Exposure to selenium or other COPCs into surface waters

4.8.1 Direct and Indirect Impacts

4.8.1.1 Proposed Action

4.8.1.1.1 Threatened, Endangered, Proposed, and Candidate Species

As discussed in **Section 3.8.1**, a list of federally listed species by county was obtained from the U.S. Fish and Wildlife Service (USFWS 2015). It was determined that the following federally listed, proposed, or candidate species have potential to occur in or near the Proposed Action and vicinity: Canada lynx (threatened) and greater sage-grouse (candidate). In accordance with Section 7 consultation requirements under the ESA, a Biological Assessment (BA) will be prepared and finalized prior to the signing of the ROD documenting the potential impacts to federally listed species from the selected alternative. As a federal candidate species, the greater sage-grouse will be included in the BA in the event that it becomes federally listed prior to signing the ROD. Overall impacts to threatened and special status species from the Proposed Action would be long-term and negligible to moderate. Individual species are discussed below. There are no endangered species in the vicinity of the Proposed Action.

Canada Lynx

As discussed in **Section 3.8.1.1**, the Study Area lies within a linkage area for the Canada lynx. Therefore, the primary impact of the Proposed Action on the Canada lynx would be the disruption of lynx movement through the linkage area. As a part of a linkage area, the Study Area would only be expected to be used by transitory lynx; therefore, impacts of temporary, small-scale habitat removal and alteration, as well as exposure to COPCs, would be negligible for the Canada lynx.

The year-round noise and human activity associated with the construction and active mining phase of the Proposed Action would likely influence lynx to travel around the periphery of the Study Area rather than directly through the Study Area. If lynx did move through the Study Area during construction or active mining, they could be at risk of vehicle collision along the haul road. However, this would be an extremely rare occurrence and it is more likely that lynx would travel around the edges of the mine rather than directly crossing the haul road during times of heavy truck traffic. The proposed area of disturbance is approximately 5 miles wide (measured northwest to southeast), but the Study Area is located near the western periphery of the linkage area and there would still be an approximately 8-mile-wide corridor of linkage habitat to the east of the Study Area that would be undisturbed by the Proposed Action. Furthermore, after active mining was completed, the majority of disturbance would be reclaimed with grasses and shrubs, and human presence in the area would be minimal. There would be short-term and negligible impacts to Canada Lynx. Over the long term, there would be no impact on lynx movement through the region. As such, a preliminary determination that the Proposed Action may affect, but is not likely to adversely affect, the Canada lynx has been made. Compliance with applicable USFS management direction for Canada lynx is summarized in **Table 4.8-1**. In addition, the following management direction was reviewed and found to not be applicable to a phosphate mine project:

- Caribou Forest Plan (USFS 2003) Lands Objective 1 and Lands Standard 1

Table 4.8-1 Compliance with USFS Management Direction for Canada Lynx under the Proposed Action

Source	Management Direction	Compliance under Proposed Action
2003 Caribou Forest Plan	Forest Vegetation DFC 1 - Forested habitats display a diversity of structure and composition. Productive and diverse populations of plants are maintained or restored.	Proposed Action would not hinder this DFC. Impacts to forested habitat would be minor (83 acres).
	Forest Vegetation DFC 2 - In conifers, a range of structural stages exists where 30 to 40 percent of the acres are in mature and old age classes. Early successional stages are maintained through endemic insect and disease disturbance, vegetation management and fire. Patterns are within historical ranges of variability with functional corridors present.	Proposed Action would not hinder this DFC. No conifer habitat would be affected.
	Forest Vegetation DFC 3 - Conifer types are maintained and disturbance processes are restored through vegetation management, endemic insect / disease disturbances, & fire.	Proposed Action would not hinder this DFC. No conifer habitat would be affected.
	Forest Vegetation DFC 4 - Quaking aspen communities are moving towards historical	Proposed Action would not hinder this DFC. Impacts to aspen communities

Table 4.8-1 Compliance with USFS Management Direction for Canada Lynx under the Proposed Action

Source	Management Direction	Compliance under Proposed Action
	ranges with fire and other practices influencing structural class distribution and patterns across the landscape. Aspen forests are managed to achieve desired vegetative conditions with 20 to 30 percent in mature and old age classes, and to reduce the decline of aspen acres as a result of succession of aspen to conifer.	would be minor (83 acres) and would not affect the distribution of forest stand age classes in the Study Area.
	Non-forest DFC-1 - Non-forested ecosystems: are resilient, diverse, and functioning within their site potential; display a diversity of structure and composition; and are within their historical range of variability (HRV).	Proposed Action would not hinder this DFC. Impacts to non-forested ecosystems would largely be temporary and they would be reclaimed with a variety of native plant species.
	Non-forest DFC-2 - Non-forested ecosystems reflect a mosaic of multiple-aged shrubs, forbs, and native grasses with management emphasis on maintaining a diverse sustainable plant community. Fire regimes exist on an approximate 20 to 40 year return cycle. Patterns are within historical ranges with 30 to 50 percent of the shrubs in greater than fifteen percent canopy cover class.	Proposed Action would not hinder this DFC. Impacts to non-forested ecosystems would largely be temporary and they would be reclaimed with a variety of native plant species. Over the long term, reclaimed areas would recover to big sagebrush and high-elevation rangeland habitat types similar to baseline conditions.
	Non-forest DFC-3 - Rehabilitation or restoration of native shrub communities is accomplished, where site potential permits.	Proposed Action would not hinder this DFC. Over the long term, reclaimed areas would recover to big sagebrush and high-elevation rangeland habitat types similar to baseline conditions.
	Non-forest DFC-4 - On areas capable of tall forb dominance, tall forb types reflect historical ranges of ground cover leading into the winter season. Composition reflects a mosaic dominance of tall forb indicator species. Disturbance regimes demonstrate stable or upward trend in tall forb indicator species. Patterns are within the historical range. Historical tall forb sites, which currently are not capable of tall forb dominance, are managed to maintain watershed stability.	Proposed Action would not hinder this DFC. Tall forbs would re-establish in reclaimed areas from surrounding habitats.
	Non-forest DFC-5 - Woodland types including mountain mahogany, juniper and maple have multiple-aged shrub layers and a balanced shrub/herbaceous understory. Patterns are within historical ranges.	Proposed Action would not hinder this DFC. The Study Area does not contain these woodland types.
	Vegetation Goal 1 - Diverse forested and non-forested ecosystems are maintained within their historic range of variability or restored through time with emphasis on aspen, aspen-conifer, mixed conifer, big sagebrush, mountain brush and tall forbs.	Proposed Action would be consistent with this goal after reclamation activities were completed and the site had recovered to big sagebrush and high-elevation rangeland habitat types.

Table 4.8-1 Compliance with USFS Management Direction for Canada Lynx under the Proposed Action

Source	Management Direction	Compliance under Proposed Action
	Vegetation Goal 2 - Aspen forests are managed to reduce or halt the decline of aspen acres as a result of succession of aspen to conifer.	Proposed Action would not be consistent with this goal, as it would permanently remove 83 acres of aspen.
	Vegetation Goal 3 - Forested ecosystems are moving towards a balance of age and size classes in each forested vegetation type on a watershed or landscape scale. Early seral species are recruited and sustained while still providing a diversity of successional stages.	Proposed Action would be consistent with this goal. The removal of 83 acres of forest habitat would not impact the distribution of forest stand age classes on the Forest.
	Vegetation Goal 4 - Sagebrush steppe and mountain shrub habitats are moving toward a balance of age, canopy cover, and size class on a watershed or landscape scale that is within their HRV.	Proposed Action would be consistent with this goal after reclamation activities were completed and the site had recovered to big sagebrush and high-elevation rangeland habitat types.
	Vegetation Goal 7 - Biodiversity is maintained or enhanced by managing for a diverse array of habitats tied to natural process occurrence and distribution of plant communities.	Proposed Action would be consistent with this goal. Habitat changes resulting from the Proposed Action would be localized to the project footprint and would not impact biodiversity on the Forest.
	Vegetation Standard 2 - In each 5th code HUC which has the ecological capability to produce forested vegetation, the combination of mature and old age classes (including old growth) shall be at least 20 percent of the forested acres. At least 15 percent of all the forested acres in the HUC are to meet or be actively managed to attain old growth characteristics.	Proposed Action would be consistent with this standard. The removal of 83 acres of forest habitat would not impact the distribution of forest stand age classes in the 5th code HUC.
	Wildlife Goal 2 - Wildlife biodiversity is maintained or enhanced by managing for vegetation and plant communities within their historical range of variability.	Proposed Action would be consistent with this goal. Habitat changes resulting from the Proposed Action would be localized to the project footprint and would not impact wildlife biodiversity on the Forest.
	Wildlife Goal 3 - Maintain multiple vegetation layers in woody riparian habitats that are stable or increasing with all age classes (seedlings, young plants, mature and decadent) represented to support native bird communities and other wildlife.	Proposed Action would not be consistent with this goal. Three acres of woody riparian habitat (shrub/scrub wetland) would be permanently removed under the Proposed Action.
	Wildlife Goal 5 - Maintain, and where necessary and feasible, provide for habitat connectivity across forested and non-forested landscapes.	Proposed Action would be consistent with this goal. Over the short term, the haul road and other project facilities would fragment some of the shrub habitats in the Study Area, but these areas would be reclaimed following active mining and therefore habitat connectivity would not be impacted over the long term.

Source: USFS 2007, 2003

Greater Sage-grouse

The Proposed Action may impact greater sage-grouse through short-term displacement of individuals, long-term habitat loss and alteration, direct mortality from vehicle collisions, avoidance responses to the proposed power line, and increased predation. However, the area is well outside of mapped greater sage-grouse habitat (Priority Habitat Management Areas [PHMA], Important Habitat Management Areas [IHMA], or General Habitat Management Areas [GHMA]); therefore, population-level impacts are unlikely. Under the Proposed Action, additional mining activities could potentially cause individual sage-grouse to temporarily or permanently avoid marginally suitable habitat in the vicinity of these activities. As a result, displaced sage-grouse may relocate to unaffected, but already occupied habitats where population and competition would increase. Consequences of such displacement and competition could result in lower survival and potentially lower reproductive success of individual sage-grouse (NTT 2011).

No occupied leks would be impacted. The single occupied lek, located 7.8 miles southwest of the Study Area, would be separated from the Proposed Action by intervening topography (Fox Hills and Wooley Range), which would block the sights and sounds of the Proposed Action from the lek and make it unlikely that breeding and nesting sage-grouse associated with this lek would be affected by the Proposed Action.

Habitat modifications associated with development of the Proposed Action may fragment marginally suitable sagebrush habitat and could directly and indirectly impact individual sage-grouse. However, the sagebrush shrublands in the Study Area are naturally patchy and fragmented. Under the Proposed Action, there would be 165 acres of direct removal of big sagebrush habitat, which is known to provide at least marginal habitat locally for small numbers of individual sage-grouse, based on baseline survey results (TRC 2012b, 2012c).

Over the long term, the areas reclaimed with the southwest aspects seed mix would be expected to recover to a plant community similar to that present in the on-site baseline big sagebrush rangeland and could again be used by sage-grouse.

Noxious weed and invasive plant introductions could indirectly impact sage-grouse over the long term through a reduction in habitat quality or changes in trophic structure. The potential for invasive species to spread would be highest in newly disturbed areas. However, impacts from noxious weeds are anticipated to be minimal because of the use of BMPs to control them.

Individual sage-grouse could collide with moving vehicles along the proposed haul road. In a study in Montana, vehicle collisions were found to be a more frequent cause of mortality than collisions with wires or fences (Wallestad 1975). A study in Idaho found that vehicle collisions were the cause of mortality for 4 percent of radio-marked females (Hagen 2005). However, vehicle collisions were not found to be a notable cause of mortality in a Nevada study (Blomberg et al. 2013). Under the Proposed Action, vehicles would travel the gravel haul road at low speeds, which would limit the potential for collisions.

The proposed power line could have direct and indirect effects on individual sage-grouse using the Study Area, but as noted previously, the area is outside of mapped habitat management areas. Several studies suggest that sage-grouse and related species instinctively avoid areas where power lines or other vertical structures are visible in order to avoid predation (Schroeder 2010). One study found that sage-grouse tend to avoid habitat located within 600 meters (1,968 feet) of power lines (Gillan et al. 2013; Braun 1998). By avoiding use of the habitat, the birds lose the benefits of that habitat. Thus, the effective habitat loss and fragmentation created by power lines may extend to an area much larger than the actual power line corridor. These impacts are

expected to be minor, as the power line would not fragment any PHMA, IHMA, or GHMA, or other important habitats for sage-grouse.

Power lines also provide hunting perches for raptors and ravens, which may result in increased predation on sage-grouse in the Study Area (Schroeder 2010; NGSGCT 2010). The power line would be constructed in compliance with APLIC standards to minimize raptor perching and thereby reduce predation on sage-grouse.

Overall, because the Proposed Action would impact marginal sage-grouse habitat and would not impact occupied leks or key breeding habitats, it would have long-term minor impacts on greater sage-grouse. Compliance with applicable BLM and USFS management direction for greater sage-grouse is summarized in **Table 4.8-2**. In addition, the following management direction was reviewed and found to not be applicable to a phosphate mine project:

- Caribou Forest Plan (USFS 2003) Sage-grouse Guideline 1

Table 4.8-2 Compliance with BLM and USFS Management Direction for Greater Sage-Grouse under the Proposed Action

Source	Management Direction	Compliance under Proposed Action
2012 PFO ARMP	**Action SS-1.3.6.** To the extent possible and to promote conservation, Greater sage-grouse habitat will be managed consistent with the *Conservation Plan for Greater Sage-grouse in Idaho* (IDFG 2006) or any future revisions/amendments and or current BLM guidance. Appropriate actions, conservation measures and guidelines that may be considered include, but are not limited to: • Continue efforts to map populations and habitat for greater sage-grouse. Map seasonal (lek, nesting, brood-rearing and winter) habitats along with source and isolated populations. • Establish goals for greater sage-grouse habitat conservation at the local level in conjunction with IDFG and local working groups for protection and maintenance of existing populations and restoration goals. • Protect and maintain suitable habitats and reconnect separated populations based upon the following priorities: 1. Key habitats 2. Source habitats (S1) 3. Restoration areas (R1, R2) 4. Areas that link isolated populations • Commensurate with site potential, manage key habitat for a range of sagebrush canopy cover averaging 15 to 25 percent (11 to 31 inches in height); at least 15 percent grass cover; and 10 percent cover of a diversity of forbs. • Monitor progress and adjust activities to make progress towards greater sage-	The Proposed Action would be consistent with BLM management direction for greater sage-grouse. No key or important sage-grouse habitats, as mapped by the BLM or IDFG, would be impacted by the Proposed Action. Disturbed areas would be reclaimed, and areas seeded with the southwest aspects seed mix would recover to big sagebrush habitat over time, which would provide shrub cover suitable for use by greater sage-grouse over the long term. There would be no temporary disturbance within 0.6 mile of occupied leks or permanent disturbance within 2 miles of occupied leks. The Proposed Action would not hinder BLM efforts to map important sage-grouse habitats; establish goals for sage-grouse habitat conservation; or protect, manage, or monitor key habitats and sage-grouse populations.

Table 4.8-2 Compliance with BLM and USFS Management Direction for Greater Sage-Grouse under the Proposed Action

Source	Management Direction	Compliance under Proposed Action
	grouse goals and objectives. • In areas where grouse habitats are fragmented by land ownership pattern, cooperate with IDFG and local working groups to identify and maintain long-term habitat by acquiring conservation easements or bringing crucial habitats into public ownership. • In cooperation with IDFG identify areas where application of pesticides for grasshopper or Mormon cricket control may negatively affect grouse broods. Identify a cooperative strategy to review requests for pesticide application in these identified locations. • Active sage-grouse leks will be protected during the lekking season from temporary human disturbance (e.g., routine maintenance, inspections, and construction activities) by requiring a minimum buffer of 0.6 miles. • New infrastructure facilities/structures (e.g., major power transmission lines, power distribution lines, communications towers, and temporary meteorological towers) requiring permanent surface occupancy will be sited in a manner that avoids sage-grouse habitat to the extent possible and will be placed at least 2.0 miles from occupied leks or other important sage-grouse seasonal habitats as identified locally. • Future permitted/authorized activities will be evaluated on a site specific basis for potential threats consistent with the Conservation Plan for Greater Sage-grouse in Idaho (IDFG 2006) and mitigated through the NEPA process. • Restore shrub-steppe habitats in the following priority: 1. source areas 2. restoration areas 3. areas that link isolated populations	
2003 Caribou Forest Plan	Sage-grouse Standard 1 – Cooperate with other state and federal agencies and private landowners to survey, inventory, and manage habitats for sage grouse and Columbian sharp-tailed grouse.	The Proposed Action would not hinder USFS efforts to cooperate on surveying, inventorying, and managing habitats for sage-grouse.
	Sage-grouse Guideline 2 – Management activities should consider proximity to active lek locations during site-specific project planning. Those within 10 miles of an active	The Proposed Action would be consistent with this guideline. Sage-grouse leks within 10 miles were considered for impacts; there is one occupied lek within 10 miles, which

Table 4.8-2 Compliance with BLM and USFS Management Direction for Greater Sage-Grouse under the Proposed Action

Source	Management Direction	Compliance under Proposed Action
	sage-grouse lek and 2 miles of active sharp-tailed grouse leks should be considered further for suitability as grouse habitat.	would not be impacted by the Proposed Action.
	Sage-grouse Guideline 3 - If management activities would impact courtship, limit physical, mechanical, and audible disturbances in the breeding complex during the breeding season (March to May) within three hours of sunrise and sunset each day.	The Proposed Action would be consistent with this guideline. No occupied leks would be impacted by the Proposed Action.
	Sage-grouse Guideline 4 - Where management actions will disturb nesting grouse, avoid manipulation or alteration of vegetation during the nesting period (May to June).	The Proposed Action would be consistent with this guideline. The nearest occupied lek is more than 7 miles away, and baseline studies indicated that sage-grouse are unlikely to use the Study Area for nesting.

Source: BLM 2012a; USFS 2003

4.8.1.1.2 USFS Sensitive and Management Indicator Species and BLM Sensitive Species

The following sections describe impacts to USFS sensitive, Management Indicator Species, and BLM sensitive species that carry potential to occur in the Study Area. As discussed in **Section 3.8.2**, the following sensitive and Management Indicator Species are not likely to occur in the Study Area because of a lack of suitable habitat and would therefore not be affected by the Proposed Action: pygmy rabbit, Uinta chipmunk, spotted bat, American three-toed woodpecker, Lewis's woodpecker, Williamson's sapsucker, Hammond's flycatcher, olive-sided flycatcher, and Virginia's warbler. These species are not discussed further. A Biological Evaluation (BE) will be prepared and finalized prior to the signing of the ROD documenting the potential impacts to USFS and BLM sensitive species from the selected alternative.

Gray Wolf

As discussed in **Section 3.8.2**, gray wolf use of the Study Area is likely limited to occasional transitory movements of individual wolves. Therefore, the primary impact of the Proposed Action on the gray wolf would be the disruption of wolf movement through the area. Impacts of temporary, small-scale habitat removal and alteration, as well as exposure to COPCs, would be negligible for the gray wolf because of their wide-ranging nature and lack of regular use of the Study Area.

The year-round noise and human activity associated with the construction and active mining phase of the Proposed Action would likely influence wolves to travel around the periphery of the Study Area rather than directly through the Study Area. If wolves did move through the Study Area during construction or active mining, they could be at risk of vehicle collision along the haul road. However, this would be an extremely rare occurrence, and it is more likely that wolves would travel around the edges of the mine rather than directly crossing the haul road during times of heavy truck traffic. After active mining was completed, the majority of disturbance would be reclaimed with grasses and shrubs, and human presence in the area would be minimal. Therefore, over the long term, there would be no impact on gray wolf movement through the region. Habitat disturbances within the Study Area would likely alter distributions of prey species, such as deer, elk, and moose, over the short term; however, over the long term, reclaimed areas would recover to shrubland habitats that support big game. Therefore, hunting areas for gray

wolves may shift away from the mine disturbance over the short term, but long-term movement patterns of gray wolves would not be affected. Overall, the Proposed Action would result in long-term but negligible impacts on gray wolves.

The PFO ARMP includes the following management guidance for gray wolves:

Action SS-1.2.4:

1. In cooperation with IDFG, USFWS, and others:
   - Determine the distribution of wolves and key gray wolf habitat areas (dens, rendezvous sites, and crucial big game winter ranges).
   - Cooperate in maintaining and improving gray wolf habitat by focusing on reducing human/wolf interactions and improving big game winter range.
2. Ensure that ongoing Federal actions support or do not preclude species recovery.
3. Ensure that new Federal actions support or do not preclude species recovery.
4. Protect gray wolves from disturbance that might result in displacement during critical periods.
5. Support conservation easements, cooperative management efforts, and other programs on adjacent non-Federal lands to support recovery of the gray wolf.

Minerals and Energy (ME)

1. Approve development of saleable or leasable minerals so as not to preclude species habitat conservation and recovery. This includes management of physical facilities, as well as disturbances to the species resulting from human uses.

Action SS-1.2.6: Gray wolf habitat (e.g., reproductive, rearing) will be conserved/managed in the following manner by:

- Analyzing habitat characteristics of public lands adjacent to the CNF in conjunction with the planned CNF evaluation to determine if suitable wolf habitat exists.
- Activities on public lands within the Yellowstone Nonessential Experimental Population Area (east of I-15) or the Central Idaho Nonessential Experimental Population Area (west of I-15) which will disturb within one mile of active gray wolf den sites and rendezvous sites between April 1 and June 30 when five or fewer breeding pairs are present will not be allowed (USFWS 1994a and 1994b).
- Coordinate habitat management with IDFG.

The Proposed Action would be consistent with this management guidance, as it would not preclude maintenance, improvement, or conservation of gray wolf habitat or preclude or hinder the species' recovery.

Wolverine

As discussed in **Section 3.8.2**, wolverine use of the Study Area is likely limited to occasional transitory movements of individual wolverines. Therefore, the primary impact of the Proposed Action on the wolverine would be the disruption of wolverine movement through the general area. Impacts of temporary, small-scale habitat removal and alteration, as well as exposure to COPCs,

would be negligible for the wolverine because of their wide-ranging nature and lack of regular use of the Study Area.

The year-round noise and human activity associated with the construction and active mining phase of the Proposed Action would likely influence wolverines to travel around the periphery of the Study Area rather than directly through the Study Area. If wolverines did move through the Study Area during construction or active mining, they could be at risk of vehicle collision along the haul road. However, this would be an extremely rare occurrence, and it is more likely that wolverines would travel around the edges of the mine rather than directly crossing the haul road during times of heavy truck traffic. After active mining was completed, the majority of disturbance would be reclaimed with grasses and shrubs, and human presence in the area would be minimal. Therefore, over the long term, there would be no impact on wolverine movement through the region. Habitat disturbances within the Study Area would likely alter distributions of prey species, such as deer, elk, and moose, over the short term; however, over the long term, reclaimed areas would recover to shrubland habitats that support big game. Therefore, foraging areas for wolverines may shift away from the mine disturbance over the short term, but long-term movement patterns of wolverines would not be affected. Overall, the Proposed Action would result in long-term but negligible impacts on wolverines.

The CNF RFP (USFS 2003) includes the following guideline for the wolverine: Restrict intrusive human disturbance within one mile around known active den sites, March 1 to May 15. The Proposed Action would be consistent with this guideline, as there are no known active den sites (or suitable denning habitat) within 1 mile of the Study Area.

Townsend's big-eared bat

The primary potential impacts of the Proposed Action on the Townsend's big-eared bat include the loss of foraging and commuting habitat, loss and degradation of water sources, mortality from vehicle collisions, changes in predator communities, and exposure to COPCs. Impacts to roosts or hibernacula of this species are unlikely, as there are no known caves or underground mine openings in the Study Area that would provide suitable roosting habitat.

The Proposed Action would result in the loss or alteration of approximately 419 acres of potential shrubland, woodland, wetland, and riparian foraging habitat. Habitat impacts would be long-term. The majority (95 percent) of disturbed habitat would be reclaimed and eventually recover to big sagebrush shrubland and high-elevation rangeland habitat types. However, losses of aspen forest, as well as wetland and riparian habitat, would be permanent. Water sources used by the Townsend's big-eared bat could be indirectly altered by sedimentation and a reduction in water quantity. These impacts would be short-term, as they would occur primarily during construction and active mining.

Townsend's big-eared bats could collide with moving vehicles along the haul road, when vehicles are traveling the road between dusk and dawn. Townsend's big-eared bats could also be subject to increased mortality from predators (such as the great horned owl) that are relatively more tolerant of human disturbance, and which may benefit from perching on the overhead power line. These impacts would be short-term, persisting until the mine had been reclaimed.

Townsend's big-eared bats may be exposed to selenium and other COPCs by foraging on aquatic insects that emerge from the streams downgradient of the mine, or by drinking water from the streams. The extent to which selenium toxicity might limit bat populations in southeast Idaho is unstudied. The Proposed Action would result in measureable loading of selenium and other COPCs to Angus Creek and the Blackfoot River, as described in **Section 4.3**; however, COPC

concentrations would be well below surface water standards. Therefore, the Proposed Action would not significantly increase the risk of selenium exposure to Townsend's big-eared bats above baseline levels.

Overall, impacts to Townsend's big-eared bats under the Proposed Action would be long-term and minor.

The CNF RFP (USFS 2003) does not contain any specific guidance for Townsend's big-eared bats relevant to a mining project; therefore, the Proposed Action would be consistent with the CNF RFP with respect to this species.

Boreal Owl

If boreal owls are nesting in the vicinity of the mine, noise and human activity may disturb or disrupt nesting pairs. However, boreal owls are relatively tolerant of noise and human presence near their nest sites and are unlikely to abandon nests as a result of these factors (Hayward and Verner 1994). Vegetation would be cleared outside of the nesting season to avoid removal of active boreal owl nests.

Project noise and activity may influence boreal owls to temporarily avoid areas near the Proposed Action while active mining is occurring. Boreal owls could also be directly impacted as a result of mortality through mechanisms, such as collision with aboveground structures (such as the overhead power line) and moving vehicles, particularly at night. Agrium would minimize collision risk on the power line by using APLIC design features such as appropriate spacing between conductors and grounded hardware, use of insulating or cover-up materials for perch management, and installation of bird flight diverters on the top grounding wire.

Approximately 83 acres of potentially suitable boreal owl habitat (aspen forest) would be removed under the Proposed Action, or approximately 16 percent of the aspen habitat in the Study Area. In addition to direct habitat loss, habitat removal could indirectly impact boreal owls by altering prey base and potentially increasing abundance of predators that are more tolerant of human activity, such as great horned owls. Most of the disturbed area would be reclaimed as soon as the area was no longer needed; however, reclaimed areas would not function as suitable habitat for boreal owls and would likely support a different prey community (favoring rodent species that are habitat generalists or grassland/shrubland species as opposed to mature forest species).

Due to the relatively small area of mature forest that would be impacted, and lack of indication from baseline studies for a robust boreal owl population in the Study Area, direct and indirect impacts under the Proposed Action are unlikely to have population-level effects on this species. Overall, the Proposed Action, with the implementation of design features and measures to minimize impacts on raptors, is expected to result in long-term but minor impacts on boreal owls.

The CNF RFP (USFS 2003) contains one guideline specific to boreal owls (Boreal Owl Habitat Guideline 1): "Within a 3,600-acre around all known boreal owl nest sites, maintain over 40% of the forested acres in mature and old age classes." This guideline would be met under the Proposed Action because there are no known nest sites in the Study Area, and even if there were, the Proposed Action would not impact enough aspen forest to change the distribution of forest age classes (which are already all either mature or old) in the Study Area.

Flammulated Owl

If flammulated owls are nesting in the vicinity of the mine, noise and human activity may disturb or disrupt nesting pairs. However, flammulated owls are relatively tolerant of noise and human presence near their nest sites and are unlikely to abandon nests as a result of these factors (Hayward and Verner 1994). Vegetation would be cleared outside of the nesting season to avoid removal of active flammulated owl nests.

Project noise and activity may influence flammulated owls to temporarily avoid areas near the Proposed Action while active mining is occurring. Flammulated owls could also be directly impacted as a result of mortality through mechanisms, such as collision with aboveground structures (such as the overhead power line) and moving vehicles, particularly at night. Agrium would minimize collision risk on the power line by using APLIC design features such as appropriate spacing between conductors and grounded hardware, use of insulating or cover-up materials for perch management, and installation of bird flight diverters on the top grounding wire.

Approximately 83 acres of potentially suitable flammulated owl habitat (aspen forest) would be removed under the Proposed Action, or approximately 16 percent of the aspen habitat in the Study Area. In addition to direct habitat loss, habitat removal could indirectly impact flammulated owls by altering prey base and potentially increasing abundance of predators that are more tolerant of human activity, such as great horned owls. Most of the disturbed area would be reclaimed as soon as the area was no longer needed; however, reclaimed areas would not function as suitable habitat for flammulated owls and would likely support a different prey community (favoring rodent species that are habitat generalists or grassland/shrubland species as opposed to mature forest species).

Due to the relatively small area of mature forest that would be impacted, and lack of indication from baseline studies that flammulated owls are present in the Study Area, direct and indirect impacts under the Proposed Action are unlikely to have population-level effects on this species. Overall, the Proposed Action, with the implementation of design features and measures to minimize impacts on raptors, is expected to result in long-term but minor impacts on flammulated owls.

The CNF RFP (USFS 2003) contains one guideline specific to flammulated owls (Flammulated Owl Habitat Guideline 1): “Do not allow timber harvest activities within a 30-acre area around all known flammulated owl nest sites.” This guideline would be met under the Proposed Action because there are no known nest sites in the Study Area.

Great Gray Owl

If great gray owls are nesting in the vicinity of the mine, noise and human activity may disturb or disrupt nesting pairs. Vegetation would be cleared outside of the nesting season to avoid removal of active great gray owl nests.

Project noise and activity may influence great gray owls to temporarily avoid some areas of the Proposed Action while active mining is occurring. Great gray owls could also be directly impacted as a result of mortality through mechanisms, such as collision with aboveground structures (such as the overhead power line) and moving vehicles, particularly at night. Agrium would minimize collision risk on the power line by using APLIC design features such as appropriate spacing between conductors and grounded hardware, use of insulating or cover-up materials for perch management, and installation of bird flight diverters on the top grounding wire.

Approximately 83 acres of potentially suitable great gray owl habitat (aspen forest) would be removed under the Proposed Action, or approximately 16 percent of the aspen habitat in the Study Area. In addition to direct habitat loss, habitat removal could indirectly impact great gray owls by altering prey base and potentially increasing abundance of predators that are more tolerant of human activity, such as great horned owls. Most of the disturbed area would be reclaimed as soon as the area was no longer needed; however, reclaimed areas would not function as suitable habitat for great gray owls and would likely support a different prey community (favoring rodent species that are habitat generalists or grassland/shrubland species as opposed to mature forest species).

Due to the relatively small area of mature forest that would be impacted, direct and indirect impacts under the Proposed Action are unlikely to have population-level effects on this species. Overall, the Proposed Action, with the implementation of design features and measures to minimize impacts on raptors, is expected to result in long-term but minor impacts on great gray owls.

The CNF RFP (USFS 2003) contains the following guidelines specific to great gray owl habitat:

- Within a 1,600-acre area around all known great gray owl nest sites, maintain over 40% of the forested acres in mature and old age classes.
- Restrict the use of strychnine poison to control pocket gophers within a ½ mile buffer around all active great gray owl nest sites.

The Proposed Action would be consistent with these guidelines. There are no known nest sites in the Study Area, and even if there were, the Proposed Action would not impact enough aspen forest to change the distribution of forest age classes (which are already all either mature or old) in the Study Area. Agrium would not use strychnine poison to control pocket gophers under the Proposed Action.

Bald Eagle

The Proposed Action is unlikely to impact nesting bald eagles because of a lack of known nests or suitable nesting habitat in the Study Area. There are also no known winter concentration areas or roosting areas in the Study Area; therefore, the impacts described below would most likely affect small numbers of individual eagles that forage in the area or move through the Study Area during the non-breeding season.

Project noise and activity may influence bald eagles to temporarily avoid some areas of the project footprint while active mining is occurring. Bald eagles could be directly impacted as a result of mortality from collision with aboveground structures (such as the overhead power line) and moving vehicles. Numerous studies have been conducted and published on the interactions between raptors (including bald eagles) and transmission lines, and raptor electrocution continues to be a concern of state and federal agencies (USGS 1999; Lehman 2001; Erickson et al. 2005; Manville 2005; Mojica et al. 2009). To minimize these potential impacts, Agrium would use APLIC avian-friendly design measures which could include appropriate spacing between conductors and grounded hardware, use of insulating or cover-up materials for perch management, and installation of bird flight diverters on the top grounding wire.

Approximately 20.5 acres of potentially suitable bald eagle foraging habitat (riparian and wetland areas) would be removed under the Proposed Action, or approximately 6 percent of the riparian and wetland habitat in the Study Area. In addition to direct habitat loss, the impacts to aquatic

habitats described in **Section 4.7** could alter the prey base for bald eagles; however, as noted in that section, substantial impacts on the overall fish population in the Study Area are unlikely. Because fish are a primary prey source for bald eagles, bald eagles may be relatively more susceptible than other raptors to toxic effects of COPC exposure. Peterson and Nebeker (1992) calculated a chronic water-borne selenium criterion specifically for bald eagles of 1.9 µg/L. As described in **Section 3.3**, baseline selenium concentrations in Angus Creek and the Blackfoot River already regularly exceed this value, especially during the spring runoff period. As described in **Section 4.3**, the Proposed Action would result in measureable loading of selenium and other COPCs into Angus Creek and the Blackfoot River, but the concentrations of these COPCs in surface water would be well below surface water standards (**Table 4.3-11** and **Table 4.3-12**). Therefore, the Proposed Action would not significantly increase the risk of selenium exposure to bald eagles in the Study Area.

Due to the relatively small area of wetland and riparian foraging habitat that would be impacted, and the negligible to minor effects anticipated to occur to aquatic resources, direct and indirect impacts under the Proposed Action are unlikely to have population-level effects on bald eagles. Overall, the Proposed Action, with the implementation of design features and measures to minimize impacts on raptors, is expected to result in long-term but minor impacts on bald eagles.

The PFO ARMP (BLM 2012a) includes the following relevant management guidance for bald eagles:

Action SS-1.2.4: Conservation measures will be implemented to support species recovery as identified below by resources and uses:

- In cooperation with IDFG, USFWS, and others:
  - Continue to cooperate in determining the distribution of populations and suitable habitats.
  - Following current monitoring protocols continue to cooperate in conducting systematic nest surveys and monitoring.
  - Cooperate in the management of nest sites and communal roost sites to promote species conservation.
  - Cooperate in the maintenance and improvement of habitat in key foraging areas, for example, mule deer winter range, and aquatic and riparian habitat for fish and waterfowl, where a need exists.
  - Cooperate to maintain and develop nesting and roosting habitat for future use by bald eagles.
- Ensure that ongoing Federal actions support or do not preclude species conservation.
- Ensure that new Federal actions support or do not preclude species conservation.
- Protect bald eagles from disturbance that might result in displacement during critical periods.
- Implement adaptive management as needed to achieve conservation objectives.
- Support conservation easements, cooperative management efforts, and other programs on adjacent non-Federal lands to support conservation of the bald eagle.

Minerals and Energy (ME)

1. Approve development of saleable or leasable minerals so as not to preclude species habitat conservation. This includes management of physical facilities, as well as disturbances to the species resulting from human uses.

The Proposed Action would be consistent with these guidelines because pesticide/herbicide use would be in accordance with label instructions, the power line would be designed to minimize raptor electrocution risk, and the Proposed Action would not preclude coordination with other agencies or habitat conservation for the species.

The CNF RFP (USFS 2003) contains the following guideline specific to bald eagle habitat: "Activities and developments should be designed to minimize conflicts with bald eagle wintering and migration habitat." The Proposed Action would be consistent with this guideline, as impacts to bald eagle wintering and migration habitat would be minimal relative to the species' home range size and dispersal capabilities.

Northern Goshawk

No northern goshawk nests have been confirmed within the Study Area. If northern goshawks are nesting in the vicinity of the mine, noise and human activity may disturb or disrupt nesting pairs. Vegetation would be cleared outside of the nesting season to avoid removal of active northern goshawk nests.

Project noise and activity may influence northern goshawks to temporarily avoid areas near the Proposed Action while active mining is occurring. Northern goshawks could also be directly impacted as a result of mortality from collision with aboveground structures (such as the overhead power line) and moving vehicles. Agrium would minimize collision risk on the power line by using APLIC design features such as appropriate spacing between conductors and grounded hardware, use of insulating or cover-up materials for perch management, and installation of bird flight diverters on the top grounding wire.

Approximately 83 acres of potentially suitable northern goshawk habitat (aspen forest) would be removed under the Proposed Action, or approximately 16 percent of the aspen habitat in the Study Area. In addition to direct habitat loss, habitat removal could indirectly impact northern goshawks by altering prey base and potentially increasing abundance of predators that are more tolerant of human activity, such as great horned owls. Most of the disturbed area would be reclaimed as soon as the area was no longer needed; however, reclaimed areas would not function as suitable nesting habitat for northern goshawks and would likely support a different prey community (favoring rodent species that are habitat generalists or grassland/shrubland species as opposed to mature forest species).

Due to the relatively small area of mature forest that would be impacted, and lack of evidence from baseline studies that there are any active or historical territories within the Study Area, direct and indirect impacts under the Proposed Action are unlikely to have population-level effects on this species. Overall, the Proposed Action, with the implementation of design features and measures to minimize impacts on raptors, would result in long-term but minor impacts on northern goshawks.

The CNF RFP (USFS 2003) provides standards and guidelines for management of forest habitat within active and historical northern goshawk nesting territories. As the Study Area is not known to contain any active or historical nesting territories, the Proposed Action would be consistent with the CNF RFP relative to impacts on northern goshawks.

Peregrine Falcon

The Proposed Action would not impact nesting peregrine falcons because of a lack of known nests or suitable nesting habitat in the Study Area. Therefore, the impacts described below would most likely affect small numbers of individual peregrine falcons that forage in the area or move through the Study Area during the non-breeding season.

Project noise and activity may influence peregrine falcons to temporarily avoid areas near the Proposed Action while active mining is occurring. Peregrine falcons could be directly impacted as a result of mortality from collision with aboveground structures (such as the overhead power line) and moving vehicles. Agrium would minimize collision risk on the power line by using APLIC design features such as appropriate spacing between conductors and grounded hardware, use of insulating or cover-up materials for perch management, and installation of bird flight diverters on the top grounding wire.

Approximately 419 acres of potentially suitable peregrine falcon foraging habitat (forest, shrubland, riparian, and wetland areas) would be removed under the Proposed Action, or approximately 17 percent of the available habitat in the Study Area. In addition to direct habitat loss, the impacts to aquatic habitats described in **Section 4.7** could alter the prey base for peregrine falcons, which often consume water birds. However, as noted in that section, the impacts on aquatic habitats are anticipated to be minor. Because of their consumption of water birds, peregrine falcons may be relatively more susceptible than other raptors to toxic effects of COPC exposure. As described in **Section 3.3**, baseline selenium concentrations in Angus Creek and the Blackfoot River already regularly exceed chronic aquatic life criteria, especially during the spring runoff period. Additional input of selenium and other COPCs into the watershed would be well below surface water standards under the Proposed Action, as described in **Section 4.3**. Therefore, the Proposed Action would not significantly increase the risk of selenium exposure to peregrine falcons in the Study Area above baseline levels.

Because the Study Area lacks nesting habitat for peregrine falcons and peregrine falcons may only use the Study Area sporadically, direct and indirect impacts under the Proposed Action are unlikely to have population-level effects on this species. Overall, the Proposed Action, with the implementation of design features and measures to minimize impacts on raptors, is expected to result in long-term but negligible impacts on peregrine falcons.

The CNF RFP (USFS 2003) contains the following standard and guideline specific to peregrine falcon habitat:

Standard 1: Within 15 miles of all known nest sites, prohibit all use of herbicides and pesticides which cause egg shell thinning as determined by risk assessment (USFS 1992).

Guideline 1: For proposed projects within two miles of known peregrine falcon nests, minimize such items as: (1) human activities (rock climbing, aircraft, ground and water transportation, high noise levels, and permanent facilities) which could cause disturbance to nesting pairs and young during the nesting period between March 15 and July 31; (2) activities or habitat alterations which could adversely affect prey availability.

These standards and guidelines would be met under the Proposed Action because Agrium would use only agency-approved herbicides and pesticides and because there are no known peregrine falcons nests within 2 miles of the Proposed Action.

Prairie Falcon

The Proposed Action would not impact nesting prairie falcons because of a lack of known nests or suitable nesting habitat in the Study Area. Therefore, the impacts described below would most likely affect small numbers of individual prairie falcons that forage in the area or move through the Study Area during the non-breeding season.

Project noise and activity may influence prairie falcons to temporarily avoid some areas of the Proposed Action while active mining is occurring. Prairie falcons could be directly impacted as a result of mortality from collision with above ground structures (such as the overhead power line) and moving vehicles. Agrium would minimize collision risk on the power line by using APLIC design features such as appropriate spacing between conductors and grounded hardware, use of insulating or cover-up materials for perch management, and installation of bird flight diverters on the top grounding wire.

Approximately 316 acres of potentially suitable prairie falcon foraging habitat (high-elevation rangeland and sagebrush) would be removed under the Proposed Action, or approximately 19 percent of the available habitat in the Study Area. The majority (99 percent) of this habitat loss would be short-term because most areas would be reclaimed once mining had ceased. Reclaimed areas would again provide potential foraging habitat for prairie falcons, initially supporting a grassland community which would recover to shrubland over the long term.

Because the Study Area lacks nesting habitat for prairie falcons, which may only use the Study Area sporadically, direct and indirect impacts under the Proposed Action are unlikely to have population-level effects on this species. Overall, the Proposed Action, with the implementation of design features and measures to minimize impacts on raptors, is expected to result in long-term but negligible impacts on peregrine falcons.

Neither the PFO ARMP nor the CNF RFP provides specific management guidance for prairie falcons.

Columbian sharp-tailed grouse

Because no Columbian sharp-tailed grouse leks were observed during baseline surveys, and the Study Area does not appear to support a breeding population (TRC 2012b), the Proposed Action would primarily affect individuals during the non-breeding season. Project noise and activity would likely cause Columbian sharp-tailed grouse to temporarily avoid some areas of the Proposed Action while active mining is occurring. Columbian sharp-tailed grouse would be at risk of collision with moving vehicles along the haul road. The haul road would also fragment formerly contiguous areas of sagebrush shrubland and create a potential barrier to grouse movement, especially during periods of heavy truck traffic.

Approximately 316 acres of potentially suitable Columbian sharp-tailed grouse foraging and wintering habitat (high-elevation rangeland and sagebrush) would be directly removed under the Proposed Action, or approximately 19 percent of the available habitat in the Study Area. The majority (99 percent) of this habitat loss would be short-term because most areas would be reclaimed once mining had ceased. Reclaimed areas would eventually recover to shrubland and again provide potential habitat for Columbian sharp-tailed grouse over the long term.

Under the Proposed Action, the power line may provide hunting perches for raptors and ravens, which may indirectly result in increased predation on Columbian sharp-tailed grouse in the Study Area. The power line would be constructed in compliance with APLIC standards to minimize the raptor perching and thereby reduce predation on Columbian sharp-tailed grouse.

Because Columbian sharp-tailed grouse use the Study Area sporadically, primarily during the non-breeding season, the Proposed Action is unlikely to have population-level effects on this species. Overall, the Proposed Action is expected to result in long-term minor impacts on Columbian sharp-tailed grouse.

The CNF RFP (USFS 2003) states that areas within 2 miles of active sharp-tailed grouse leks should be considered further for suitability as grouse habitat. As there are no active leks within 2 miles of the Proposed Action, there is no applicable USFS management guidance specific to this species. The PFO ARMP (BLM 2012a) provides management guidance for Columbian sharp-tailed grouse within 4 miles of leks for protection of winter habitat. There are no known leks within 4 miles of the Proposed Action. Therefore, the Proposed Action would be consistent with the CNF RFP and PFO ARMP with respect to Columbian sharp-tailed grouse.

Willow Flycatcher

To comply with the Migratory Bird Treaty Act (MBTA), Agrium would minimize the potential for direct mortality of willow flycatchers and other migratory birds by clearing vegetation from potential nesting habitat outside of the breeding season. If willow flycatchers are nesting in the vicinity of the mine, noise and human activity may disturb or disrupt nesting pairs. As discussed in **Section 4.6.1.1.2**, noise can negatively impact small birds by interfering with acoustic communication and eliciting an avoidance response.

Approximately 3 acres of potentially usable willow flycatcher habitat (shrub/scrub wetland) would be removed under the Proposed Action, or approximately 4 percent of the shrub/scrub wetland habitat in the Study Area. This loss of habitat would be permanent because reclaimed areas would be seeded with upland vegetation rather than being restored to their baseline riparian habitat type. These impacts would be short-term, as they would occur primarily during construction and active mining.

Willow flycatchers may be exposed to selenium and other COPCs by foraging on aquatic insects that emerge from the streams downgradient of the mine. The extent to which selenium toxicity might limit willow flycatcher populations in southeast Idaho is unstudied; however, in general, baseline selenium concentrations do not seem to limit migratory bird populations in the region (Ratti et al. 2006). Under the Proposed Action, additional loading of selenium and other COPCs into streams would be well below surface water standards, as described in **Section 4.3**. Therefore, the Proposed Action would not significantly increase the risk of selenium exposure to willow flycatchers at concentrations higher than baseline levels.

Due to the relatively small area of riparian habitat that would be impacted, direct and indirect impacts under the Proposed Action are unlikely to have population-level effects on this species. Overall, the Proposed Action, with the implementation of design features and measures to minimize impacts on migratory birds, is expected to result in long-term but minor impacts on willow flycatchers.

The PFO ARMP (BLM 2012a) does not provide any specific management direction for the willow flycatcher.

Loggerhead Shrike

To comply with the MBTA, Agrium would minimize the potential for direct mortality of loggerhead shrikes and other migratory birds by clearing vegetation from potential nesting habitat outside of the breeding season. If loggerhead shrikes are nesting in the vicinity of the mine, noise and human

activity may disturb or disrupt nesting pairs. As discussed in **Section 4.6.1.1.2**, noise can negatively impact small birds by interfering with acoustic communication and eliciting an avoidance response.

Approximately 316 acres of potentially suitable loggerhead shrike habitat (big sagebrush shrubland and high-elevation rangeland) would be removed under the Proposed Action, or approximately 19 percent of the habitat in the Study Area. The majority (99 percent) of this habitat loss would be short-term because most areas would be reclaimed once mining had ceased. Reclaimed areas would eventually recover to shrubland and again provide potential habitat for loggerhead shrikes over the long term.

Under the Proposed Action, the power line may provide a new perching and hunting opportunity for loggerhead shrikes. However, it may also provide a hunting perch for predators such as raptors and ravens. The power line would be constructed in compliance with APLIC standards to minimize the raptor perching and thereby reduce predation on loggerhead shrikes and other migratory birds.

Due to the relatively small area of shrubland habitat that would be impacted, as well as reclamation practices that would return the site to grassland and eventually to shrubland habitat after cessation of mining, direct and indirect impacts under the Proposed Action are unlikely to have population-level effects on loggerhead shrikes. Overall, the Proposed Action, with the implementation of design features and measures to minimize impacts on migratory birds, is expected to result in long-term but minor impacts on this species.

The PFO ARMP (BLM 2012a) does not provide any specific management direction for the loggerhead shrike.

Sage Sparrow and Brewer's Sparrow

To comply with the MBTA, Agrium would minimize the potential for direct mortality of migratory birds by clearing vegetation from potential nesting habitat outside of the breeding season. If sage sparrows or Brewer's sparrows are nesting in the vicinity of the mine, noise and human activity may disturb or disrupt nesting pairs. As discussed in **Section 4.6.1.1.2**, noise can negatively impact small birds by interfering with acoustic communication and eliciting an avoidance response.

Approximately 165 acres of potentially suitable sage sparrow and Brewer's sparrow habitat (big sagebrush shrubland) would be removed under the Proposed Action, or approximately 21 percent of the habitat in the Study Area. The majority (99 percent) of this habitat loss would be temporary because most areas would be reclaimed once mining had ceased. Areas reclaimed with the southwest aspects seed mix would eventually recover to big sagebrush shrubland and again provide potential habitat for sage sparrows and Brewer's sparrows over the long term.

Under the Proposed Action, the power line may provide a hunting perch for predators such as raptors and ravens. The power line would be constructed in compliance with APLIC standards to minimize the raptor perching and thereby reduce predation on sage sparrows, Brewer's sparrows, and other migratory birds.

Due to the relatively small area of big sagebrush habitat that would be impacted, as well as reclamation practices that would return much of the site to big sagebrush habitat after cessation of mining, direct and indirect impacts under the Proposed Action are unlikely to have population-level effects on sage sparrows or Brewer's sparrows. Overall, the Proposed Action, with the

implementation of design features and measures to minimize impacts on migratory birds, is expected to result in long-term but minor impacts on these two species.

The PFO ARMP (BLM 2012a) does not provide specific management direction for the sage sparrow or Brewer's sparrow.

Calliope Hummingbird

To comply with the MBTA, Agrium would minimize the potential for direct mortality of calliope hummingbirds and other migratory birds by clearing vegetation from potential nesting habitat outside of the breeding season. If calliope hummingbirds are nesting in the vicinity of the mine, noise and human activity may disturb or disrupt nesting pairs. As discussed in **Section 4.6.1.1.2**, noise can negatively impact small birds by interfering with acoustic communication and eliciting an avoidance response.

Approximately 86 acres of potentially suitable calliope hummingbird habitat (shrub/scrub wetland and aspen forest) would be removed under the Proposed Action, or approximately 14 percent of the habitat in the Study Area. This loss of habitat would be permanent because reclaimed areas would be seeded with upland grasses and shrubs rather than being restored to their baseline riparian or aspen forest habitat type. In addition, as discussed in **Section 4.5.1.1.2**, riparian habitats used by the calliope hummingbird could be indirectly altered by sedimentation and a reduction in water quantity. These impacts would be short-term, as they would occur primarily during construction and active mining.

Calliope hummingbirds may be exposed to selenium and other COPCs by foraging on plant nectar within riparian areas downgradient of the mine. The extent to which selenium toxicity might limit Calliope hummingbird populations in southeast Idaho is unstudied; however, in general, baseline selenium concentrations do not seem to limit migratory bird populations in the region (Ratti et al. 2006). The Proposed Action would raise the concentration of selenium and other COPCs in downstream surface waters by an amount well below surface water standards, as described in **Section 4.3**. Therefore, the Proposed Action would not significantly increase the risk of selenium exposure to Calliope hummingbirds above baseline levels.

Due to the relatively small area of riparian and forest habitat that would be impacted, direct and indirect impacts under the Proposed Action are unlikely to have population-level effects on this species. Overall, the Proposed Action, with the implementation of design features and measures to minimize impacts on migratory birds, is expected to result in long-term but minor impacts on Calliope hummingbirds.

The PFO ARMP (BLM 2012a) does not provide specific management direction for the Calliope hummingbird.

Trumpeter Swan

To comply with the MBTA, Agrium would clear vegetation from potential nesting habitat outside of the breeding season; therefore, direct impacts to trumpeter swan nests are not anticipated. Even if no nests are present within the Proposed Action, noise and human activity may disturb or disrupt nesting pairs if nests are present in the vicinity of the mine. Trumpeter swans are known to be sensitive to human disturbance and human activity near nest sites may lead to nest failure (Mitchell and Eichholz 2010). Furthermore, noise and human presence near wintering areas may lead to mortality or reduced reproductive potential (Mitchell and Eichholz 2010).

Trumpeter swans could also be directly impacted as a result of mortality from collision with above ground structures (such as the overhead power line) and moving vehicles. Agrium would minimize collision risk on the power line by using APLIC design features such as appropriate spacing between conductors and grounded hardware and installation of bird flight diverters on the top grounding wire.

Approximately 20.5 acres of potentially suitable trumpeter swan habitat (wetlands and riparian areas) would be removed under the Proposed Action, or approximately 6 percent of the wetland habitat in the Study Area. Most of the disturbed area would be reclaimed as soon as the area was no longer needed; however, reclaimed areas would not function as suitable trumpeter swan habitat, and wetland losses would be permanent. In addition, as discussed in **Section 4.5.1.1.2**, wetland habitats used by trumpeter swans could be indirectly altered by sedimentation and a reduction in water quantity. These impacts would be short-term, as they would occur primarily during construction and active mining.

Water birds such as trumpeter swans may be susceptible to toxic effects of COPC exposure in surface waters and aquatic food sources. As described in **Section 3.3**, baseline selenium concentrations in Angus Creek and the Blackfoot River already regularly exceed chronic aquatic life criteria, especially during the spring runoff period. Additional input of selenium and other COPCs into the watershed would be well below surface water standards under the Proposed Action, as described in **Section 4.3**. Therefore, the Proposed Action would not significantly increase the risk of selenium exposure to trumpeter swans in the Study Area above baseline levels.

Due to the relatively small area of wetland habitat that would be impacted, and lack of evidence from baseline studies that the Study Area supports nesting trumpeter swans, direct and indirect impacts under the Proposed Action are unlikely to have population-level effects on this species. Overall, the Proposed Action, with the implementation of design features and measures to minimize impacts on migratory birds, is expected to result in long-term but minor impacts on trumpeter swans.

The CNF RFP (USFS 2003) provides the following standard for trumpeter swan nesting habitat: *Maintain suitable trumpeter swan nesting habitat conditions in Elk Valley Marsh and other sites.* There is no known trumpeter swan nesting in the Study Area; however, the Proposed Action would not be consistent with maintaining potentially usable nesting habitat, as it would result in the permanent removal of 20.5 acres of wetland habitat and could indirectly degrade nesting habitat through releases of sediment and COPCs.

American White Pelican

There are no known American white pelican breeding colonies in the Study Area; therefore, direct impacts on nesting birds are unlikely. Flocks of foraging pelicans are sensitive to human encroachment and may disperse if approached (Knopf and Evans 2004). Project noise and activity may influence American white pelicans to temporarily avoid some areas of the Proposed Action while active mining is occurring. American white pelicans could also be directly impacted as a result of mortality from collision with above ground structures (such as the overhead power line) and moving vehicles. Agrium would minimize collision risk on the power line by using APLIC design features such as appropriate spacing between conductors and grounded hardware and installation of bird flight diverters on the top grounding wire.

Approximately 20.5 acres of potentially suitable American white pelican habitat (wetlands and riparian areas) would be removed under the Proposed Action, or approximately 6 percent of the

wetland habitat in the Study Area. Most of the disturbed area would be reclaimed as soon as the area was no longer needed; however, reclaimed areas would not function as suitable pelican habitat, and wetland losses would be permanent. In addition, as discussed in **Section 4.5.1.1.2**, wetland habitats used by American white pelicans could be indirectly altered by sedimentation and a reduction in water quantity. These impacts would be short-term, as they would occur primarily during construction and active mining.

Water birds such as American white pelicans may be susceptible to toxic effects of COPC exposure in surface waters and aquatic food sources. As described in **Section 3.3**, baseline selenium concentrations in Angus Creek and the Blackfoot River already regularly exceed chronic aquatic life criteria, especially during the spring runoff period. Additional input of selenium and other COPCs into the watershed would be well below surface water standards under the Proposed Action, as described in **Section 4.3**. Therefore, the Proposed Action would not significantly increase the risk of selenium exposure to American white pelicans in the Study Area above baseline levels.

Due to the relatively small area of wetland habitat that would be impacted, and lack of evidence from baseline studies that the Study Area supports nesting American white pelicans, direct and indirect impacts under the Proposed Action are unlikely to have population-level effects on this species. Overall, the Proposed Action, with the implementation of design features and measures to minimize impacts on migratory birds, is expected to result in long-term but minor impacts on American white pelicans.

The PFO ARMP includes the following action specific to American white pelican habitat: "**Action SS-1.3.10:** American white pelican habitat on BLM-administered public lands will be managed in coordination with IDFG to maintain habitat requirements to sustain viable populations." As the Proposed Action would not affect pelican habitats to an extent that would preclude a viable population, this alternative would be consistent with ARMP guidance for this species.

Harlequin Duck

As there is no suitable habitat, and this species is not expected to occur in the Study Area, the Proposed Action would have no impact on harlequin ducks.

White-faced Ibis

There are no known white-faced ibis breeding colonies in the Study Area; therefore, direct impacts on nesting birds are unlikely. Project noise and activity may influence white-faced ibis to temporarily avoid some areas of the Proposed Action while active mining is occurring. White-faced ibis could also be directly impacted as a result of mortality from collision with aboveground structures (such as the overhead power line) and moving vehicles. Agrium would minimize collision risk on the power line by using APLIC design features such as appropriate spacing between conductors and grounded hardware and installation of bird flight diverters on the top grounding wire.

Approximately 20.5 acres of potentially suitable white-faced ibis habitat (wetlands and riparian areas) would be removed under the Proposed Action, or approximately 6 percent of the wetland habitat in the Study Area. Most of the disturbed area would be reclaimed as soon as the area was no longer needed; however, reclaimed areas would not function as suitable ibis habitat, and wetland losses would be permanent. In addition, as discussed in **Section 4.5.1.1.2**, wetland habitats used by white-faced ibis could be indirectly altered by sedimentation and a reduction in water quantity. These impacts would be short-term, as they would occur primarily during construction and active mining.

Water birds such as white-faced ibis may be susceptible to toxic effects of COPC exposure in surface waters and aquatic food sources. As described in **Section 3.3**, baseline selenium concentrations in Angus Creek and the Blackfoot River already regularly exceed chronic aquatic life criteria, especially during the spring runoff period. Additional input of selenium and other COPCs into the watershed would be well below surface water standards under the Proposed Action, as described in **Section 4.3**. Therefore, the Proposed Action would not significantly increase the risk of selenium exposure to white-faced ibis in the Study Area above baseline levels.

Due to the relatively small area of wetland habitat that would be impacted, and lack of evidence from baseline studies that the Study Area supports nesting white-faced ibis, direct and indirect impacts under the Proposed Action are unlikely to have population-level effects on this species. Overall, the Proposed Action, with the implementation of design features and measures to minimize impacts on migratory birds, is expected to result in long-term but minor impacts on white-faced ibis.

The PFO ARMP (BLM 2012a) does not provide specific management direction for the white-faced ibis.

Black Tern

To comply with the MBTA, Agrium would clear vegetation from potential nesting habitat outside of the breeding season. Therefore, direct impacts to black tern nests are not anticipated. Even if no nests are present, project noise and activity may influence black terns to temporarily avoid some areas of the Proposed Action while active mining is occurring. Black terns could also be directly impacted as a result of mortality from collision with above ground structures (such as the overhead power line) and moving vehicles. Agrium would minimize collision risk on the power line by using APLIC design features such as appropriate spacing between conductors and grounded hardware and installation of bird flight diverters on the top grounding wire.

Approximately 20.5 acres of potentially suitable black tern habitat (wetlands and riparian areas) would be removed under the Proposed Action, or approximately 6 percent of the wetland habitat in the Study Area. Most of the disturbed area would be reclaimed as soon as the area was no longer needed; however, reclaimed areas would not function as suitable black tern habitat, and wetland losses would be permanent. In addition, as discussed in **Section 4.5.1.1.2**, wetland habitats used by black terns could be indirectly altered by sedimentation and a reduction in water quantity. These impacts would be short-term, as they would occur primarily during construction and active mining.

Water birds such as black terns may be susceptible to toxic effects of COPC exposure in surface waters and aquatic food sources. As described in **Section 3.3**., baseline selenium concentrations in Angus Creek and the Blackfoot River already regularly exceed chronic aquatic life criteria, especially during the spring runoff period. Additional input of selenium and other COPCs into the watershed would be well below surface water standards under the Proposed Action, as described in **Section 4.3**. Therefore, the Proposed Action would not significantly increase the risk of selenium exposure to black terns in the Study Area above baseline levels.

Due to the relatively small area of wetland habitat that would be impacted, and lack of evidence from baseline studies that the Study Area supports nesting black terns, direct and indirect impacts under the Proposed Action are unlikely to have population-level effects on this species. Overall, the Proposed Action, with the implementation of design features and measures to minimize impacts on migratory birds, is expected to result in long-term but minor impacts on black terns.

The PFO ARMP (BLM 2012a) does not provide specific management direction for the black tern.

Columbia Spotted Frog

As Columbia spotted frogs are not known to occur in the CNF or in Caribou County, there would be no impacts on this species under the Proposed Action.

Boreal Toad, Northern Leopard Frog, Common Garter Snake

Impacts to these three species would be similar to those described for amphibians and reptiles generally in **Section 4.7.1.1.4**. Proposed Action impacts would include the permanent loss of 20.5 acres of riparian/wetland habitat, potential mortalities of individuals crossing the haul road, as well as potential introduction of sediment and COPCs into the watershed. Overall, impacts on these species would be long-term and moderate.

The PFO ARMP (BLM 2012a) contains the following applicable guidance for special status amphibian species:

Action SS-1.3.5: Populations of boreal toads and Northern leopard frogs will be identified and inventoried and where populations are located, permitted activities will be managed to maintain quality frog and or toad habitat by:

- Managing riparian areas to make progress towards or achieving PFC.
- Increasing pool habitat based upon site potential.
- Mitigating or adjusting activities having adverse effects on boreal toad and Northern leopard frog habitats.

Furthermore, the CNF RFP (USFS 2003) contains the following guidelines for special status amphibian species:

1. Ensure habitats in the Tincup Creek Drainage and other known toad breeding locations are managed to maintain or improve the existing population and distribution of western toads.
2. Ensure habitats in the Toponce area and other known northern leopard frog breeding locations are managed to maintain or improve the existing population and distribution of the frogs.
3. Maintain amphibian habitats when developing and modifying springs and wetlands.

Neither the BLM nor the USFS guidance would be met under the Proposed Action, as the boreal toad and northern leopard frog are known to breed in the Study Area, yet the Proposed Action would result in the permanent loss of 20.5 acres of breeding habitat for these species. The permanent loss of breeding habitat in the Study Area would be counter to the goals of improving and expanding existing populations of these species.

Fish (Yellowstone cutthroat trout, northern leatherside chub)

Impacts to special status fish species would be the same as those generally described for fish in **Section 4.7.1.1.3** and include the potential for long-term habitat alteration as a result of the removal and alteration of riparian vegetation in the AIZ, the potential for the short-term release of sediment into the watershed, and the potential for the release of COPCs into the watershed. Overall, impacts would be long-term and moderate.

Action SS-1.3.9 in the PFO ARMP provides management direction for the Yellowstone cutthroat trout. A number of conservation actions are included under Action SS-1.3.9. The Proposed Action would be consistent with most of the conservation actions except the following:

- Enhance and maintain channel integrity, channel processes, water quality, salmonid habitat and habitat connectivity.
- Strive to eliminate or significantly reduce threats to present or potential cutthroat trout distribution within their historic range and to habitat quality and quantity.
- Strive to achieve the criteria for highest quality trout habitats as described in the Cutthroat Trout Matrix.

The Proposed Action would be inconsistent with these actions because it would impact water quality and quantity in known cutthroat trout bearing streams (Angus Creek and the Blackfoot River) over the short term, result in the permanent loss of 20.5 acres of wetlands adjacent to these streams, and contribute to moderate and long-term increases in COPC concentrations within these waterways.

4.8.1.1.3 Special Status Plant Species

As discussed in **Section 3.8.3**, there are no identified plant species listed as threatened, endangered, or proposed under the ESA in Caribou County (USFWS 2015). No CNF sensitive plant species or CNF Forest Watch rare plant species have been documented in the baseline studies. Additionally, no BLM sensitive plant species were documented during baseline studies. Therefore, impacts to sensitive plants are not anticipated to occur and are not analyzed further.

4.8.1.2 Rasmussen Collaborative Alternative

Overall impacts of the RCA on threatened, endangered, and special status species would be similar in nature to those under the Proposed Action, but would vary slightly for some species. The overall impact of the RCA on threatened, endangered, and special status species would be long-term and negligible to minor. Individual species are discussed below.

4.8.1.2.1 Threatened, Endangered, Proposed, and Candidate Species

<u>Canada Lynx</u>

Impacts to the Canada lynx under the RCA would be similar to those described in **Section 4.8.1.1** for the Proposed Action. Noise and human activity associated with the RCA would likely cause lynx to travel around the periphery of the Study Area but would not impede broad-scale movements of lynx or preclude the use of the linkage area. Over the long term, human activity would cease, and reclaimed areas would recover to high-elevation rangeland habitat. Because disturbance would be small in scale relative to the overall size of the linkage area and most of the disturbed habitat would be reclaimed, the RCA may affect, but is not likely to adversely affect, the Canada lynx.

Compliance with applicable USFS management direction for Canada lynx is summarized in **Table 4.8-3**. In addition, the following management direction was reviewed and found to not be applicable to a phosphate mine project:

- CNF RFP (USFS 2003) Lands Objective 1 and Lands Standard 1

Table 4.8-3 Compliance with USFS Management Direction for Canada Lynx under the RCA

Source	Management Direction	Compliance under Proposed Action
2003 Caribou Forest Plan	Forest Vegetation DFC 1 - Forested habitats display a diversity of structure and composition. Productive and diverse populations of plants are maintained or restored.	The RCA would not hinder this DFC. Impacts to forested habitat would be minor (103 acres).
	Forest Vegetation DFC 2 - In conifers, a range of structural stages exists where 30 to 40 percent of the acres are in mature and old age classes. Early successional stages are maintained through endemic insect and disease disturbance, vegetation management and fire. Patterns are within historical ranges of variability with functional corridors present.	The RCA would not hinder this DFC. No conifer habitat would be affected.
	Forest Vegetation DFC 3 - Conifer types are maintained and disturbance processes are restored through vegetation management, endemic insect / disease disturbances, & fire.	The RCA would not hinder this DFC. No conifer habitat would be affected.
	Forest Vegetation DFC 4 - Quaking aspen communities are moving towards historical ranges with fire and other practices influencing structural class distribution and patterns across the landscape. Aspen forests are managed to achieve desired vegetative conditions with 20 to 30 percent in mature and old age classes, and to reduce the decline of aspen acres as a result of succession of aspen to conifer.	The RCA would not hinder this DFC. Impacts to aspen communities would be minor (103 acres) and would not affect the distribution of forest stand age classes in the Study Area.
	Non-forest DFC-1 - Non-forested ecosystems: are resilient, diverse, and functioning within their site potential; display a diversity of structure and composition; and are within their historical range of variability (HRV).	The RCA would not hinder this DFC. Impacts to non-forested ecosystems would largely be temporary, and they would be reclaimed with a variety of native plant species.
	Non-forest DFC-2 - Non-forested ecosystems reflect a mosaic of multiple-aged shrubs, forbs, and native grasses with management emphasis on maintaining a diverse sustainable plant community. Fire regimes exist on an approximate 20 to 40 year return cycle. Patterns are within historical ranges with 30 to 50 percent of the shrubs in greater than fifteen percent canopy cover class.	The RCA would not hinder this DFC. Impacts to non-forested ecosystems would largely be temporary, and they would be reclaimed with a variety of native plant species. Over the long term, reclaimed areas would recover to high-elevation rangeland similar to baseline conditions.
	Non-forest DFC-3 - Rehabilitation or restoration of native shrub communities is accomplished, where	The RCA would not hinder this DFC. Over the long term, reclaimed areas would recover to high-elevation rangeland similar

Table 4.8-3 Compliance with USFS Management Direction for Canada Lynx under the RCA

Source	Management Direction	Compliance under Proposed Action
	site potential permits.	to baseline conditions.
	Non-forest DFC-4 - On areas capable of tall forb dominance, tall forb types reflect historical ranges of ground cover leading into the winter season. Composition reflects a mosaic dominance of tall forb indicator species. Disturbance regimes demonstrate stable or upward trend in tall forb indicator species. Patterns are within the historical range. Historical tall forb sites, which currently are not capable of tall forb dominance, are managed to maintain watershed stability.	The RCA would not hinder this DFC. Tall forbs would re-establish in reclaimed areas from surrounding habitats.
	Non-forest DFC-5 - Woodland types including mountain mahogany, juniper and maple have multiple-aged shrub layers and a balanced shrub/herbaceous understory. Patterns are within historical ranges.	The RCA would not hinder this DFC. The Study Area does not contain these woodland types.
	Vegetation Goal 1 - Diverse forested and non-forested ecosystems are maintained within their historic range of variability or restored through time with emphasis on aspen, aspen-conifer, mixed conifer, big sagebrush, mountain brush and tall forbs.	The RCA would be consistent with this goal after reclamation activities were completed and the site had recovered to high-elevation rangeland habitat.
	Vegetation Goal 2 - Aspen forests are managed to reduce or halt the decline of aspen acres as a result of succession of aspen to conifer.	The RCA would not be consistent with this goal, as it would permanently remove 103 acres of aspen.
	Vegetation Goal 3 - Forested ecosystems are moving towards a balance of age and size classes in each forested vegetation type on a watershed or landscape scale. Early seral species are recruited and sustained while still providing a diversity of successional stages.	The RCA would be consistent with this goal. The removal of 103 acres of forest habitat would not impact the distribution of forest stand age classes on the Forest.
	Vegetation Goal 4 - Sagebrush steppe and mountain shrub habitats are moving toward a balance of age, canopy cover, and size class on a watershed or landscape scale that is within their HRV.	The RCA would be consistent with this goal after reclamation activities were completed and the site had recovered to high-elevation rangeland habitat.
	Vegetation Goal 7 - Biodiversity is maintained or enhanced by managing for a diverse array of habitats tied to natural process occurrence and distribution of plant communities.	The RCA would be consistent with this goal. Habitat changes resulting from the RCA would be localized to the project footprint and would not impact biodiversity on the Forest.
	Vegetation Standard 2 - In each 5th	The RCA would be consistent with this

Table 4.8-3 Compliance with USFS Management Direction for Canada Lynx under the RCA

Source	Management Direction	Compliance under Proposed Action
	code HUC which has the ecological capability to produce forested vegetation, the combination of mature and old age classes (including old growth) shall be at least 20 percent of the forested acres. At least 15 percent of all the forested acres in the HUC are to meet or be actively managed to attain old growth characteristics.	standard. The removal of 103 acres of forest habitat would not impact the distribution of forest stand age classes in the 5th code HUC.
	Wildlife Goal 2 - Wildlife biodiversity is maintained or enhanced by managing for vegetation and plant communities within their historical range of variability.	The RCA would be consistent with this goal. Habitat changes resulting from the RCA would be localized to the project footprint and would not impact wildlife biodiversity on the Forest.
	Wildlife Goal 3 - Maintain multiple vegetation layers in woody riparian habitats that are stable or increasing with all age classes (seedlings, young plants, mature and decadent) represented to support native bird communities and other wildlife.	The RCA would be consistent with this goal, as it was designed to avoid all but 0.3 acre of disturbance to woody riparian habitat (shrub/scrub wetland).
	Wildlife Goal 5 - Maintain, and where necessary and feasible, provide for habitat connectivity across forested and non-forested landscapes.	The RCA would be consistent with this goal. Over the short term, project facilities would fragment some of the shrub habitats in the Study Area, but these areas would be reclaimed following active mining; therefore, habitat connectivity would not be impacted over the long term.

Source: USFS 2007, 2003

Greater Sage-grouse

The RCA would result in the long-term loss of approximately 35 fewer acres of big sagebrush habitat compared with the Proposed Action. The RCA would eliminate the need for an overhead power line, which would result in reduced impacts on greater sage-grouse from predator perching and power line avoidance. Other impacts to greater sage-grouse would be the same as those described in **Section 4.8.1.1.1** for the Proposed Action. Overall, the RCA would have a minor, long-term impact on greater sage-grouse.

Compliance with applicable BLM and USFS management direction for greater sage-grouse is summarized in **Table 4.8-4**. In addition, the following management direction was reviewed and found to not be applicable to a phosphate mine project:

- CNF RFP (USFS 2003) Sage-grouse Guideline 1

Table 4.8-4 Compliance with BLM and USFS Management Direction for Greater Sage-Grouse under the RCA

Source	Management Direction	Compliance under Proposed Action
2012 PFO	**Action SS-1.3.6.** To the extent possible and	The RCA would be consistent with BLM

Table 4.8-4 Compliance with BLM and USFS Management Direction for Greater Sage-Grouse under the RCA

Source	Management Direction	Compliance under Proposed Action
ARMP	to promote conservation, Greater sage-grouse habitat will be managed consistent with the *Conservation Plan for Greater Sage-grouse in Idaho* (IDFG 2006) or any future revisions/amendments and or current BLM guidance. Appropriate actions, conservation measures and guidelines that may be considered include, but are not limited to: • Continue efforts to map populations and habitat for greater sage-grouse. Map seasonal (lek, nesting, brood-rearing and winter) habitats along with source and isolated populations. • Establish goals for greater sage-grouse habitat conservation at the local level in conjunction with IDFG and local working groups for protection and maintenance of existing populations and restoration goals. • Protect and maintain suitable habitats and reconnect separated populations based upon the following priorities: 1. Key habitats 2. Source habitats (S1) 3. Restoration areas (R1, R2) 4. Areas that link isolated populations • Commensurate with site potential, manage key habitat for a range of sagebrush canopy cover averaging 15 to 25 percent (11 to 31 inches in height); at least 15 percent grass cover; and 10 percent cover of a diversity of forbs. • Monitor progress and adjust activities to make progress towards greater sage-grouse goals and objectives. • In areas where grouse habitats are fragmented by land ownership pattern, cooperate with IDFG and local working groups to identify and maintain long-term habitat by acquiring conservation easements or bringing crucial habitats into public ownership. • In cooperation with IDFG identify areas where application of pesticides for grasshopper or Mormon cricket control may negatively affect grouse broods. Identify a cooperative strategy to review requests for pesticide application in these identified locations. • Active sage-grouse leks will be protected during the lekking season from temporary	management direction for greater-sage grouse. No key or important sage-grouse habitats, as mapped by the BLM or IDFG, would be impacted by the RCA. There would be no temporary disturbance within 0.6 mile of occupied leks or permanent disturbance within 2 miles of occupied leks. The RCA would not hinder BLM efforts to map important sage-grouse habitats; establish goals for sage-grouse habitat conservation; or protect, manage, or monitor key habitats and sage-grouse populations.

Table 4.8-4 Compliance with BLM and USFS Management Direction for Greater Sage-Grouse under the RCA

Source	Management Direction	Compliance under Proposed Action
	human disturbance (e.g., routine maintenance, inspections, and construction activities) by requiring a minimum buffer of 0.6 miles. • New infrastructure facilities/structures (e.g., major power transmission lines, power distribution lines, communications towers, and temporary meteorological towers) requiring permanent surface occupancy will be sited in a manner that avoids sage-grouse habitat to the extent possible and will be placed at least 2.0 miles from occupied leks or other important sage-grouse seasonal habitats as identified locally. • Future permitted/authorized activities will be evaluated on a site specific basis for potential threats consistent with the Conservation Plan for Greater Sage-grouse in Idaho (IDFG 2006) and mitigated through the NEPA process. • Restore shrub-steppe habitats in the following priority: 1. source areas 2. restoration areas 3. 3. areas that link isolated populations	
2003 Caribou Forest Plan	Sage-grouse Standard 1 – Cooperate with other state and federal agencies and private landowners to survey, inventory, and manage habitats for sage grouse and Columbian sharp-tailed grouse.	The RCA would not hinder USFS efforts to cooperate on surveying, inventorying, and managing habitats for sage-grouse.
	Sage-grouse Guideline 2 – Management activities should consider proximity to active lek locations during site-specific project planning. Those within 10 miles of an active sage-grouse lek and 2 miles of active sharp-tailed grouse leks should be considered further for suitability as grouse habitat.	The RCA would be consistent with this guideline. Sage-grouse leks within 10 miles were considered for impacts, and there is one occupied lek within 10 miles, which would not be impacted by the RCA.
	Sage-grouse Guideline 3 - If management activities would impact courtship, limit physical, mechanical, and audible disturbances in the breeding complex during the breeding season (March to May) within three hours of sunrise and sunset each day.	The RCA would be consistent with this guideline. No occupied leks would be impacted by the RCA.
	Sage-grouse Guideline 4 - Where management actions will disturb nesting grouse, avoid manipulation or alteration of vegetation during the nesting period (May to June).	The RCA would be consistent with this guideline. The nearest occupied lek is more than 7 miles away, and baseline studies indicated that sage-grouse are unlikely to use the Study Area for nesting.

Source: BLM 2012a; USFS 2003

4.8.1.2.2 USFS Sensitive and Management Indicator Species and BLM Sensitive Species

In general, impacts to sensitive and management indicator species under the RCA would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action, except where noted below. Compliance with BLM and USFS management direction for sensitive species would be the same as under the Proposed Action, except where noted below.

Gray Wolf

Impacts to gray wolves from the RCA would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action. Noise and human activity associated with the RCA would likely cause wolves to travel around the periphery of the Study Area but would not impede broad-scale movements of wolves. Over the long term, human activity would cease, and reclaimed areas would recover to high-elevation rangeland habitat. Overall impacts to wolves would be long-term but negligible under the RCA.

Wolverine

Impacts to wolverines would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action. Noise and human activity associated with the RCA would likely cause wolverines to travel around the periphery of the Study Area but would not impede broad-scale movements of wolverines. Over the long term, human activity would cease, and reclaimed areas would recover to high elevation rangeland habitat. Overall impacts to wolverines would be negligible because of the small number of individual wolverines that potentially use the Study Area and the wide-ranging nature of this species.

Townsend's big-eared bat

The RCA would result in the loss or alteration of approximately 28 fewer acres of potential foraging habitat for this species compared with the Proposed Action. Other impacts would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action. Overall, impacts to Townsend's big-eared bats under the RCA would be long-term and minor.

Boreal Owl

The type of impacts that could occur to the boreal owl would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action. Compared with the Proposed Action, the RCA would result in the direct loss of approximately 20 more acres of aspen habitat. The RCA would eliminate the risk of power line collision and predator perching because it would not use an overhead power line. Overall, impacts to boreal owls under the RCA would be long-term and minor.

Flammulated Owl

The type of impacts that could occur to the flammulated owl would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action. Compared with the Proposed Action, the RCA would result in the direct loss of approximately 20 more acres of aspen habitat. The RCA would eliminate the risk of power line collision and predator perching because it would not use an overhead power line. Overall, impacts to flammulated owls under the RCA would be long-term and minor.

Great Gray Owl

The type of impacts that could occur to the great gray owl would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action. Compared with the Proposed Action, the RCA would result in the direct loss of approximately 20 more acres of aspen habitat. The RCA would eliminate the risk of power line collision because it would not use an overhead power line. Overall, impacts to great gray owls under the RCA would be long-term and minor.

Bald Eagle

The type of impacts that could occur to the bald eagle would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action. Compared with the Proposed Action, the RCA would result in the direct loss of approximately 20.5 fewer acres of wetland and riparian habitat. The RCA would eliminate the risk of power line collision and electrocution because it would not use an overhead power line, and it would minimize the potential for COPC mobilization to streams because of the elimination of permanent external overburden piles downslope of the mine and the use of the modified store-and-release cap and cover. Overall, impacts to bald eagles under the RCA would be long-term and negligible.

Northern Goshawk

The type of impacts that could occur to the northern goshawk would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action. Compared with the Proposed Action, the RCA would result in the direct loss of approximately 20 more acres of aspen habitat. The RCA would eliminate the risk of power line collision because it would not use an overhead power line. Overall, impacts to northern goshawks under the RCA would be long-term and minor.

Peregrine Falcon

The type of impacts that could occur to the peregrine falcon would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action. Compared with the Proposed Action, the RCA would result in the direct loss of approximately 28 fewer acres of forest, shrubland, riparian, and wetland foraging habitat. The RCA would eliminate the risk of power line collision because it would not use an overhead power line, and it would eliminate the potential for COPC mobilization to streams. Overall, impacts to peregrine falcons under the RCA would be long-term and negligible.

Prairie Falcon

The type of impacts that could occur to the prairie falcon would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action. Compared with the Proposed Action, the RCA would result in the direct loss of approximately 7 fewer acres of high-elevation rangeland and big sagebrush foraging habitat. The RCA would eliminate the risk of power line collision because it would not use an overhead power line. Overall, impacts to prairie falcons under the RCA would be long-term and negligible.

Columbian sharp-tailed grouse

The type of impacts that could occur to the Columbian sharp-tailed grouse would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action. Compared with the Proposed Action, the RCA would result in the direct loss of approximately 7 fewer acres of high-elevation rangeland and big sagebrush habitat. The RCA would eliminate the risk of predator perching along the power line because it would not use an overhead power line. Overall, impacts to Columbian sharp-tailed grouse under the RCA would be long-term and minor.

Willow Flycatcher

The type of impacts that could occur to the willow flycatcher would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action; however, impacts would be reduced in magnitude under the RCA. Compared with the Proposed Action, the RCA would result in the direct loss of approximately 3 fewer acres of shrub/scrub wetland habitat. Because the RCA was designed to avoid most impacts to riparian habitats, the RCA would be much less likely to inadvertently destroy willow flycatcher nests or disrupt breeding willow flycatchers compared with the Proposed Action. It would also be less likely to degrade riparian habitats through sedimentation or releases of COPCs into surface waters. For these reasons, the RCA would have long-term negligible impacts on willow flycatchers.

Loggerhead Shrike

The type of impacts that could occur to the loggerhead shrike would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action. Compared with the Proposed Action, the RCA would result in the direct loss of approximately 7 fewer acres of high-elevation rangeland and big sagebrush habitat. The RCA would eliminate the risk of predator perching along the power line because it would not use an overhead power line. Overall, impacts to loggerhead shrikes under the RCA would be long-term and minor.

Sage Sparrow and Brewer's Sparrow

The type of impacts that could occur to the sage sparrow and Brewer's sparrow would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action. Compared with the Proposed Action, the RCA would result in the direct loss of approximately 35 fewer acres of big sagebrush habitat. However, overall long-term loss of habitat under the RCA would be greater compared with the Proposed Action because reclaimed areas would be most likely to recover to high-elevation rangeland, which may not be as suitable for use by these species as the baseline big sagebrush habitat in the Study Area. The RCA would eliminate the risk of predator perching along the power line because it would not use an overhead power line. Overall, impacts to sage sparrow and Brewer's sparrow under the RCA would be long-term and minor.

Calliope Hummingbird

The type of impacts that could occur to the Calliope hummingbird would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action. Compared with the Proposed Action, the RCA would result in the direct loss of approximately 20 more acres of aspen forest habitat for this species, but 3 fewer acres of shrub/scrub wetland habitat. Because the RCA was designed to avoid most impacts to riparian habitats, the RCA would be less likely to degrade riparian habitats through sedimentation or releases of COPCs into surface waters. Therefore, there would be less risk that calliope hummingbirds could be exposed to COPCs by feeding on plant nectar within the Study Area. Overall, impacts to the calliope hummingbird under the RCA would be long-term and minor.

Trumpeter Swan

The type of impacts that could occur to the trumpeter swan would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action; however, impacts would be reduced in magnitude under the RCA. Compared with the Proposed Action, the RCA would result in the direct loss of approximately 20 fewer acres of wetland habitat. Because the RCA was designed to avoid most impacts to wetlands and riparian habitats, the RCA would be much less likely to disrupt breeding trumpeter swans compared with the Proposed Action. The RCA would not include an overhead power line; o there would be no risk of power line collision or predator perching under therefore,

the RCA. The RCA would also be less likely to degrade riparian habitats through sedimentation or releases of COPCs into surface waters. For these reasons, the RCA would have long-term negligible impacts on trumpeter swans.

American White Pelican

The type of impacts that could occur to American white pelicans would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action; however, impacts would be reduced in magnitude under the RCA. Compared with the Proposed Action, the RCA would result in the direct loss of approximately 20.5 fewer acres of wetland habitat. Because the RCA was designed to avoid most impacts to wetlands and riparian habitats, the RCA would be much less likely to disturb foraging American white pelicans compared with the Proposed Action. The RCA would not include an overhead power line; therefore, there would be no risk of power line collision or predator perching under the RCA. The RCA would also be less likely to degrade riparian habitats through sedimentation or releases of COPCs into surface waters. For these reasons, the RCA would have long-term negligible impacts on American white pelicans.

Harlequin Duck

As there is no suitable habitat and this species is not expected to occur in the Study Area. The RCA would have no impact on harlequin ducks.

White-faced Ibis

The type of impacts that could occur to white-faced ibis would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action; however, impacts would be reduced in magnitude under the RCA. Compared with the Proposed Action, the RCA would result in the direct loss of approximately 20.5 fewer acres of wetland habitat. Because the RCA was designed to avoid most impacts to wetlands and riparian habitats, the RCA would be much less likely to disturb foraging white-faced ibis compared with the Proposed Action. The RCA would not include an overhead power line; therefore, there would be no risk of power line collision or predator perching under the RCA. The RCA would also be less likely to degrade riparian habitats through sedimentation or releases of COPCs into surface waters. For these reasons, the RCA would have long-term negligible impacts on white-faced ibis.

Black Tern

The type of impacts that could occur to the black tern would be similar to those described in **Section 4.8.1.1.2** for the Proposed Action; however, impacts would be reduced in magnitude under the RCA. Compared with the Proposed Action, the RCA would result in the direct loss of approximately 20.5 fewer acres of wetland habitat. Because the RCA was designed to avoid most impacts to wetlands and riparian habitats, the RCA would be much less likely to disrupt breeding black terns compared with the Proposed Action. The RCA would not include an overhead power line; therefore, there would be no risk of power line collision or predator perching under the RCA. The RCA would also be less likely to degrade riparian habitats through sedimentation or releases of COPCs into surface waters. For these reasons, the RCA would have long-term negligible impacts on black terns.

Columbia Spotted Frog

As Columbia spotted frogs are not known to occur in the CNF or in Caribou County, there would be no impacts on this species under the RCA.

Boreal Toad, Northern Leopard Frog, Common Garter Snake

Impacts to these three species would be similar to those described for amphibians and reptiles generally in **Section 4.7.1.1.4**. Compared with the Proposed Action, the RCA would result in the direct loss of approximately 20 fewer acres of wetland habitat. Because the RCA was designed to avoid most impacts to wetlands and riparian habitats, the RCA would be much less likely to result in inadvertent mortality of special status amphibians and reptiles by crushing with construction equipment or vehicles. The RCA would also be less likely to degrade riparian habitats through sedimentation or releases of COPCs into surface waters. For these reasons, the RCA would have long-term negligible impacts on boreal toads, northern leopard frogs, and common garter snakes. In contrast to the Proposed Action, the RCA would be consistent with BLM and USFS guidance for special status amphibians and reptiles, because it would allow for maintenance of aquatic habitat and wetlands providing habitat for these species.

Fish (Yellowstone cutthroat trout, northern leatherside chub)

Impacts to special status fish species would be the same as those generally described for fish in **Section 4.7.1.2.3**. Impacts would be reduced in severity and scale relative to those that would occur under the Proposed Action because the RCA would avoid most direct removal of wetland habitat, would eliminate permanent external overburden piles downslope of the mine, and would incorporate a store-and-release system that would help to protect downstream water quality. Furthermore, the RCA would eliminate the need to construct road crossings over fish-bearing streams. Overall, impacts to special status fish species would be long-term and negligible under the RCA. In contrast to the Proposed Action, the RCA would be consistent with BLM and USFS guidance for special status fish species because it would allow for maintenance of aquatic habitat and wetlands, providing habitat for these species

4.8.1.2.3 Special Status Plant Species

As discussed in **Section 4.8.1.1.3** for the Proposed Action, no impacts to sensitive plants are anticipated to occur under the RCA.

4.8.1.3 No Action Alternative

Under the No Action Alternative, the federal phosphate leases would not be developed at this time. The No Action Alternative would result in no new impacts to special status species in the Study Area. The No Action Alternative would maintain the current status of special status species and populations in and around the Study Area. However, this does not preclude future development of the federal phosphate leases under a different mine plan.

4.8.2 Irreversible and Irretrievable Commitment of Resources

Under the Proposed Action, the loss of aspen and wetland/riparian habitat is considered an irreversible commitment of resources and would have long-term impacts on special status species using those habitats. Although the Mine and Reclamation Plan would re-establish upland grassland and shrub vegetation in disturbed areas after mining operations end, it is not anticipated that aspen would re-establish because the existing root stock would be removed. Impacted wetland and riparian areas would be re-seeded with upland vegetation, and while off-site mitigation would be required to offset wetland impacts under the CWA, the loss of wetland and riparian habitat within the Study Area would be considered irreversible. Under the RCA, this irreversible commitment of resources would largely be limited to loss of aspen habitat because the RCA would avoid most direct loss of wetland/riparian habitat. Due to the reductions in habitat,

special status wildlife species that use aspen and wetland/riparian habitats may decline in abundance within the analysis area. The reduction in biological diversity within aspen and wetland/riparian habitats in and around the Study Area would be considered an irreversible commitment of resources.

4.8.3 Unavoidable Residual Adverse Effects

Based on the HEA, reclamation would offset about 55 percent of the wildlife habitat services lost under the Proposed Action, with a net debit of 3,279 residual DSAYs of lost wildlife habitat services (ARCADIS 2015c). This loss of wildlife habitat services would be an unavoidable, long-term, residual adverse effect of the Proposed Action on special status species. The RCA would result in a lower net DSAY debit (with 69 percent of wildlife habitat services offset by reclamation, the net debit is 2,242 DSAYs), and would therefore have a relatively lower overall residual adverse effect on special status species than the Proposed Action.

4.8.4 Mitigation Measures

Mitigation measures for special status species would be applied in accordance with actions, standards, and guidelines documented in the PFO ARMP and CNF RFP. These include:

- Species-specific raptor nest buffers would be applied as detailed in Table B-2 of Appendix B of the PFO ARMP.
- Agrium would plan ground-clearing activities during the non-nesting season to minimize potential impacts to nesting birds.
- Agrium would implement APLIC raptor-friendly design measures on the 0.7-mile overhead power line that would be constructed under the Proposed Action. These may include, but would not be limited to, a 60-inch separation between conductors or grounded hardware, the use of insulating or cover-up materials for perch management, and installation of bird flight diverters on the top grounding wire.
- In addition to the mitigation measures listed above, on-site reclamation would partially offset the loss of wildlife habitat in the Proposed Action. Under the Proposed Action, 415 acres, or 99 percent of the disturbed vegetation area, would be reclaimed. According to the HEA, this reclamation would result in a long-term credit of 3,979 DSAYs at the mine sit. This means that reclamation would offset about 55 percent of the wildlife habitat services lost under the Proposed Action, with a net debit of 3,279 residual DSAYs of lost wildlife habitat services. Under the RCA, 96 percent of the disturbed vegetation area would be reclaimed, for a net debit of 2,242 DSAYs (ARCADIS 2015c).

As described in **Section 2.3.6.10**, Agrium has proposed to use a hypothetical mitigation project to calculate an in-lieu-fee amount for mitigating some or all of the DSAY debit from the Proposed Action. Because the selected alternative would not be known until after the publication of the Draft EIS, the project and cost estimate would be described in a Wildlife Habitat Mitigation Plan prepared by Agrium after the Draft EIS is published, but before the ROD is signed. This document would include five components: 1) details of the hypothetical mitigation project(s); 2) the gain in DSAY values from the project and assumptions; 3) a calculation of the total cost to offset the selected alternative DSAY debit using the hypothetical mitigation project as a basis; 4) description of the provisions of the corresponding in-lieu fee to a third party; and 5) fulfillment of the voluntary mitigation.

The cost of the final hypothetical mitigation actions would be calculated in coordination with the Agencies. The BLM, Agrium, and other stakeholders would identify a third-party recipient of the in-lieu fee and confirm that the fee would be spent in accordance with the wildlife habitat mitigation objectives. After the ROD is signed, Agrium would provide the in-lieu fee to the third party.

4.9 VISUAL RESOURCES

Issue: What are the potential visual impacts on the scenic landscape?

Indicators:

- Change in scenic attractiveness from various public and occupied points within the Study Area including post-reclamation changes
- Compliance with the Visual Quality Objectives (VQOs) of the CNF RFP
- Compliance with the objectives of Visual Resource Management (VRM) system per the PFO ARMP
- Compliance with mining best management practices regarding light pollution

4.9.1 Direct and Indirect Impacts

Visual analysis involves determining the degree of visual change (contrast) between the existing landscape features and the changes that would be produced by the Proposed Action or the RCA. Using the Forest Service's VQO and the BLM VRM systems, as described in **Section 3.9.1**, the analysis for visual resources involved determining whether the potential visual impacts from Proposed Action components and surface-disturbing activities would meet the VQOs established for the Study Area. Under the Proposed Action and the RCA, there would be some degree of visual change to the Study Area because some project components and areas cleared of vegetation would be visible from publically accessible locations and residences (occupied points); however, the Study Area is remote and seen by a relatively small number of people. The Proposed Action would create a large, dramatic visual impact to National Forest, Blackfoot Wildlife Management Area (WMA), and other land users who travel the Blackfoot River Road. In addition, nighttime lighting of project facilities under the Proposed Action and RCA could impact visibility of the nighttime sky within some portions of the analysis area.

4.9.1.1 Proposed Action

Under the Proposed Action, direct and indirect impacts to visual resources would include the introduction of project components and mine-related activities to the existing natural landscape for the 5.8-year duration of the Proposed Action. The project-related structures, landforms including pit walls, and activities would introduce new elements and visual contrasts compared to the existing landscape character. Under the Proposed Action, short-term, localized effects to the visual character of the landscape would result from removal of vegetation, including timber, and exposure of soils of contrasting colors and textures relative to the surrounding landscape. Mine-related vehicles and equipment would be observed traveling to and from the mine for the 3.9-year life of proposed mining activities.

Key observation points (KOPs) are locations from which the Study Area could be visible to the general public on travel corridors, recreation use areas, and residences. The potential viewers (casual observers) of the Study Area would be local residents and ranchers, mine personnel, and

motorists traveling on portions of Blackfoot River Road, Diamond Creek Road, Rasmussen Valley Road, and Lanes Creek County Road, as well as recreation users within the Blackfoot WMA and surrounding federal lands.

Views of the Study Area are limited from paved highways, towns, and cities because it is surrounded by mountain ranges and rugged terrain, which screen some portions of the Study Area from view. One KOP location was selected from these key viewing areas for the preparation of visual simulations that depict the appearance of proposed mining disturbance. KOP 1 is located within the Blackfoot River WMA, near the Stocking Ranch, as shown on **Figure 4.9-1**. The KOP looks northeast toward the Proposed Action components.

A computer-generated visual simulation was created by photographing the existing landscape at a KOP, then modifying the photograph to show the Proposed Action components as seen from the KOP. The visual simulation serves as an aid to visualizing the changes associated with mining and reclamation to identify the degree of visual contrast of the Proposed Action components relative to the existing and surrounding landscape. **Figure 4.9-1** illustrates existing conditions as seen from KOP 1. Based on the visual simulation of the Proposed Action components as seen from KOP 1 (**Figure 4.9-1**), the overburden piles, ore stockpiles, backfilled areas, walls of the pit excavations, power line, and the haul road and would be visible from KOP 1. The ore stockpile would appear as light to medium brown, flat or rounded forms. The overburden piles, backfilled areas, and active mining area would introduce medium to light brown, flat or rounded forms with medium to coarse textures. The proposed landforms would be visible below the skyline and low on the horizon in the foreground-middleground distance zone (**Section 3.9.1**). From the background distance zone, the scale of the landforms would be subordinate to the existing landscape and would be very difficult to discern. The colors and textures of the ore stockpile, overburden piles, backfilled areas, and active mining area would represent a moderate to strong degree of contrast relative to the colors and textures of the surrounding landforms and vegetation. The Proposed Action components and facilities would appear as visible alterations to the existing landscape for the duration of the Proposed Action.

Construction of the haul road and the power line spur parallel to and north of the haul road would introduce new linear features to the existing landscape. The proposed haul road would appear as a thin, light to medium brown, horizontal line within the middleground distance zone. The road would not be vegetated during operations; therefore, the tan to light brown colors and fine to medium texture of the proposed road would contrast with the green colors and medium to coarse textures of the existing surrounding vegetation cover. The proposed haul road would result in a weak to moderate degree of contrast in form, line, color, and texture relative to the elements of the existing landscape in the surrounding middleground area because it would be low on the horizon. These contrasts are anticipated to be difficult to discern from the background because they would blend into the horizon.

The proposed power line might be visible from KOP 1 as a faint diagonal line behind the haul road, and the removal of trees and shrubs along the power line corridor would create a color contrast with the surrounding vegetation. As seen from KOP 1, the overall visual effect of the power lines would be small in scale relative to the surrounding landscape and unlikely to attract attention because the poles would be low on the horizon and are anticipated to blend into the background. The impacts from the poles may be noticeable when structures are sky-lined; however, the overburden piles and the existing hilly terrain would screen the poles by allowing the vertical forms to blend to some degree into the surrounding variable textures and colors of the slopes in the background. The proposed power line would result in a weak degree of contrast in form, line, color, and texture relative to the elements of the existing landscape in the surrounding middleground distance zone.

The visual intrusion of mine-related workers, vehicles and vehicle lights, heavy equipment, the bustle of activities, and associated dust would detract from the visual quality of the surrounding landscape in the immediate vicinity of the Study Area. Although slopes and vegetative screening would likely obscure direct views of project-related components and activities, at times vehicle lights and dust raised by vehicle and equipment movements would be visible. Pit walls would be obvious until pits are backfilled.

Some recreationists may find the visual impact of the proposed facilities and mine-related activities detrimental to the recreational experience, as the natural setting would be modified with a strong industrial element, and opportunities for solitude would be reduced. Impacts to recreation are addressed in **Section 4.10**. Others would find interest in a view of large-scale mining activities.

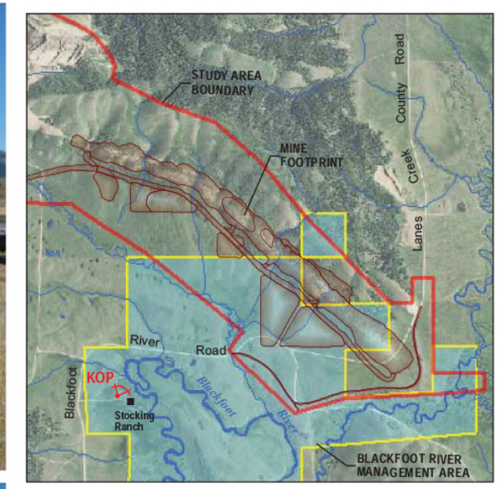
During night hours, the Proposed Action would have a substantially different type of impact on visual resources than during day hours. Mine facilities would be lit at night in compliance with Mine Safety and Health Administration (MSHA) illumination requirements for worker safety. Lights would be used on project equipment and vehicles during nighttime operations, and stationary lights would be positioned at various locations within the mine area. Night-lighting is generally visible for longer distances than the proposed project facilities, and activities would be visible during daylight hours.

Mine lighting would affect dark night skies until the completion of active mining. Lights would be visible from the mine at night, but overall effects to dark night skies would be similar to those from current operations at the Rasmussen Ridge Mines. Subsequent reclamation would reduce the effects (illuminated mining activities) to dark night skies. During and after reclamation, there would be few or no remaining lights and little or no residual affects to dark night skies. Use of project lights would contribute to the illumination of the night sky in an area that is largely uninhabited. With the exception of lights from vehicles traveling on nearby roads, existing mining exploration equipment, and homesteads, there are few existing light sources in the analysis area. Because the ambient light level is low, any lights used for the Proposed Action would be surrounded by an otherwise dark, unlit background. The brightness of the lights would create a strong contrast against the backdrop of the black or nearly black background night sky. As illumination of the night sky increases over an uninhabited and dark area, the number of stars and constellations that are visible would be reduced, and the night sky would be adversely impacted.

As standard practice for mining, light fixtures would be placed at the lowest practical height and directed at the ground or work areas to avoid being cast skyward or over long distances. Shields or louvers would be used on light fixtures, and full cut-off type fixtures would be used where possible. With implementation of the proposed type of night-lighting, night shine from the facilities would be minimized.

As mining progresses under the Proposed Action, reclamation would be started on the mined-out areas through concurrent reclamation. Some coarse and durable materials that would be placed on angle-of-repose slopes that are not re-vegetated may be darker than naturally exposed rock surfaces in the area. Over time, as the rock weathers, these changes may become less visible and may more closely resemble naturally occurring rock surfaces in the surrounding area.

After mine closure is complete, long-term visual impacts would be reduced by reclamation and re-vegetation. Successfully re-vegetated areas would reduce differences in color and texture among disturbed and undisturbed areas. Based on the visual simulation for reclamation conditions (**Figure 4.9-1**), reseeded areas may appear as somewhat different colors and textures compared with the surrounding landscape. After successful reclamation, the vegetative cover of the reclaimed landscape is anticipated to be a mixture of grasses, forbs, and shrubs.



Location Map of KOP

Key observation point (KOP) 1 is located within the Blackfoot River Management Area, near the Stocking Ranch. The KOP faces northeast and provides a view of the mine site.

RASMUSSEN VALLEY MINE

FIGUIRE 4.9-1
Proposed Action
Existing Conditions and Visual Simulation

ANALYSIS AREA: Caribou County, Idaho

Date: 08/26/2015 | Prepared By: JC

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Unreclaimed pit walls, water management facilities, and reclaimed overburden piles would represent long-term modifications to topography and the existing landscape character in localized areas. The reclaimed landscape may mimic surrounding topography and vegetative cover so that the existing landscape character would be retained to the extent possible over the long term.

The Forest Service land within the Study Area, including the areas visible from KOP 1, are designated VQO Modification as defined in the Forest Service RFP. Human modifications to the natural landscape resulting from the Proposed Action would occur within a landscape that contains existing man-made modifications, including the Rasmussen Ridge Mines, mining and exploration activities, and roads. The VQO of Modification allows the greatest change in the landscape, including management activities that dominate the original characteristic landscape. Implementation of the Proposed Action would add industrial components to a landscape currently characterized by a natural appearance. Under the Proposed Action, there would be large-scale visual changes to the characteristic landscape, but the Proposed Action would meet the Forest Service VQO of Modification. Under implementation of the Proposed Action, there would be large-scale visual changes to the characteristic landscape; however, the Proposed Action would meet the Forest Service VQO of Modification.

Although BLM lands constitute a relatively small portion of the land within the Study Area, some of the Proposed Action components visible from KOP 1 would be located in areas designated as VRM Class III (partial retention) as defined in the PFO ARMP. The BLM's Visual Contrast Rating System, as described in the BLM Manual H-8431 (BLM 1986b), was used to describe and analyze the effects of the Proposed Action on visual resources. As part of the analysis process, a Visual Contrast Rating (VCR) worksheet was developed for KOP 1 to help describe visual impacts associated with the Proposed Action. The basic elements (form, line, color, and texture) of the Proposed Action component were then compared to those of the existing landscape to quantify the degree of contrast. The results of this comparison and expected degree of contrast were applied to determine whether the basic design elements of the Proposed Action are consistent with the management objectives for VRM Class III areas. For public lands managed for the objectives for VRM Class III areas, the level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

Based on the results of the VCR worksheet, the Proposed Action landforms would result in a moderate to strong degree of contrast in form, line, color, and texture relative to the elements of the existing landscape in the surrounding foreground-middleground area. The Proposed Action components would be visible but would not attract attention or dominate the casual observer's view from KOP 1 because the landforms would be more than 1 mile away, below the skyline and low on the horizon, and anticipated to blend into the horizon; therefore, the visual contrast of the Proposed Action components would comply with BLM's management objectives of VRM Class III areas. Overall, the impacts of the Proposed Action to scenic attractiveness would be long-term and minor.

4.9.1.2 Rasmussen Collaborative Alternative

Under implementation of the RCA, the mine footprint would be 17.8 acres larger than that for the Proposed Action. Pit development under the RCA would be sequenced, consisting of nine phases, with a 7.1-year duration, beginning at the north end of the mine and generally progressing south. This progression would be in contrast to the Proposed Action mining sequence, which would begin at the southern end of the Rasmussen Valley deposit and progress north over nine

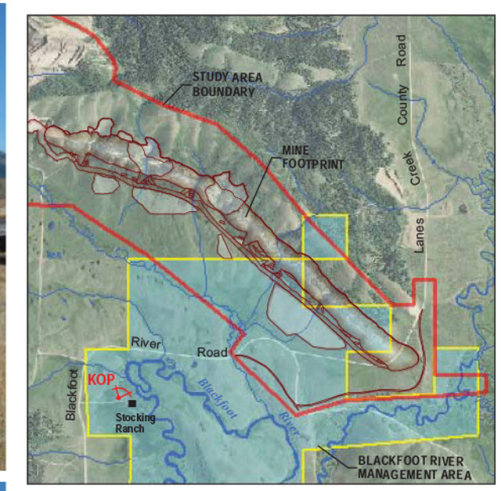
phases. Similar to the Proposed Action, as mining progresses, reclamation would be started on the mined-out areas and the maximum unreclaimed pit disturbance at any one time would be minimized. Upon completion of mining operations, small portions of footwall (limestone) exposures would remain in the reclaimed pit. The pit backfill would be capped with the approved store-and-release system.

Based on the visual simulation of the RCA as seen from KOP 1 (**Figure 4.9-2**), the GM stockpiles, backfilled areas, the walls of the pit excavations, and the haul road would be visible from KOP 1. Similar to the Proposed Action, the landforms would be visible in the foreground-middleground distance zone (**Section 3.9.1**). Under the RCA, the GM stockpiles, backfilled areas, and active mining area would introduce medium to light brown, flat or rounded forms with medium to coarse textures below the skyline in the foreground-middleground area and would remain unvegetated during operations; therefore, the brown colors and medium to coarse textures of the GM stockpiles, backfilled areas and active mining area would contrast with the green colors and medium to course textures of the existing surrounding vegetation. Under the RCA, the GM stockpiles, backfilled areas, and active mining area would introduce medium to light brown, flat or rounded forms with medium to coarse textures below the skyline in the foreground-middleground area and would remain unvegetated during operations; therefore, the brown colors and medium to coarse textures of the GM stockpiles, backfilled areas, and active mining area would contrast with the green colors and medium to course textures of the existing surrounding vegetation. Although the appearance of the landforms would vary in size as mining progresses, the GM stockpiles and backfilled areas associated with the RCA may be less noticeable relative to the Proposed Action landforms. The project components and facilities would appear as visible alterations to the existing landscape in the surrounding areas for the life of proposed mining activities.

Under the RCA, the West Side Haul Road would be constructed concurrent with the mine phases rather than at the beginning of mining, as described for the Proposed Action. Construction of HR-5 would be completed before mining of RCA Phase 1. HR-5 would be constructed between the terminus of the West Side Haul Road at the northern extent of the Lease and the existing Wooley Valley Tipple Haul Road north of South Rasmussen Mine. Relative to the Rasmussen Valley Haul Road under the Proposed Action, the haul road for the RCA would be less visible because it would be located farther to the north. The proposed haul road would result in a weak to moderate degree of contrast in form, line, color, and texture relative to the elements of the existing landscape in the surrounding middleground-background area because the haul road would be low on the horizon and is anticipated to be difficult to discern from the background.

After mine closure is complete, long-term visual impacts would be reduced by reclamation and revegetation. Successfully revegetated areas would reduce differences in color and texture among disturbed and undisturbed areas. Based on the visual simulation for reclamation conditions (**Figure 4.9-2**), reseeded areas may appear as somewhat different in color and texture compared with the surrounding landscape.

Although the mine footprint would be slightly larger under the RCA, and the pit development sequencing would differ from the phases described for the Proposed Action, the visual effects would be similar in type, intensity, and duration to those described for the Proposed Action. There would be essentially the same effects to dark night skies as those described for the Proposed Action during mining and after reclamation. Under the RCA, there would be large-scale visual changes to the characteristic landscape; however, the RCA would meet the Forest Service VQO of Modification.



Location Map of KOP

Key observation point (KOP) 1 is located within the Blackfoot River Management Area, near the Stocking Ranch. The KOP faces northeast and provides a view of the mine site.

RASMUSSEN VALLEY MINE

FIGUIRE 4.9-2
Rasmussen Collaborative Alternative
Existing Conditions and Visual Simulation

ANALYSIS AREA: Caribou County, Idaho

Date: 08/26/2015 | Prepared By: JC

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The portions of the Proposed Action overburden piles, backfilled areas, and active mining area visible from KOP 1 would be located in area designated as VRM Class III (partial retention) as defined in the PFO ARMP. Based on the results of the VCR worksheet, the RCA landforms would result in moderate to strong degree of contrast in form, line, color, and texture relative to the elements of the existing landscape in the surrounding foreground-middleground area. The RCA components would be visible but would not attract attention or dominate the casual observer's view from KOP 1 because the landforms would be more than 1 mile away, below the skyline and low on the horizon, and anticipated to blend into the horizon; therefore, the visual contrast of the Proposed Action components would comply with BLM's management objectives of VRM Class III areas. The overall impacts of the RCA to scenic attractiveness would be long-term and negligible.

4.9.1.3 No Action Alternative

Under the No Action Alternative, the Proposed Action would not be constructed as planned. There would be no project-related impacts to visual resources. Existing mining-related facilities and activities within the analysis area, including the Rasmussen Ridge Mines, would continue to be visible under the No Action Alternative.

4.9.2 Irreversible and Irretrievable Commitment of Resources

Unreclaimed pit walls, water management facilities, and reclaimed overburden piles would represent irreversible modifications to topography and the existing landscape character; however, reclamation would minimize the effects to visual resources. The reclaimed landscape may mimic surrounding topography, and vegetative cover would be predominantly grasses. Irreversible commitment of resources could occur if re-establishment of plants through reclamation is unsuccessful.

4.9.3 Unavoidable Residual Adverse Effects

Extensive backfill has been proposed under both the Proposed Action and the RCA. After reclamation is complete, minimal residual impacts to the visual quality of the analysis area would be expected. There would be minimal modification of the scenic attractiveness in background views along a limited number of public roadways resulting from the contrasting color and texture of the disturbed areas relative to the undisturbed landscape of surrounding areas.

4.9.4 Mitigation Measures

Under the Mine and Reclamation Plan (Agrium 2011), the final grading of the disturbed areas would create landforms that would blend with the surrounding, undisturbed topography to the extent practicable. The disturbed areas would be reclaimed using a seed mixture composed of grasses, forbs, and shrubs. As a result, reclaimed areas would represent a shift from a plant community composed predominantly of aspen/conifer forest and sagebrush to one composed mostly of grasses. There is likely to be a minor visual contrast from the vegetation community of the reclaimed areas compared with the background landscape.

Project design features, BMPs, and the Mine and Reclamation Plan (Agrium 2011) are the elements of the Proposed Action designed to reduce environmental impacts to visual resources. Additional mitigation measures are not deemed necessary.

4.10 LAND USE, ACCESS, AND TRANSPORTATION

Issue: What are effects of increased traffic on public roads used for mine access and associated increased potential for traffic accidents?

Indicators:

- Estimated increase in average daily traffic on public roads in the analysis area as a result of proposed mining activities
- Estimated increased number of heavy-duty vehicle and heavy equipment traveling on public roads

Issue: What are the potential effects to permitted range allotments for livestock grazing within and adjacent to the Study Area?

Indicators:

- Estimated short- and long-term displacement of range allotments by mine facilities (reduced number of grazing allotments)
- Calculated change in forage production, carrying capacity, or rangeland condition of grazing allotments
- Estimated reduction in acreage suitable for range allotments as a result of insufficient water availability (changes to the number of watering points and locations) or unsuitable water quality (high levels of selenium or other COPCs)
- Reduction in diversity of vegetation or forage value of reclamation cover (increased occurrence of invasive or noxious species) within grazing allotments
- Unacceptable vegetative uptake of COPCs from overburden

Issue: What are the potential effects to existing recreational uses (hunting, fishing, hiking, wildlife viewing, winter recreation and the Blackfoot River WMA) or other land uses, including effects on public access to recreational areas?

Indicators:

- Acres of temporary and long-term impacts to land uses
- Indirect effects to the WMA, including displacement of game during hunting seasons and changes to the quality of the recreational experience
- Displacement of recreational or other land uses by mine-related activities
- Diminished quality of the recreational experience or indirect effects to other land uses
- Restricted public access to recreation areas or other land use areas

4.10.1 Direct and Indirect Impacts

4.10.1.1 Proposed Action

4.10.1.1.1 Grazing

Altogether, 967 acres of allotments within the Rasmussen Valley Cattle Allotment (RVCA) would be rendered unusable for grazing, which equates to approximately 9 percent of the RVCA. Almost

the entirety of RVCA Unit 3A is included in the Study Area, and would realize the greatest impacts. However, Unit 3A accounts for only 9 percent of the total grazing days permitted in the RVCA. Other units within the RVCA would realize lesser impacts in terms of acreage rendered unusable for grazing. The Angus Creek Unit would lose 113 animal unit months (AUMs) and 86 head months. Impacts to the RVCA would be minor, as the grazing lands would not be displaced all at once, but progressively as mining activities progress; therefore, portions of the grazing lands within the Study Area may remain accessible during mining activities.

To compensate for grazing lands that are rendered temporarily unusable during operation of the Proposed Action, the USFS may need to reduce stocking rates or arrange for alternate allotments during mining. The Little Long Valley Unit could gain 201 AUMs and 169 head months with additional water and fence development, thus offsetting the losses in the Angus Creek Unit. Therefore, impacts to the amount of grazing land available would be negligible at the local and regional scales, and negligible to moderate at the scale of the individual grazing allotments, with the greatest impact to Unit 3A and with lesser impacts to Units 1B, 2A, and 2B.

The 9 acres of allotments that would be rendered unusable for grazing in the Henry Olsen Sheep and Goat Allotment (HOSGA) equates to only 0.08 percent of the HOSGA. The impact during operations to the HOSGA would be negligible.

During and following the cessation of mining at the Proposed Action, more than 96 percent of the Proposed Action would be reclaimed. As described in **Chapter 2**, the objectives of reclamation are, among others, to re-establish regional drainage patterns; to provide vegetative cover suitable to stabilize the surface; and to re-establish the pre-mining multiple land uses of recreation, wildlife habitat, and livestock grazing where authorized. Native seed mixtures would be applied using Agency-approved seed mixes to complement the existing plant communities, and appropriate BMPs to control invasive and noxious species would be implemented throughout the duration of the Proposed Action.

After reclamation of any given area, the forage production and condition of the grazing land may be improved compared to existing conditions. In the early stages of succession after reclamation, grasses would dominate, and relatively more forage may be available for livestock grazing than before mining. In addition, noxious and invasive species would be actively controlled during the Proposed Action on disturbed and reclaimed lands. Therefore, in the long term, impacts to the quality of grazing lands would be negligible to minor, and a minor improvement may be realized in the years immediately following reclamation in any given area.

4.10.1.1.2 Traffic

Under the Proposed Action, the workforce and equipment currently being used at the Rasmussen Ridge Mines would transition to the Proposed Action as the ore is exhausted. Because the Proposed Action represents a continuation of current activities at the Rasmussen Ridge Mines, no increase in the workforce or numbers of construction vehicles is anticipated. The workforce and mining-related vehicles are expected to travel to the Proposed Action along the same routes that they currently travel to the Rasmussen Ridge Mines and in the same numbers. Consequently, no increase in the average daily traffic on public roads is anticipated, and no increase in the number of heavy vehicles traveling on public roads is anticipated. No impacts to traffic or motorist safety are anticipated under the Proposed Action. The impacts on traffic from the Proposed Action would be short-term and negligible.

4.10.1.1.3 Recreation

Approximately 1,008 acres of federal lands and 833 acres of state lands open for recreation are included in the analysis area; of that, approximately 410 acres are located in the Blackfoot River WMA. Given the industrial nature of the Proposed Action, recreation either would be restricted or prohibited on these lands during the duration of the Proposed Action, or recreationists would not choose to use these lands. The acreage lost to recreational use under the Proposed Action is a small fraction of the lands that would remain open to recreation in the area. The CTNF alone accounts for approximately 2.6 million acres of unaffected land that would remain open to recreation, and approximately 2,000 acres in Blackfoot River WMA would remain open to recreation. The acreage of lands available for recreation that would be reduced under the Proposed Action is negligible at the local and regional scales given the large acreage that would remain available.

There are no developed recreational facilities (e.g., campsites) on lands that would be impacted under the Proposed Action. One parking area within the Blackfoot River WMA and a portion of a trail located on the Blackfoot River WMA would be lost. Given the number of other trails located in the vicinity to which existing users could displace and the availability of the other three parking areas, access to the Blackfoot River WMA would not be impacted. CTNF motorized ATV trails 322 and 322B would be temporarily lost through the mining process. The loss of these trails and the parking area would be long-term and have a moderate, site-specific impact, but a negligible local or regional impact. After mining, the USFS and Agrium would determine the location of ATV trails to access the area in coordination with the roads to access the monitoring wells. This would amend the CTNF Travel Plan to accommodate the new location of the ATV trail.

There are no data on the number of individuals who recreate on the majority of the lands that could be impacted by the Proposed Action. Data from the Blackfoot River WMA conservatively indicate that approximately 200 people per year visited the WMA in the 2002-2012 period. Of these, approximately 70 percent visited to fish, 15 percent visited to hunt, with the remainder visiting for ‘viewing’ and other purposes. These data suggest that the area is not heavily visited, and thus, few users would be impacted.

During operation of the Proposed Action, impacts to the majority of users of the Blackfoot River WMA would be indirect. The new mining operations would represent a new industrial activity on and near Blackfoot River MWA lands, with corresponding increases in noise, activity, and dust that may result in a deterioration of the recreational experience. Direct impacts would be realized by those recreationists who use the trail that would be lost and the lands that would be closed (e.g., hikers, snowmachiners, and others whose recreation is tied to the land) and hunters and wildlife viewers who pursue species on lands that would be closed to recreation under the Proposed Action. In both cases, these impacts would be moderate and site-specific, but negligible at the local and regional scales. Displaced users of the land could use one of the many other trails in the vicinity of the Proposed Action or other public lands in the area, and hunters and wildlife viewers could continue to pursue game species on public and private lands (where permitted) to which these species would likely migrate when the Proposed Action begins.

Following cessation of activities under the Proposed Action, including reclamation, both direct and indirect impacts to recreation may be realized. While better than 96 percent of the area disturbed by the Proposed Action would be reclaimed and re-opened for recreation, these areas may not be desired for some recreational uses because of the altered topography and vegetation. Conversely, other recreationists (for instance, hunters) may find these areas desirable, as the re-vegetated areas may provide better forage or cover for game species than the original habitat.

In summary, given the relatively small area that would be directly or indirectly impacted under the Proposed Action, the large area surrounding the Proposed Action to which recreationists could disperse, and the relatively few visitors to the area around the Proposed Action, overall impacts to recreation would be long-term, moderate and site-specific, but negligible at the local and regional scales.

4.10.1.2 Rasmussen Collaborative Alternative

Potential impacts to grazing, traffic, and recreation under the RCA would be equivalent to those presented above for the Proposed Action. The location of ore haul road traffic would be different under the RCA, but the impacts would be comparable. The RCA would not include the HR-1 crossing of Rasmussen Valley Road, but the Wooley Valley Tipple Haul Road would remain active. The additional acreage to be mined would have minor additional effects on the amount of land available for agricultural and recreational uses, but these minor additional effects would not change the results of the analysis presented in **Section 4.10.1.1**. The modified mine plan and activities would have similar effects on wildlife species, and thus impacts to game hunters similar to those described for the Proposed Action above. The modified mine plan may lessen potential effects to hydrology and water quality which, in combination with the reduced impacts to wetlands, would reduce impacts to aquatic species including game fish. The reduction in these impacts would not change the results of the analysis presented in **Section 4.10.1.1**.

4.10.1.3 No Action Alternative

Under the No Action Alternative, traffic on local public roadways would be reduced because of the loss of mining and ore processing positions. No impacts to recreation or recreationists would be realized, and no impacts to the availability or quality of grazing lands would be realized.

4.10.2 Irreversible and Irretrievable Commitment of Resources

There would be only negligible to minor irreversible or irretrievable commitment of grazing and recreational resources associated with the Proposed Action or the RCA.

4.10.3 Unavoidable Residual Adverse Effects

The Proposed Action and the RCA would result in only minor residual adverse effects on grazing and recreational resources, and no effects related to traffic. The Proposed Action would result in a small amount of unreclaimed land, which would be unusable for both recreation and grazing. No long-term, residual adverse effects on wildlife species or habitat are anticipated. The No Action Alternative would not result in any unavoidable residual adverse effects.

4.10.4 Mitigation Measures

To partially mitigate the temporary displacement of grazing AUMs due to mining activity in the Angus Creek pasture of the RVCA, Agrium is proposing to provide water on the southwest side of the Little Long Valley pasture of the RVCA. The proposal is for Agrium to drill a water well, and the water would be pumped to water troughs. If a suitable place is not found for a well, Agrium would propose to place a pipeline from a well on Agrium's property and pump it to water troughs to be located on the southwest side of Little Long Valley pasture. The southwest side of the Little Long Valley pasture has limited grazing from livestock because of the lack of water and the Blackfoot River being fenced out. Some of the AUMs temporarily lost in the Angus Creek pasture would be moved to the Little Long Valley pasture. This would decrease the economic impacts and

affects to the local ranchers. The Little Long Valley pasture would not be grazed beyond the capacity of the suitable rangeland within the pasture. The Forest Service grazing permits associated with the RVCA would not have a net increase in head months. Agrium is also proposing to build a boundary fence on the south end of the Little Long Valley pasture in order to facilitate livestock using the southwest side of this pasture. No other specific mitigation measures for land use, access, and transportation have been proposed at this time.

4.11 CULTURAL RESOURCES

Issue: What are the potential impacts to important cultural resources in the disturbed area?

Indicators:

- Number of historic properties (cultural sites eligible for the National Register of Historic Places [NRHP]) impacted by the Proposed Action

4.11.1 Direct and Indirect Impacts

The entire area of potential effects (APE) of the Proposed Action and alternatives (the cultural resources survey area) has been inventoried for the presence of cultural resources. As discussed in **Section 3.11**, 28 cultural resources have been identified within the cultural resources survey area. All of these sites have been recommended to be not eligible for special protection or mitigation under the NRHP. The CTNF and the Idaho State Historic Preservation Office (SHPO) have concurred with these recommendations. Therefore, no historic properties (cultural sites eligible for the NRHP) have been identified in the cultural resources survey area. The results of cultural resources studies have been considered in the development of the Proposed Action and RCA.

4.11.1.1 Proposed Action

Under the Proposed Action, no historic properties are within areas of proposed disturbance. Therefore, the Proposed Action would have no impact to known historic properties. Effects of the Proposed Action to cultural resources would be long-term and negligible.

4.11.1.2 Rasmussen Collaborative Alternative

No historic properties are within areas of proposed disturbance of the RCA. The RCA would have no impact to known historic properties. Effects of the RCA to cultural resources would be long-term and negligible.

4.11.1.3 No Action Alternative

Under the No Action Alternative, the Rasmussen Valley Mine would not be developed, and there would be no effect to known historic properties.

4.11.2 Irreversible and Irretrievable Commitment of Resources

Cultural resource sites are non-renewable resources. Any project plan or design that would result in adverse impacts to historic properties would be an irreversible and irretrievable commitment of resources. No historic properties have been identified in the Rasmussen Valley Mine Survey Area. Therefore, the Proposed Action or the RCA would not result in irreversible and irretrievable commitment of historic properties.

4.11.3 Unavoidable Residual Adverse Effects

The Proposed Action or the RCA would not result in unavoidable residual adverse impacts to historic properties.

4.11.4 Mitigation Measures

Twenty-eight cultural resource observations were made in the field. None were recommended to be historic properties; therefore, historic properties would not be impacted by the Proposed Action or the RCA. If any unidentified cultural resources are discovered during the mining process or associated activities, operations in the immediate area of the discovery would be halted. The discovery reported to the BLM or CTNF, and the BLM or CTNF or its authorized representatives would document and evaluate the discovery. If necessary, a treatment plan would be developed and implemented.

4.12 TRIBAL TREATY RIGHTS AND INTERESTS

Issue: What are the potential impacts on the Shoshone Bannock Tribal members to exercise their treaty rights in the Study Area and the potential impacts to resources of cultural significance to Tribal members including diminishing the traditional value of sites?

Indicators:

- Changes in the quality and quantity of culturally valued resources on unoccupied public land, including ground and surface water, traditionally valued vegetation, grazing resources, and wildlife
- Increased uptake by wildlife and vegetation of COPCs in mining disturbed areas and areas that are reclaimed
- Acres of traditional use areas that would be available or unavailable and the duration of mining activities
- Visibility of disturbances to adjoining areas
- Known historic properties affected
- Changes in the natural setting of the traditional resources that would diminish their value to traditional practices
- Rendering of culturally important natural resources unfit for harvest or consumption

4.12.1 Direct and Indirect Impacts

Resources or issues of interest to the Tribes that could involve their traditional use or treaty rights include Tribal historic and archaeological sites, sacred sites and traditional cultural properties (TCPs), traditional use sites, fisheries, traditional use plant and animal species, vegetation (including noxious and invasive, non-native species), air and water quality, wildlife, access to lands and continued availability of traditional resources, land status, and the visual quality of the environment. As reflected in the indicators listed above, Tribal concerns include potential changes in the quality and quantity of groundwater and surface water, traditionally valued vegetation, grazing resources, and wildlife. Changes in quality of these resources may include increased uptake of COPCs by vegetation and wildlife, changes in the natural setting of traditional resources

that would diminish their value to traditional practices, rendering of culturally important natural resources unfit for harvest or consumption, and impairment of access to resource areas. In addition, some cultural resources that are not considered to be historic properties may have traditional value to the Tribes. Many of these resources or issues overlap with other resource concerns discussed in this assessment, but also must be dealt with in consultation with the Tribes. Tribal consultation to date has not identified culturally unique resources in this Study Area, including any sacred sites.

4.12.1.1 Proposed Action

There would be no changes in land status or access associated with the Proposed Action, and those portions of the Study Area that are currently unoccupied public land would retain that status. However, there would be substantial areas of disturbance on those federal lands. Although, there would be a temporary interruption during mining activities to the Shoshone and Bannock Tribes' access to the lands to exercise treaty rights and traditional uses, that access would be restored at the completion of mining.

The Proposed Action would result in adverse impacts to some of the natural resources that the Tribes may desire in the exercise of their treaty rights. Long-term impacts would be associated with the disturbance or displacement of plant and wildlife species that are used for traditional purposes and subsistence and would be minor.

4.12.1.2 Rasmussen Collaborative Alternative

The RCA would not result in changes in land status or access for traditional use or treaty rights. The areas of disturbance on unoccupied public lands would be similar to those under the Proposed Action with some additional disturbance at the north end adjacent to the South Rasmussen Mine. As with the Proposed Action, the RCA would also result in adverse impacts to some of the natural resources that the Tribes may desire in the exercise of their treaty rights. Long-term impacts would be associated with the disturbance or displacement of plant and wildlife species that are used for traditional purposes and subsistence and would be minor.

4.12.1.3 No Action Alternative

Under the No Action Alternative, the Proposed Action or RCA would not be authorized, and there would be no adverse impact to known Tribal treaty rights and interests.

4.12.2 Irreversible and Irretrievable Commitment of Resources

Mining would result in partial or complete loss of access to traditional resources on public lands during the mining and initial reclamation of public lands. Therefore, project elements would include irreversible and irretrievable commitments of resources. However, resources including vegetative resources and wildlife habitat would be reclaimed or replaced.

4.12.3 Unavoidable Residual Adverse Effects

No potential for unavoidable residual adverse impact to Tribal treaty rights and interests has been identified.

4.12.4 Mitigation Measures

Potential impacts to traditional use or treaty rights that have been identified include short-term interruption of access to the lands to exercise treaty rights and traditional uses. No specific impacts to traditional resources or uses that are not available in other areas have been identified. If adverse impacts to traditional resources or uses were identified, mitigation measures specific to that resource would be developed through consultation among the Tribes and the Agencies.

4.13 SOCIAL AND ECONOMIC CONDITIONS

Issue: What are the potential adverse or beneficial socioeconomic impacts including employment, ancillary businesses, agriculture, and tax base?

Indicators:

- Changes in employment and personal income; distribution of jobs within industrial sectors
- Payments to local and regional businesses providing goods and services to current operation/projections of payments
- Economic value of land in agricultural use (employment, tax, and other revenue)
- Corporate contributions to local/state tax and other revenues over time
- Relative change in property values

Issue: What are the potential impacts on tourism and recreation economy?

Indicators:

- Estimated changes in acres open to recreation compared to acres closed to recreation
- Tourism and recreation value per acre
- Estimated changes in economic contribution of tourism and recreation in the area and changes over time

Issue: What are the potential impacts of the closure of the mine, resulting in decreased domestic phosphate production, effect of reduced fertilizer supply, increased price on national agriculture, and increased foreign natural resource dependence?

Indicators:

- Percentage of U.S. phosphate fertilizer market derived from Agrium CPO Plant production and ability of other domestic and foreign sources to satisfy this demand, if necessary

4.13.1 Direct and Indirect Impacts

The analysis area for the socioeconomic environment is Caribou, Bear Lake, and Bannock Counties in Idaho, and Lincoln County (Star Valley area) in Wyoming. Actions or decisions that influence the economic feasibility of the mining operations would also be reflected in the

socioeconomic environment. Mine economics have an effect on employment; salaries; property tax payments; royalties going to schools, roads, and bridges; net proceeds of mining tax revenues; and local purchases by the mine operator and its employees.

4.13.1.1 Proposed Action

Overall impacts of the Proposed Action to social and economic conditions would be short-term and major. Aspects of social and economic conditions are discussed in the following sections.

4.13.1.1.1 Population

The Proposed Action would result in no impacts to the population of the analysis area. It is expected that the workforce and equipment currently excavating the deposits at the Rasmussen Ridge Mines would shift to the Proposed Action as the Rasmussen Ridge Mines deposits are exhausted. Because no new workers would be hired under the Proposed Action, no in-migration of new workers and their families is expected; thus, there would be no impacts to population, housing, or community services.

4.13.1.1.2 Economy and Employment

The Proposed Action would result in no changes in employment or distribution of jobs within industrial sectors. It is expected that the workforce and equipment currently excavating the deposits at the Rasmussen Ridge Mines would shift to the Proposed Action as the Rasmussen Ridge Mines deposits are exhausted. The direct and indirect effects of current operations at the Rasmussen Ridge Mines, including the positive effects of direct, indirect, and induced employment, would be extended for another 3.9-year duration of active mining under the Proposed Action when compared with the No Action Alternative. Therefore, the Proposed Action would preserve the approximately 1,700 direct, indirect, and induced employment positions supported by the Proponent's current activities within the Study Area and elsewhere in Idaho.

Payments to Businesses

The Proponent's current facilities spend more than $85 million in the Study Area per year. It is expected that operations under the Proposed Action would begin as the Rasmussen Ridge Mines deposits are exhausted. Businesses that currently provide goods and services in support of activities at the Rasmussen Ridge Mines are expected to continue to provide those goods and services during operation of the Proposed Action, and thus payments to businesses on the order of $85 million per year (or approximately $340 million over the approximate 4-year life of the mine) would be realized.

Agricultural Use

As presented in **Section 3.10.3**, portions of the Study Area are leased for the grazing of cattle and sheep. Mining exploration work has occurred on Federal Phosphate Lease I-05975, which underlies the Proposed Action, since 2008. As described in **Section 4.10**, approximately 975 acres of current grazing allotments would be rendered temporarily unavailable for grazing during the Proposed Action. Given the small amount of this land compared to the entirety of grazing lands in the area, impacts to the agricultural economy would be negligible.

Tourism/Recreation

The Proposed Action would result in disturbance of approximately 380 acres of state and federal lands. Given the activities on these lands under the Proposed Action, there would be a long-term loss of lands available or usable for recreational purposes. These 380 acres of state and federal

lands represent a very small portion of the total acreage of state and federal lands in the area that would remain open for recreation. The CTNF alone accounts for 2.6 million acres of land that is open to recreation. Although there are no data on the number of individuals who recreate on the majority of the lands that would be impacted the Proposed Action, data from the Blackfoot River WMA conservatively indicate that approximately 200 people per year visited the WMA in the 2002-2012 period. Of these, approximately 70 percent visited to fish, 15 percent visited to hunt, with the remainder visiting for 'viewing' and other purposes. These data suggest that the area is not heavily visited.

According to data from the Forest Service's National Visitor Use Monitoring program, each acre of the CTNF generates approximately $127 in visitor spending per year. The lands on which project components would be located would no longer be available for hunting; however, the Proposed Action would likely also cause game species to disperse to adjacent, non-impacted lands where those species would remain available for hunting. Assigning this value to state lands also open to recreation in the Study Area results in a potential loss of approximately $48,260 per year as a result of 380 acres of state and federal land being unavailable for recreation. However, this loss may not be realized in practice given the large area that would remain available for recreation and that these other areas may be preferred or superior for recreation given the mining activity in the vicinity of the Proposed Action.

As presented in **Section 3.10.3.4**, hunting is a recreational activity pursued in the area around the Proposed Action. Given the small area of land that the Proposed Action would disturb, and the large area available for recreational purposes in the vicinity, impacts to the recreation and tourism industry would be negligible.

4.13.1.1.3 Unemployment and Labor Force

The Proposed Action would result in no changes in employment or the size of the labor force. It is expected that the workforce and equipment currently excavating the deposits at the Rasmussen Ridge Mines would shift to the Proposed Action as the Rasmussen Ridge Mines deposits are exhausted. The direct and indirect effects of current operations at the Rasmussen Ridge Mines (including the positive effects of direct, indirect, and induced employment) would be extended for another 3.9 years of active mining under the Proposed Action when compared with the No Action Alternative, and thus there would be no impact to unemployment rates or the size or composition of the labor force in the Study Area.

4.13.1.1.4 Income

The Proponent's current activities generate approximately $181 million in personal income per year throughout Idaho, with approximately $65 million in personal income generated in Caribou County alone. It is expected that the workforce and equipment currently excavating the deposits at the Rasmussen Ridge Mines would shift to the Proposed Action as the Rasmussen Ridge Mines deposits are exhausted. The direct and indirect effects of current operations at the Rasmussen Ridge Mines (including the positive effects of direct, indirect, and induced employment and the associated personal income generated from that employment) would be extended for another 3.9 years of active mining under the Proposed Action when compared with the No Action Alternative. Therefore, the Proposed Action would result in the continued generation of approximately $181 million in personal income per year throughout Idaho, with approximately $65 million in personal income continuing to be generated in Caribou County alone. Over the life of proposed mining activities, the Proposed Action would generate approximately $724 million in personal income throughout Idaho, and approximately $260 million in personal income in Caribou County alone, over the approximate 4-year life of the mine.

4.13.1.1.5 Housing

The Proposed Action would result in no impacts to the price or availability of housing in the analysis area. It is expected that the workforce and equipment currently excavating the deposits at the Rasmussen Ridge Mines would shift to the Proposed Action as the Rasmussen Ridge Mines deposits are exhausted. Because no new workers would be hired under the Proposed Action, no in-migration of new workers and their families is expected; thus, there would be no impacts to housing.

Property Values

The area surrounding the Proposed Action has been the site of phosphate mining for decades, and the Proposed Action represents a continuation of this historical activity. The Proposed Action is largely located on state and federal lands, although some components of the Proposed Action would be located on private lands. Owners of these private lands would be compensated for the use of the surface estate.

The value of private property in the vicinity of the Proposed Action may be affected by the development of the mine because of actual or perceived changes in the environment. It is beyond the scope of this EIS to predict in detail how such land values would be impacted. However, the Proposed Action would affect some of the areas' characteristics or amenities that subjectively affect property values (e.g., noise, aesthetics, traffic). These impacts may be positive or negative and may change over time as desired property characteristics change. With the exception of the lands on which project components would be located, the existing uses of private property in the area would not be impacted. Given that the large majority of the private lands in the area are used for agricultural purposes, and that agricultural production on private lands would not be impacted, the value of these agricultural lands would likely be unaffected.

4.13.1.1.6 Community Services

The Proposed Action would result in no impacts to community services (including schools, emergency services, law enforcement, and social services). It is expected that the workforce and equipment currently excavating the deposits at the Rasmussen Ridge Mines would shift to the Proposed Action as the Rasmussen Ridge Mines deposits are exhausted. Because no new workers would be hired under the Proposed Action, no in-migration of new workers and their families is expected; thus, there would be no impacts to community services.

4.13.1.1.7 Public Finance

The Proposed Action would ensure that the beneficial impacts to public finance in the Study Area generated by current operations at the Rasmussen Ridge Mines would continue to be realized over the life of proposed mining activities.

During the Proposed Action, Caribou County would continue to receive revenues from property taxes, fees, and permits. The current direct fiscal impacts made to state and local governments are presented in **Section 3.13.5**. Because the Proposed Action represents a continuation of current mining activities, there would be no perceptible change in the amount of these revenues. Caribou County can expect to continue to collect approximately $1.65 million annually in property taxes from Proponent-owned property and other project-related properties (or approximately $6.5 million over the life of proposed mining activities).

Federal lease royalties are paid on any production from a lease in accordance with the terms specified by the BLM, as included in the lease. Minimum royalty rates are not less than 5 percent of the gross value of production from leased deposits at the mine, or not less than 25 cents per

ton, whichever is greater, for the right "to mine and dispose of all the phosphate rock and associated and related minerals hereafter referred to as leased deposits." Federal law requires royalties and other revenues collected from federal phosphate leases be split equally between the state where the activity occurs and the federal treasury. The state receives 50 percent of royalty revenues, placing the revenues in a general fund and a special revenue fund for mineral impacts. Typically, Caribou County receives about 10 percent of the general fund revenues received by the state. Assuming a gross value of $39.33 per ton and a life of mine production of approximately 11.2 million tons, the estimated total federal royalties could be $19.7 million over the 3.9-year duration of active mining. The state would receive approximately $9.85 million over the life of proposed mining activities, and approximately $985,000 would be received by Caribou County over the life of proposed mining activities.

A mine license tax, payable to the State of Idaho Tax Commission, would be assessed at a rate of 1 percent of the net value of ores mined or extracted (or the net value of royalties received). The sums are remitted to the state treasurer, who then places 66 percent to the credit of the general fund of the state and 34 percent to the credit of the abandoned mine reclamation fund created by the provisions of section 47-1703, Idaho Code. The value to the state of the mine license tax would fluctuate over the life of proposed mining activities as a result of changes in the price of phosphate ore and the cost of mining. In 2013 and 2014, Idaho collected mine license taxes of $959,166 and $842,686, respectively. Phosphate mining accounts for approximately 12 percent of the value of mineral production in Idaho, and the Proposed Action could account for approximately 50 percent of the phosphate mined in Idaho in any given year during its production. Assuming a hypothetical $1,000,000 in mine license taxes in the future, the Proposed Action would generate approximately $60,000 in mine license tax. In addition to the mine license tax, the state would continue to receive sales taxes from the expenditures of the Proposed Action as well as from the expenditures of those employed directly and indirectly as a result of the Proposed Action. Because the Proposed Action represents a continuation of current mining activities, there would be no perceptible increase in these tax payments to the state in a given year.

4.13.1.2 Rasmussen Collaborative Alternative

The impacts realized under the RCA would be generally equivalent to those presented above for the Proposed Action. The modifications to the Proposed Action included in the RCA would not substantially affect the numbers of employees or the life of active mining. The additional acreage to be mined would have minor additional effects on agricultural and recreational uses of the land, but these minor additional effects would not change the results of the analysis presented in **Section 4.13.1.1**. The additional volume of ore to be mined would result in small increases in personal income, payments to businesses, and local/state tax and other revenues. These small increases would be positive, and would not change the results of the analysis presented in **Section 4.13.1.1**. Under the RCA, Agrium's mining activities would continue; thus, there would be no impacts associated with closure of the mine. Overall effects of the RCA on social and economic conditions would be short-term and major.

4.13.1.3 No Action Alternative

The analysis in this section is largely focused on Caribou County, as both the proposed mine and existing processing facilities are located in Caribou County, and because approximately two thirds of employees at the existing mine and processing facility reside in Caribou County. Therefore, any potential impacts would be most severely realized in Caribou County, with lesser impacts realized in other jurisdictions. Impacts to Lincoln County, Wyoming would be negligible because few of the current employees live outside of Idaho. Overall impacts of the No Action Alternative to social and economic conditions would be long-term and major.

4.13.1.3.1 Population

The No Action Alternative would result in the loss of the approximately 480 jobs associated with the currently operating Rasmussen Ridge Mines and Agrium's processing facility. As the deposits in the Rasmussen Ridge Mines are exhausted, operations would cease in the No Action Alternative. The loss of each direct employment position could also result in the loss of two or more indirect or induced employment positions throughout the economy (Qu and Anderson 2014). Given that similarly compensated positions are few in number outside of the phosphate mining and processing industries, it is likely that the loss of employment would also trigger a loss in population as workers leave the area to find other opportunities.

4.13.1.3.2 Economy and Employment

The No Action Alternative would result in the loss of the approximately 480 jobs associated with the currently operating Rasmussen Ridge Mines and Agrium's processing facility. Under the Proposed Action, employees currently working at the Rasmussen Ridge Mines would transfer to the deposits to be mined under the Proposed Action; however, under the No Action Alternative, these employees would not have a new deposit to which to transfer when the deposits in the Rasmussen Ridge Mines are exhausted; thus, an undetermined number of these mining positions would be eliminated. Some displaced employees may find employment at other mines in the area; however, it is unknown what number of displaced employees would be hired elsewhere, as currently operating mines are assumed to be fully staffed. In addition, the loss of the phosphate ore under the No Action Alternative could result in a reduction in employment at Agrium's milling and fertilizer facilities.

Caribou County is economically dependent upon phosphate mining and processing. Approximately 30 percent of the county's gross regional product ($115 million) is attributed to Agrium's current mining and ore processing operations. Under the No Action Alternative, purchases from businesses that support the mining and processing industries would be reduced. The reductions would be proportional to the reduction in overall phosphate mining and processing under the No Action Alternative. If the No Action Alternative resulted in closure of the Proponent's processing facilities as a result of insufficient volumes of phosphate ore being available, or premature closing of the facilities, losses to businesses throughout the economy could be major and unmitigateable, as this facility (and the mines that provide its ore) anchors the economy of Caribou County. Losses to businesses in other affected locales would be less than those realized in Caribou County, but could be minor to moderate. Losses would be greatest to businesses that are more directly dependent upon the phosphate mining and processing industry than other businesses that may have a more diverse base of business.

Agricultural Use

The No Action Alternative would have no impacts on the agricultural industry in the vicinity of the Proposed Action.

Tourism/Recreation

The No Action Alternative would have no impacts on tourism or recreation in the vicinity of the Proposed Action.

4.13.1.3.3 Unemployment and Labor Force

The No Action Alternative would result in the loss of the approximately 480 jobs associated with the currently operating Rasmussen Ridge Mines and Agrium's processing facility. Some displaced employees may find employment at other mines in the area; however, it is unknown what number

of displaced employees would be hired elsewhere, as currently operating mines are assumed to be fully staffed. Given that similarly compensated positions are few in numbers outside of the phosphate mining and processing industries, it is likely that the loss of employment would also trigger a loss in population as workers leave the area to find other opportunities. This would result in an increase in unemployment and a reduction in the labor force in the Study Area.

4.13.1.3.4 Income

As presented in **Section 3.13**, the average annual wages associated with mining and manufacturing in Caribou County are considerably higher than those for other industrial sectors. Consequently, the loss of these high-paying jobs would be felt throughout the economy, particularly as the loss of each direct employment position could also result in the loss of two or more indirect or induced employment positions throughout the economy that are supported by the mining and processing of phosphate ore and the spending of these highly paid employees. If all 480 positions associated with the mining and processing of phosphate ore were eliminated under the No Action Alternative, approximately $123 million in compensation (pay and benefits) could be lost throughout the state, with approximately $65 million potentially lost in Caribou County. This loss would account for approximately 27 percent of the total compensation of all employees in Caribou County, and the loss of approximately 20 percent of the employment positions in the county (Peterson 2013). These impacts to employment and personal income throughout the economy in Caribou County would be major and unmitigateable, and could range from negligible to minor at the relevant scales in the other affected locales.

4.13.1.3.5 Housing

The No Action Alternative would result in the loss of the approximately 480 jobs associated with the currently operating Rasmussen Ridge Mines and Agrium's processing facility. Given that similarly compensated positions are few in number outside of the phosphate mining and processing industries, it is likely that the loss of employment would also trigger a loss in population as workers leave the area to find other opportunities. The loss of employment would result in workers putting their houses up for sale and terminating leases on rental properties. The loss of employment could also spark concern for the overall health and future of the phosphate mining industry in southeast Idaho, perhaps putting downward pressure on housing prices and increasing availability.

Property Values

The No Action Alternative could have a negative impact on property values. A loss of employment under the No Action Alternative would result in workers putting their houses up for sale and terminating leases on rental properties. The loss of employment could also spark concern for the overall health and future of the phosphate mining industry in southeast Idaho, perhaps putting downward pressure on housing prices and property values. These impacts would be minor to moderate.

4.13.1.3.6 Community Services

The No Action Alternative would result in the loss of the approximately 480 jobs associated with the currently operating Rasmussen Ridge Mines and Agrium's processing facility. The loss of employment positions and potential loss of population as affected workers leave the area would reduce the demand for community services at the same time as the No Action Alternative would result in lowered funding for those services (sales and property taxes would be reduced, thus reducing the budget available to fund community services).

4.13.1.3.7 Public Finance

Selection of the No Action Alternative would result in a reduction in sales, use, and property tax revenues generated by phosphate mining operations once existing operations at the Rasmussen Ridge Mines cease. Agrium directly pays approximately $1.1 million annually in property taxes to taxing districts within Caribou County, which is approximately 14 percent of all property taxes paid in the county (Peterson 2013). These property tax revenues would be lost or considerably reduced, as would taxes paid by employees, and by secondary businesses and their employees. This would result in a decrease in Caribou County's overall revenues, as well as revenues in other analysis area counties from the circulation of payroll dollars. This impact could range from negligible (in areas where few individuals or businesses are employed or supported by the phosphate mining or processing industries) to moderate or major in areas like Caribou County that are heavily dependent upon phosphate mining or processing.

The federal government would realize a loss of royalty payments totaling an estimated $19.7 million that would have been paid over the life of proposed mining activities under the Proposed Action, and would realize a decrease in the corporate income tax paid by Agrium. These impacts would be negligible.

Under the No Action Alternative, the State of Idaho and Caribou County would not receive royalty proceeds dispersed to the state by the federal government. Further, the state would not collect the mine license tax of 1 percent of the value of ores mined or extracted, and would realize a decrease in the corporate income tax paid by Agrium. These impacts would be negligible to minor at the relevant scales.

4.13.1.3.8 Agricultural Use

The No Action Alternative would have no impacts on the agricultural industry in the vicinity of the Proposed Action.

4.13.1.3.9 Impacts under the No Action Alternative

The preceding sections address the potential local and regional impacts associated with the cessation of mining activities under the No Action Alternative. Impacts could also be realized at a national scale.

In 2013, phosphate rock ore was mined by six firms at 11 mines in four states and upgraded to an estimated 32.3 million tons of marketable product. More than 85 percent of total domestic output was sourced in Florida and North Carolina, with the remainder produced in Idaho and Utah. Imports of ore totaled 2.6 million tons, resulting in a net import reliance of 3 percent of apparent consumption in the U.S. This net import reliance is considerably less than the 16 and 13 percent rates seen in 2010 and 2011, respectively (USGS 2014d). The current annual wet phosphoric acid production capacity in the U.S. is approximately 10.5 million tons. Facilities in Idaho account of approximately 863,000 tons of capacity, and Agrium's facility produces about 538,000 tons of phosphate fertilizers per year (CRA 2009; Agrium n.d.). There are currently 77 establishments identified as phosphatic fertilizer manufacturers. Fourteen of these are large establishments with more than 100 workers like Agrium's facility (U.S. Census Bureau [USCB] 2014a). In the first two quarters of 2014, fertilizer manufacturing facilities were operating at approximately 78 percent of capacity (USCB 2014b).

Cessation of mining activities and the closure of Agrium's processing facility would have only a minor impact on the supply of phosphate, the supply of fertilizer, and the costs of agricultural production in the U.S. Less than 15 percent of phosphate ore mined in the U.S. is mined in Idaho,

and only 15 percent of the global production is sourced from the U.S.; therefore, impacts to the supply of phosphate would be negligible. The Project Proponent's facility accounts for less than 5 percent of the phosphatic fertilizer produced in the U.S., and existing facilities have unused capacity; therefore, impacts to the supply of fertilizer would be negligible to minor. Because there would be only negligible to minor impacts to the supply of fertilizer, there would be only negligible to minor increases to the cost of agricultural production in the U.S. Cessation of mining activities and the closure of Agrium's processing facility would likely result in only a negligible to minor increase in the dependence on foreign sources of phosphate. The underutilized capacity at existing facilities could, if necessary, maintain domestic production rates.

4.13.2 Irreversible and Irretrievable Commitment of Resources

There would be no irreversible or irretrievable commitment of social or economic resources associated with the Proposed Action or the RCA.

4.13.3 Unavoidable Residual Adverse Effects

The Proposed Action and the RCA would not have unavoidable residual adverse effects on social or economic resources. The No Action Alternative would result in some social dislocations and economic changes at the county and local levels beginning when mining at the Rasmussen Ridge Mines ceases.

4.13.4 Mitigation Measures

No specific mitigation measures for socioeconomic resources have been proposed for any alternative.

4.14 ENVIRONMENTAL JUSTICE

Issue: What disproportionately high and adverse human health or environmental effects on people of race, color, religion, or income could be realized?

Indicators:

- High or adverse human health effect
- High or adverse environmental effect
- Disproportionately high or adverse human health or environmental effect on people of race, color, religion, or income

4.14.1 Direct and Indirect Impacts

On February 11, 1994, EO 12898, "Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations" was published in the Federal Register (59 FR 7629). The order requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.

4.14.1.1 Proposed Action

The Proposed Action is located on uninhabited lands. The nearest concentration of population is in Soda Springs, which is located more than 15 miles from the Proposed Action. The demographic composition of the Census County Division in which the Proposed Action is located approximates that of Census Tract 9602 (which includes the eastern portion of Caribou County, including the City of Soda Springs) and the State of Idaho as a whole. Therefore, there are no communities in the vicinity of the Proposed Action that are minority as a whole, and none would be exposed to high and adverse environmental impacts.

The Fort Hall Indian Reservation is located approximately 30 miles west of the mine site. As shown in **Table 3.14–1**, those identifying as minorities or as Hispanic or Latino comprise a majority on the Fort Hall Reservation and Off-Reservation Trust Lands. The Shoshone-Bannock Tribes represent both a population (readily identifiable collection of persons) and a community (readily identifiable social group who reside in a specific locality, share government, and have a common cultural and historical heritage). The Proposed Action is not directly associated with or located in proximity to the Fort Hall Indian Reservation, but because of treaty rights and interests in public lands in the region, the Proposed Action could have disproportionate impacts on the population of the Reservation. These potential impacts are addressed in **Section 4.12**.

As presented in **Section 3.14**, data indicate that the numbers of people living in Caribou County and in Census Tract 9602 whose income is below the poverty level is lower than that of the State of Idaho as a whole, and that there are no individuals living in the Census County Division in which the Proposed Action is located whose income is below the poverty level. There are low-income populations in the vicinity of the Proposed Action; however, none would be exposed to adverse environmental impacts.

Impacts of the Proposed Action to the Shoshone-Bannock Tribe would be long-term and minor. Impacts to remaining populations using the Study Area would be long-term and negligible.

4.14.1.2 Rasmussen Collaborative Alternative

The environmental justice impacts realized under the RCA would be generally equivalent to those presented above for the Proposed Action.

4.14.1.3 No Action Alternative

Environmental justice impacts under the No Action Alternative would be the same as those described for the Proposed Action. Although the No Action Alternative may result in significant and unmitigateable impacts to employment and the local economy, there is no indication that these impacts would be disproportionately realized by minority or low-income populations.

4.14.2 Irreversible and Irretrievable Commitment of Resources

There would be no irreversible or irretrievable commitments of resources for environmental justice.

4.14.3 Unavoidable Residual Adverse Effects

There would be no unavoidable residual adverse effects related to environmental justice.

4.14.4 Mitigation Measures

No specific mitigation measures for environmental justice have been proposed for any alternative.

4.15 HAZARDOUS MATERIALS AND SOLID WASTES

Issue: What is the potential for accidental spills from generation, handling, use, and storage of fuels, hazardous materials, and wastes?

Indicators:

- Compliance with appropriate local, state, and federal standards for handling of fuels and hazardous materials

4.15.1 Direct and Indirect Impacts

This section describes the potential impacts associated with hazardous materials and wastes under implementation of the Proposed Action or the RCA. Under either of these, fuels, hazardous materials, and wastes would be transported, stored, and used in accordance with appropriate local, state, and federal regulations.

4.15.1.1 Proposed Action

Under implementation of the Proposed Action, wastes would be managed in compliance with state and federal regulations and recycled or disposed of in existing Agency-approved facilities. Used lubricants and solvents would be characterized according to the Resource Conservation and Recovery Act (RCRA) requirements and would be managed appropriately. Non-hazardous solid waste, trash, and other non-mineral waste would be hauled from the mine site by licensed waste disposal services for disposal off site.

The Proposed Action is anticipated to be a “small-quantity generator” as defined under RCRA because Agrium would generate less than 100 kilograms of hazardous waste per month. The term “hazardous wastes” designates materials defined in 40 CFR Part 261.3 and regulated under RCRA. Hazardous wastes are regulated from the point of generation to the point of disposal. Trucks would transport small quantities of hazardous and solid wastes infrequently.

Under the Proposed Action, the materials to be used are listed in **Table 2.3-4**. Hazardous materials and wastes would be stored in the new fuel storage area and shop (**Figure 2.3-2**). Hazardous materials would continue to be used, and wastes generated at rates similar to those at the existing Rasmussen Ridge Mines.

The primary transportation route from Soda Springs to the new fuel storage area and shop would be via State Highway 34, Blackfoot River Road, and the existing haul road to the new West Side Haul Road to the mine site. Transportation of fuels, hazardous materials, and wastes associated with the Proposed Action would comply with federal regulations.

Management practices for hazardous materials and wastes would continue in the same manner as currently implemented at Rasmussen Ridge Mines. No spills in quantities higher than the regulatory reporting limits have occurred during operation of the Rasmussen Ridge Mines (Guedes 2015).

Fuels and other liquid petroleum products, solvents, antifreeze, and most of the hazardous materials to be used for the Proposed Action would be stored in multiple aboveground tanks to reduce the risk of spillage and meet containment requirements. Barriers would be installed under and around fuel tanks that meet applicable requirements for secondary containment of petroleum products. Fuel would be dispensed at the new fuel storage area directly or by fuel trucks that comply with appropriate local, state, and federal regulations.

Inadvertent spills and releases of fuels and hazardous materials or wastes may occur. Agrium would implement an SPCC Plan to meet the requirements of Title 40 CFR 112. The SPCC Plan would provide management direction for preventing and controlling potential spills; inventory the aboveground tanks and secondary containment structures for bulk petroleum products, solvents, and antifreeze; identify the routine monitoring requirements; and describe the BMPs for the pollutants of concern. Pollutants of concern are defined as any fuels, chemicals, or other materials with the potential to be released from the site via storm water runoff from the vehicle maintenance shop.

Compliance with the SPCC Plan and applicable government regulations would reduce the risk of a large-scale release of hazardous materials or wastes. With implementation of timely spill response procedures, an accidental spill of hazardous materials or wastes associated with the Proposed Action is unlikely to pose environmental or public health and safety risks. With continued implementation of the management practices for hazardous materials and wastes as currently implemented at Rasmussen Ridge Mines, impacts of the Proposed Action associated with hazardous materials and wastes are anticipated to be short-term and negligible.

4.15.1.2 Rasmussen Collaborative Alternative

Under the RCA, the hazardous materials to be used would be the same as those for the Proposed Action (**Table 2.3-4**). Hazardous materials would be used and wastes generated at the same rates as those for the Proposed Action. Management practices for hazardous materials and wastes would continue in the same manner as currently implemented at Rasmussen Ridge Mines.

Unlike the Proposed Action, the RCA eliminates the need for new fuel facilities. Under the RCA, the haul road would route mine traffic past the existing fuel facilities at the Rasmussen Ridge Mines; therefore, the storage area for fuels and hazardous materials would be the existing shop and maintenance facilities at the Rasmussen Ridge Mines (**Figure 2.5-3**).

The transport route for hazardous materials and wastes would be the same route that is currently used at the Rasmussen Ridge Mines. The primary transportation route from Soda Springs to the shop at the existing Rasmussen Ridge Mines would be via State Highway 34, Blackfoot River Road, and the existing haul road to the mine site.

The total fuel storage capacity at the Rasmussen Ridge Mines shop facility is approximately 40,000 gallons. Fuel is stored in multiple aboveground tanks to reduce the risk of spillage and meet containment requirements. Barriers under and around fuel tanks meet applicable requirements for secondary containment of petroleum products. Fuels and other liquid petroleum products, solvents, antifreeze, and most of the hazardous materials to be used for the RCA would be stored in aboveground tanks in the existing shop area at the Rasmussen Ridge Mines. Fuel would be distributed from this site directly to equipment or through the use of fuel trucks that comply with relevant federal and state regulations.

Compliance with the SPCC Plan and applicable government regulations would reduce the risk of a large-scale release of hazardous materials or wastes. Relative to the Proposed Action, the use

of the existing fuel storage area and shop at the Rasmussen Ridge Mines would limit potential spills to previously disturbed areas. Impacts associated with hazardous materials and wastes would be similar to those described for the Proposed Action. With continued implementation of the management practices for hazardous materials and wastes used currently implemented at Rasmussen Ridge Mines, impacts associated with hazardous materials and wastes are anticipated to be short-term and negligible.

4.15.1.3 No Action Alternative

Under the No Action Alternative, the facilities would not be constructed or operated; therefore, no additional hazardous materials would be used in the assessment area, and no additional solid or hazardous wastes would be generated. In the short term, hazardous materials would continue to be used and wastes generated by the Rasmussen Ridge Mines at rates similar to current conditions; however, the use of hazardous materials and wastes generated would ultimately decline as mining is completed at the Rasmussen Ridge Mines. There would be no project-related impacts associated with hazardous materials or wastes.

4.15.2 Irreversible and Irretrievable Commitment of Resources

Implementation of any of the action alternatives would result in irreversible or irretrievable commitment of the fuels and hazardous materials consumed by the project.

4.15.3 Unavoidable Residual Adverse Effects

None of the action alternatives would have unavoidable residual adverse effects related to hazardous materials or wastes.

4.15.4 Mitigation Measures

No specific mitigation measures are proposed to address hazardous materials and wastes, as the handling and storage of those materials are already controlled by a body of laws and regulations.

4.16 PUBLIC HEALTH AND SAFETY

Issue: Would the project result in potentially adverse effects to public health and safety?

Indicators:

- Changes in levels of dust, selenium, or other COPCs in transport media (air, water, fish, wildlife) and in natural resources that exceed appropriate local, state, and federal standards for public health and safety

4.16.1 Direct and Indirect Impacts

This section describes the potential impacts to public health and safety under implementation of the Proposed Action or the RCA. Under either of these alternatives, Agrium would comply with existing and appropriate local, state, and federal regulatory requirements to minimize impacts to the environment or public human health and safety. Mining activities would comply with appropriate air quality, surface water, and groundwater quality standards.

4.16.1.1 Proposed Action

The active mining areas would be restricted from public access for security and safety reasons. Agrium personnel would visually survey the mine areas for livestock daily. Livestock would be immediately removed from any areas of risk.

The mining activities described under the Proposed Action have the potential to impact surface waters by introducing pollutants, such as sediment, selenium, and other COPCs, via storm water runoff and spills and by surface runoff contacting exposed overburden. Agrium would design and implement BMPs to control erosion, sediment, and to minimize the potential for a release of COPCs to protect surface waters in and around the Proposed Action, and to prevent exceedances of water quality standards.

As described in **Section 4.3**, groundwater quality impacts by selenium and other COPCs are a concern at phosphate mines in southeast Idaho. Agrium would protect groundwater resources by managing all material during the Proposed Action and by implementation of BMPs designed to control infiltration and percolation of precipitation into backfill and overburden.

There could be adverse effects to public health and safety if selenium is released to the environment during mining operations and subsequently bioaccumulates in the food chain to affect fish, livestock, or wildlife consumed by the public. The impact to vegetation associated with selenium bioaccumulation would be localized to the reclaimed areas. All reclamation would be required to meet the vegetation COPC concentrations in the PFO ARMP. At reclamation, any Meade Peak-containing material from haul roads, berms, or water management structures would be placed as backfill within the mine. Water management structures would be cleaned of any materials potentially containing selenium or other COPCs before the originally excavated materials are used to fill the structures. Under implementation of the Proposed Action, inadvertent spills and releases of fuels and hazardous materials or wastes may occur. The most probable spills would be fuel, hydraulic oil, and coolant from mobile equipment. Numerous local, state, and federal laws regulate the storage, use, recycling, disposal, and transportation of hazardous materials, wastes, and fuels. An SPCC Plan would be developed prior to construction and operations, providing direction for preventing and controlling potential spills and describing BMPs for the releases of COPCs. In the event of an inadvertent spill or release of hazardous materials or wastes, standard response and cleanup practices would be implemented, but there could be some short-term effects on water quality and some aquatic species if spilled materials reached nearby streams. The potential for such spills to occur would be limited to mine and haul road areas, and the potential for stream impact would be limited. These impacts are considered to be negligible to minor, site-specific, and short-term. An accidental spill of hazardous materials or wastes is unlikely to pose public health and safety risks.

Implementation of BMPs at the Proposed Action consistent with those currently used at Rasmussen Ridge Mines would reduce the risk of a large-scale release of hazardous materials or wastes and minimize the potential for exposure of the public to COPCs. No adverse effects to public health and safety are anticipated to occur from implementation of the Proposed Action. The impacts of the Proposed Action to public health would be short-term and negligible.

4.16.1.2 Rasmussen Collaborative Alternative

Under the RCA, potential impacts to public health and safety would be similar to those described for the Proposed Action; however, the RCA would incorporate a store-and-release cover system that would reduce percolation of precipitation through backfill and overburden areas thus reducing the release of COPCs to groundwater. The elimination of permanent external overburden piles

downslope from the mine would virtually eliminate the potential for release of selenium or other COPCs to surface water under the RCA. Under the RCA, the potential for bioaccumulation of selenium or other COPCs in the aquatic food chain would be minimized.

Implementation of BMPs at the RCA consistent with those currently implemented at Rasmussen Ridge Mines would reduce the risk of a large-scale release of hazardous materials or wastes and minimize the potential for exposure of the public to COPCs. No adverse effects to public health and safety are anticipated to occur from implementation of the RCA. The impacts of the RCA to public health would be short-term and negligible.

4.16.1.3 No Action Alternative

Under the No Action Alternative, the facilities would not be constructed or operated; therefore, there would be no project-related impacts to public health and safety. However, this does not preclude future development of the federal phosphate leases under a different mine plan. In the short term, mining activities would continue at Rasmussen Ridge Mines similar to current conditions.

4.16.2 Irreversible and Irretrievable Commitment of Resources

Implementation of BMPs at the Rasmussen Valley Mine consistent with those currently implemented at Rasmussen Ridge Mines would minimize the potential for exposure of the public to COPCs. No irreversible or irretrievable long-term effects to public health and safety are anticipated to occur as a result from implementation of the Proposed Action or the RCA.

4.16.3 Unavoidable Residual Adverse Effects

Implementation of BMPs at the Rasmussen Valley Mine consistent with those currently implemented at the Rasmussen Ridge Mines would minimize the potential for exposure of the public to COPCs. No residual adverse impacts to public health and safety would result from implementation of the Proposed Action or the RCA.

4.16.4 Mitigation Measures

Project design features and BMPs of the Proposed Action are designed to reduce impacts to public health and safety from dust, selenium, or other COPCs in transport media. Compliance with the existing body of laws and regulations would minimize potential impacts to public health and safety; therefore, no specific mitigation measures are proposed.

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