Smoky Canyon Mine
Panels F & G Final EIS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 4
Environmental Consequences

4.0 Environmental Consequences

This chapter discusses anticipated direct and indirect impacts of the Proposed Action, alternate mining and transportation alternatives, and the No Action Alternative. This chapter also describes the Irreversible and Irretrievable Commitment of Resources, and the Residual Impacts from the Proposed Action and Alternatives.

Impacts are described in terms of context (site-specific, local, or regional effects), duration (short- or long-term), and intensity (negligible, minor, moderate, or major). The thresholds of change for the intensity of an impact are defined as follows.

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

To reiterate the discussion in **Section 2.1**, in order to provide the Agencies with flexibility in selecting actions out of the many alternatives, the alternatives are analyzed individually in this chapter. Some of the mining alternatives are broken down into their components, which are also analyzed separately in this chapter. This allows approval of various mining actions (such as mining one panel and not the other) along with any combination of the multiple transportation alternatives. The alternative components are organized in two general groups: mining alternatives and transportation alternatives. The Agency Preferred Alternative, identified in **Section 2.10.2**, is a combination of alternative components and the combined environmental effects of those components are discussed in **Section 2.10.2**.

The environmental impacts of the Agency Preferred Alternative are evaluated in this section of the EIS and are disclosed within the discussion of the separate mining alternative components and transportation alternatives that were identified by the Agencies to comprise the Agency Preferred Alternative. These are identified as being part of the Agency Preferred Alternative within the subheadings that follow. **Table 4.0-1** includes a summary the combined environmental impacts of the Agency Preferred Alternative and references to the sections within this chapter where the impacts are evaluated.

The environmental impacts of each mining component, mining alternative, or transportation alternative are presented in two ways in the following sections of this chapter. First, the actual impact of each mining component or alternative, when compared to the baseline condition is presented. In most cases, this is the same as the comparison of the impact with the No Action Alternative. This information is typically displayed in tables within the following sections. Additionally, the impacts are compared with the Proposed Action to provide the reader with an analysis of how the component or alternative would differ from the action proposed by Simplot.

TABLE 4.0-1 AGENCY PREFERRED ALTERNATIVE IMPACTS

	MINING	TRANSPORTATION	TOTAL	SECTION
Disturbed Acres	1,165	284	1,449	4.1
Acres not Reclaimed	46	25	71	4.1
Total Tons Air Emissions	8,613	2,711	11,324	4.2
DBA Noise at Crow Creek	50 – 52	None	50 – 52	4.2
% Crow Ck. HUC 5 Disturbed	1.3	0.3	1.6	4.3
Springs Impacted	20	2	22	4.3
TPY Sediment	Negligible	9.0	9.0	4.3
Culverts in Perennial Streams	0	2	2	4.3
Culverts in Intermittent Channels	0	6	6	4.3
Comply w/ SW or GW Standards?	YES	YES	YES	4.3
Acres Forest Disturbed	1,072	262	1,334	4.5
Feet Waters of the US Disturbed	12,470	770	13,240	4.6
Acres of Wetlands Disturbed	1.39	1.43	2.82	4.6
Feet Intermittent Channel Disturbed	19,520	680	22,200	4.8
Feet Perennial Stream Disturbed	0	475	475	4.8
Acres AIZs Disturbed	51.1	15.6	66.7	4.8
Acres Wolf & Lynx Habitat Disturbed	1,165	284	1,449	4.7
Acres Raptors and Owl Habitat Disturbed	1,072	262	1,334	4.7
Acres Sagebrush Habitat Disturbed	73	9	82	4.5
Acres Riparian Habitat Disturbed	1.3	1.5	2.8	4.5
Acres Western Toad Area Dist.	388	120	508	4.7
Acres Grazing Allotments Disturbed	1,165	284	1,449	4.9
Number Forest Trails Disturbed	3/0	6/2	8*/2	4.10
Acres On/Off Lease in SCRA	830 / 194	7 / 83	837 / 277	4.11
Acres On/Off Lease in MPRA	31 / 0	2 / 32	33 / 32	4.11
Number Cultural Sites Impacted	1	2	2*	4.13
Heritage Impacts	Minor – Mod.	Negligible	Neg. – Mod.	4.13

*Note: Both mining and roads disturb a common trail and a common cultural site.

4.1 Geology, Minerals, and Topography

Issue:

Scoping did not identify any issues related to geology, minerals or topography but impacts to these resources will still be evaluated in this section.

4.1.1 Direct and Indirect Impacts

The primary indicators for geology, minerals, and paleontology are the total bank cubic yards of ore and overburden mined. The primary indicators for topography are acres of original topography disturbed and lengths and heights of highwalls and road cuts remaining after reclamation is completed.

4.1.1.1 Proposed Action

Geology and Mineral Resources

Panel F, Including Lease Modifications (Component of Agency Preferred Alternative)

Under the Proposed Action, geology and mineral resources for Panel F would be directly affected by the removal of phosphate ore and overburden. This would be a long-term, major, local impact on these resources. All of the ore would be concentrated at the existing Smoky Canyon mill facilities before being transported by existing pipeline to Pocatello, Idaho for fertilizer production. The phosphate resources produced under the Proposed Action would be available to meet regional and national requirements for this commodity.

Operational practices have been developed to address pit wall and road cut stability. The Smoky Canyon Mine has over 20 years of experience with constructing stable cut and fill slopes. Reclamation of inactive overburden fills to stable slopes would be performed concurrently with mining. Pit backfilling would bury most of the excavated pit highwalls, eliminating the stability issue for these cuts. The remaining exposed highwalls are generally expected to remain in a stable condition, and localized instability of these cuts would be a minor problem.

Effects to paleontological resources could occur from the disturbance of the ore and overburden during the mining of Panels F and G and the construction of the haul/access roads. Rock units disturbed would be in the Dinwoody formation, various members of the Phosphoria formation, Wells formation, and alluvial or colluvial material. Invertebrate fossils in the geologic units that would be disturbed are not restricted only to the Smoky Canyon area and are likely to be found throughout the outcrop area of these formations in Southeastern Idaho. Any vertebrate fossils encountered would be managed as described in **Section 2.5**. This is expected to present a negligible impact.

Weathering of overburden shales could lead to increased mobility of certain COPCs that are contained in the overburden rock. As described in **Section 3.1**, Acid Base Accounting data for both Panels F and G were similar and indicated that overburden would not present a significant risk of Acid Rock Drainage. COPCs that are flushed from the overburden during weathering are available to be transported from the overburden by surface runoff water and/or infiltration. The environmental effects from this flushing of the overburden are described in **Section 4.3**.

Panel F Haul/Access Road (Component of Agency Preferred Alternative)

The Panel F haul/access road would encounter some phosphate ore in its southern end within the mine panel. This, plus the elevation of the road where it enters the proposed mine panel, would enable the removal of ore and overburden from the lower portions of Pit 1 in Panel F that would not be available if access to the pit were from a higher elevation. This would enable increased mineral resource recovery from Panel F.

As the volume of rock affected by road cuts along the haul road would be minimized by the design and are relatively insignificant compared to the volume of rock disturbed by the open pit mining, impacts to paleontological resources are considered to be negligible.

Panel G (Component of Agency Preferred Alternative)

Under the Proposed Action, geology and mineral resources for Panel G would be directly affected by the removal of phosphate ore and overburden. This ore removed from the federal phosphate lease would be made available for conversion to fertilizer products that meet the regional and national demands. This would be a long-term, major, local impact on these resources.

As in Panel F, with the environmental protection measures incorporated in the Proposed Action, the impact to paleontological resources from this mining is considered to be negligible.

Panel G West Haul Access Road (Component of Agency Preferred Alternative)

The Panel G West Haul/Access road would encounter very small amounts of phosphate ore during its construction. Accommodations for the value of this ore would be made between Simplot and the underlying lease holders where this ore is removed during road construction.

For the same reasons as the Panel F Haul/Access Road, impacts to paleontological resources from this haul/access are considered to be negligible.

Power Line Between Panels F and G

The Panel F to G power line construction would only disturb three acres of ground surface outside of the mine panel disturbance areas. This construction would have a negligible effect on ore and paleontological resources.

Topography

Existing topography would be affected under the Proposed Action by the removal of the ore and relocation of the overburden. **Figure 2.4-1** shows the proposed mine plan, including pits and overburden disposal facilities. **Table 2.4-5** identifies the acreage that would be disturbed and reclaimed as part of the Proposed Action. A total of 1,340 acres of existing topography would be modified by the disturbance required to mine Panels F and G, including the haul/access roads and topsoil stockpiles. Approximately 89 percent of the overburden would be placed as pit backfill in Panels F and G, reducing the topographic impacts of the open pits. Final reclamation topography for the Proposed Action is shown in **Figures 2.4-3** and **2.4-4**. Final reclaimed configurations for Panels F and G would mimic the pre-mining landforms and slope aspects.

Panel F, Including Lease Modifications (Component of Agency Preferred Alternative)

Developing the Panel F open pits and the external overburden fill would result in modifying 473 acres of existing topography (not including the roads and other categories in **Table 2.4-5**). A 29-acre open pit in Panel E, currently permitted to be left as a permanent open pit disturbance, would also be backfilled with Panel F overburden to a configuration that would blend with the surrounding reclamation contours (**Figure 2.4-3**).

Panel F would be backfilled to slopes ranging from 8h:1v to 2.5h:1v that blend with adjacent natural terrain except for a 38-acre portion of Pit 4 that would be left as an open pit (**Figure 2.4-4**). This open pit would contain a footwall sloping west at about 2.3h:1v and two exposed highwalls up to 250 feet high and up to 2,600 feet long. The remaining highwalls would have overall slopes of approximately 49 degrees. Impacts to topography from Panel F are considered to be major for the mining period and moderate where reclamation would blend with adjacent terrain. The remaining open Pit 4 would be a permanent, major impact on local topography. The backfilling and recontouring of the 29-acre Pit E-0 would be a major beneficial effect on the local topography.

Panel F Haul/Access Road (Component of Agency Preferred Alternative)

A typical cross section of the Proposed Action, haul/access roads is shown in **Figure 2.4-2**. Cut slopes would be up to 1h:1v, depending on the material type exposed in the slope. More resistant rock like sandstone and limestone would have steeper slopes than shale or alluvium. Fill slopes would be at the angle of repose for earth material, 1.5h:1v.

During reclamation activities, the road fills would be pulled up with excavation equipment and piled against the cut slopes to achieve approximate pre-mining topography. In areas with extremely steep natural slopes, the height of the cut slopes would be more than what can be fully backfilled, leaving exposed cuts above the reclaimed slopes in certain areas. There is no way to practically and safely reduce the remaining cuts, so they would be left unreclaimed. Impacts to topography would be moderate during operations and minor when reclamation results in slopes that blend with adjacent natural terrain. Remaining road cuts would be a moderate, permanent impact to topography.

The total topographic disturbance along the Panel F Haul/Access Road is 66.5 acres, of which approximately 4 acres would not be reclaimed (**Figure 2.4-4**). The maximum road corridor width of about 750 feet would occur near the end of the road where it would split into two levels as it entered the north end of Panel F.

Panel G (Component of Agency Preferred Alternative)

Developing the Panel G open pit and the external overburden fills would result in modifying 466 acres of existing topography. These Panel G disturbances would be reclaimed to slopes of 3h:1v that blend with adjacent natural terrain except for a 8-acre highwall 2,600 feet long and up to 250 feet high along the west margin of the Panel G pit (**Figure 2.4-4**). The remaining highwall would have an overall slope of approximately 49 degrees. Impacts to topography from the Panel G are considered to be major for the mining period and moderate when reclamation would blend most of the regraded area with the adjacent terrain.

Panel G West Haul/Access Road (Component of Agency Preferred Alternative)

The total topographic disturbance along the Panel G West Haul/Access Road is 217 acres. The portion of the road corridor that would be built through the South Fork Deer Creek canyon would have road cuts up to 230 feet high and a disturbed corridor width of up to 350 feet. The balance of the road would have much lower road cuts and corridor widths from about 200 to 350 feet. Reclamation of this road would be affected by its conversion to a future Forest Service (FS) road, which would replace the existing FS road in South Fork Deer Creek Canyon (FR 146) and from the west mouth of this canyon to the summit between Deer Creek and Diamond Creek (FR 1102) (**Figure 2.4-4**). The existing FS road in these areas would be abandoned and reclaimed. The amount of the haul/access road that would not be reclaimed would be approximately 21 acres, much of which is due to the conversion of about 4 miles of the road to FS public access. Assuming the existing FS road corridor that would be abandoned and reclaimed is approximately 12 feet wide; approximately 5.8 acres of this existing disturbance would be reclaimed. Impacts to topography from the Panel G West Haul/Access Road would be moderate during operations and minor when reclamation is completed. Remaining road cuts would be a moderate, permanent impact to topography.

Power Line Between Panels F and G

The Panel F to G power line construction would only disturb three acres of ground surface outside of the mine panel disturbance areas. This construction would have a negligible effect on topographic resources.

4.1.1.2 Mining Alternatives

Alternative A incorporates a reduction in the area available to be mined. Alternatives B through F involve mitigation measures designed to decrease the overall environmental impacts of the mining Project. They were formulated, based on public and agency concerns, to either decrease the area of disturbance of the Project or to decrease the exposure of seleniferous material to the natural post-mining leaching-release processes. Alternatives B through F all involve extra implementation costs to the proponent. In most cases, these costs are significant. Typically, mine pit design – size and shape – is a function of the recovered value of a unit of ore versus the cost to mine that unit of ore. In the case of a dipping, strataform orebody such as a phosphate deposit, the depth of a pit is determined by the amount of overburden a company can economically remove. The removal of overburden is a cost. As phosphate is mined deeper, the cost to mine a unit of ore increases incrementally.

If the Agencies choose an alternative to the Proposed Action that increases costs to mine, it is likely that Simplot would mine a shallower, smaller pit to compensate for the increase in costs. They would remove less overburden, to decrease the cost, and thus remove less ore. This action by Simplot would result in less ore recovery. An economic analysis for this EIS by the Agencies and their contractor has estimated the potential reduction in recovery of ore for each mining alternative. Those potential reductions in recovery will be discussed here as they pertain to geologic impacts and will be discussed again in the Socioeconomic section (**Section 4.16**). The actual amounts of ore that would be mined in the Proposed Action and the mining alternatives are confidential business information, so only the comparisons between the amounts of ore that would be mined as part of each mining alternative are discussed in the following paragraphs.

The amount that pit size would be decreased is uncertain. For this reason, for resources other than Geology and Socio-economics, the maximum pit sizes will be used in the impact analysis.

Alternative A – No South and/or North Panel F Lease Modifications

No Panel F South Lease Modification

Not mining the South Lease Modification would reduce the ore recovery for the entire Proposed Action by about 10.7 percent and would reduce the individual Panel F ore recovery by 22 percent. The reduction in ore recovery that could result from disallowing the South Lease Modification could shorten the mine life of Panel F by about 1.8 years. Thus, mining in Panel G would need to be moved up from its original schedule. After completion of mining and reclamation of the remaining portion of Panel F, it is unlikely that the tons of phosphate ore not mined from the lease modification area would be economically recovered in the future. At the end of the mine life and reclamation there would be no local mining infrastructure remaining. The unleased phosphate ore within the South Lease Modification would be too small to capitalize a stand-alone, future mining operation. It would result in a loss to the public of the resource in the lease modification area.

Potential impacts to paleontological resources would be slightly less for this portion of Alternative A than the Proposed Action because of the smaller volume of rock being mined. The net impacts would still be negligible.

Alternative A would result in a total Panel F pit and overburden fill disturbance area of about 333 acres, approximately 140 acres less than the Panel F pit and overburden fill disturbance in the Proposed Action (**Figure 2.6-1**). The final backfilled topography for this alternative is shown in

Figure 2.6-2. Final contours would generally mimic pre-mining landforms and slope aspects with final slopes that blend with adjacent terrain.

If the South Lease Modification were not approved, there would be no disturbance to the Deer Creek topographic drainage area from Panel F under this alternative, which would eliminate the 138-acre expansion of Pit 3 extending approximately 3,000 feet southwest down the slope into the Deer Creek drainage area that is included in the Proposed Action, South Lease Modification.

All portions of the Panel F footwall would be backfilled under this alternative. The remaining 9-acre highwall would be approximately 2,400 feet long and up to 300 feet high and would be located approximately 1,900 feet north of the remaining Proposed Action highwall. The unreclaimed Panel F pit disturbance under this alternative would be reduced from 38 acres in the Proposed Action to 9 acres under this alternative, a reduction of 29 acres. Impacts to topography from Panel F under this alternative are considered to be major for the mining period and moderate when reclamation would blend most of the regraded area with adjacent terrain.

The topographic impacts from Panel F Haul/Access Road would be the same in this alternative as the Proposed Action.

The topographic impacts from Panel G and the Panel G West Haul/Access Road would be the same in this alternative as for the Proposed Action.

<u>No Panel F North Lease Modification</u>

Not mining the North Lease Modification would result in leaving approximately 0.1 percent of the mineral resource for the entire Proposed Action in place and 0.2 percent of the mineral resource for Panel F itself. After completion of mining and reclamation of the remaining portion of Panel F, it is unlikely that the tons of phosphate ore left in the lease modification would be economically recovered in the future.

The reduction in ore recovery that could result from disallowing the North Lease Modification could shorten the mine life of Panel F by about 0.5 years. Thus, mining in Panel G would need to be moved up slightly from its original schedule.

Potential impacts to paleontological resources would be slightly less for this portion of Alternative A than the Proposed Action because of the smaller volume of rock being mined. The net impacts would still be negligible.

If the North Lease Modification were not approved, the topographic disturbance from the north end of Panel F would be approximately 2 acres less and not extend as far down the south slope of South Fork Sage Creek Canyon as the Proposed Action. Impacts to topography from Panel F under this alternative are considered to be major for the mining period and moderate when reclamation would blend most of the regraded area with adjacent terrain.

The topographic impacts from Panel G and the Panel G West Haul/Access Road would be the same in this alternative as the Proposed Action.

Alternative B – No External Seleniferous Overburden Fills

This alternative would incorporate all the components of the Proposed Action but would require Simplot to replace all seleniferous shale and mudstone overburden as backfill into the mine pits. There would be no seleniferous overburden permanently left in the Panel F External

Overburden Fill (38 acres) and the Panel G East External Overburden Fill (64 acres). Overburden would be selectively handled and placed as needed in the external fills during mining, but the seleniferous overburden, 4.7 MM BCY, would be rehandled at the end of mining and placed back in the pits. This would reduce the potential area of seleniferous overburden fills (pits and external) from 819 to 725 acres.

If this alternative were selected, the cost for mining the panels would be increased by the double handling of a large amount of overburden. Because mine costs would be greater than in the Proposed Action, Simplot could potentially decide to redesign the mine pits to reduce stripping ratios and decrease mining costs to offset the additional cost. This would reduce the size of the open pits and have the effect of reducing the amount of phosphate ore extracted from the mining operations, shortening the life of the mine. Simplot may also need to begin mining operations at another location in Southeastern Idaho earlier than planned, with a higher disturbance area to replace the reserves lost under this alternative. The detailed mine planning for the redesigned mine pits at Panels F and G, as well as the design for the potential new mine at another location, is beyond the scope of this EIS. The reduction in ore recovery that could result from this alternative is estimated to be 19.3 percent of the total mining reserves in the Proposed Action mine plans for both panels, which could shorten the overall mine life by about 3.2 years.

The potential impact on paleontological resources would be negligible.

The initial total disturbed area of native topography would remain the same for this alternative as the Proposed Action because all the external overburden fill areas would still be required for temporary storage of seleniferous overburden. The Panel F surface disturbance footprint would stay the same as the Proposed Action under this alternative. The final Panel G reclamation configuration would be different than the Proposed Action (**Figure 2.6-3**). The east external overburden fill would be reduced in height during reclamation, and the 11-acre extension of the reclaimed overburden fill east of the lease boundary would be eliminated.

The top and bottom of the Panel G pit backfill would receive more overburden, which would eliminate the remaining highwall along the west side of the pit area compared to the Proposed Action. Impacts to topography from the mining under this alternative are considered to be major for the mining period and moderate when reclamation would blend most of the regraded areas with adjacent terrain.

Alternative C – No External Overburden Fills at All

This alternative would incorporate all the components of the Proposed Action but would require Simplot to replace all overburden as backfill in the mine pits with no remaining external overburden fills following reclamation. Some overburden would be placed in the external fills during mining, but all 10 MM LCY of this would have to be rehandled at the end of mining and placed back in the pit areas. This would reduce the total area of seleniferous overburden from 819 to 763 acres.

The concern described in Alternative B for loss of phosphate mining reserves at Panels F and G, shortening the mine life, and opening up another phosphate mine sooner than planned would be exacerbated with this alternative. The reduction in ore recovery that could result from this alternative is estimated to be 46 percent of the total mining reserves in the Proposed Action mine plans for both panels, which could shorten the overall mine life by about 7.7 years.

Panel G would be affected more than Panel F in this regard. The reduction in ore reserves for Panel G would be approximately 75 percent under this alternative. Such a drastic reduction in reserves and mine life for that panel could potentially prevent it from being mined.

The potential impact on paleontological resources would be negligible.

The initial total disturbed area of native topography would remain the same for this alternative as the Proposed Action and Alternative B because all the external overburden fill areas would still be required for temporary storage of seleniferous overburden. The final topography and remaining open pit and associated highwalls in Panel F would be different under this alternative compared to the Proposed Action or Alternative B (**Figure 2.6-4**). The area that contained the 38-acre external overburden fill in the northern portion of Panel F would be restored to approximate original configuration during final reclamation. The portion of Pit 4 with its associated highwalls that would be left unreclaimed under the Proposed Action and Alternative B would be completely backfilled under this alternative. The final Panel G reclamation configuration would also be different than the Proposed Action or Alternative B. The east and south external overburden fills would be eliminated during reclamation, and the top and bottom of the pit backfill would receive more overburden than under Alternative B. Like in Alternative B, there would be no remaining highwall in Panel G after reclamation. Impacts to topography under this alternative are considered to be major for the mining period and minor when reclamation would blend most of the regraded areas with adjacent terrain.

Alternative D – Store and Release Covers on Overburden Fills (Component of Agency Preferred Alternative)

This alternative would involve mining Dinwoody formation to provide construction material for a store and release cover that would be constructed over all areas of seleniferous overburden in pit backfills and external overburden fills.

The concern described in Alternatives A, B, and C for loss of phosphate mining reserves at Panels F and G, shortening the mine life, and opening up another phosphate mine sooner than planned would also be relevant to this alternative. If this alternative were selected by the Agencies, Simplot might decide to redesign the mine pits to reduce overburden stripping ratios and decrease mining costs to offset the additional cost of constructing a store and release cover over all seleniferous overburden fills. This would reduce the size of the open pits and have the effect of reducing the amount of phosphate ore extracted from the mining operations, shortening the life of the mine. Decreasing the size of the pits would also reduce the area requiring the store and release cover. The detailed mine planning for the redesigned mine pits at Panels F and G, as well as the design for the new mine at another location, is beyond the scope of this EIS. The reduction in ore recovery that could result from this alternative is estimated to be 18 percent of the total mining reserves in the Proposed Action mine plans for both panels, which could shorten the overall mine life by about 2.9 years.

The potential impact on paleontological resources would be negligible.

The initial total area of disturbed topography under this alternative for Panel F could be as much as 104 acres more than the Proposed Action, if adequate Dinwoody shale resources were not available within the pit overburden, which is currently thought to be unlikely. The disturbance area for Panel G would be as much as 33 acres more than the Proposed Action for the same reason. All disturbances related to obtaining the Dinwoody material would be reclaimed. Impacts to topography from the mine panels under this alternative are considered to be major for the mining period and moderate when reclamation would blend most of the regraded area with adjacent terrain.

Alternative E – Power Line Connection from Panel F to Panel G Along Haul/Access Road (Component of Agency Preferred Alternative)
This alternative would have the same impact as the Proposed Action haul/access roads on the geology, minerals, paleontology, or topography of the Project Area.

Alternative F – Electrical Generators at Panel G
The concern described in Alternatives A, B, C and D for loss of phosphate mining reserves at Panels F and G, shortening the mine life, and opening up another phosphate mine sooner than planned would also be relevant to this alternative. This is because although the capital cost of the generators is similar to a power line, the operating costs are much higher. If this alternative were selected by the Agencies, Simplot might decide to redesign the mine pits to reduce overburden stripping ratios and decrease mining costs to offset the additional cost of operating the generators. This would reduce the size of the open pits and have the effect of reducing the amount of phosphate ore extracted from the mining operations and shortening the life of the mine. The detailed mine planning for the redesigned mine pits at Panels F and G, as well as the design for the new mine at another location, is beyond the scope of this EIS. The reduction in ore recovery that could result from this alternative is estimated to be 38 percent of the total mining reserves in the Proposed Action mine plans for both panels, which could shorten the overall mine life by about 6.5 years.

The generators would produce more used lubricating oil and coolant, which would be added to the mine's waste disposal activities. The impacts to geology, topography, and paleontology from this alternative would be the same as the Proposed Action.

4.1.1.3 Transportation Alternatives

The various transportation alternatives would have negligible impacts on mineral resources and little incremental effect on the geology or paleontological resources of the Project Area because they would disturb relatively small volumes of earth material compared to the volumes of mined material (**Figure 2.6-8a**).

Each of the transportation alternatives would have their own effects on topography due to cuts and fills imposed on the natural terrain along each road corridor. A typical cross section of these access haul roads is shown in **Figure 2.4-2**. Cut slopes would be up to 1h:1v, depending on the material type exposed in the slope. More resistant rock, like sandstone and limestone, could have steeper slopes than soil or shale. Fill slopes would be at the angle of repose for earth material, approximately 1.5h:1v.

The disturbance corridors for the various Proposed Action and alternative roads would have different initial disturbance widths, fill heights, and cut heights. The maximum values for these dimensions are summarized in **Table 4.1-1**.

TABLE 4.1-1 TRANSPORTATION ALTERNATIVES APPROXIMATE CROSS SECTION DIMENSIONS

#	ALTERNATIVE	MAX CORRIDOR WIDTH (FT)	MAX FILL HEIGHT (FT)	MAX CUT HEIGHT (FT)
	Proposed Action Panel F Haul/Access Road	750	130	130
	Proposed Action Panel G Haul/Access Road	350	150	230
1	Alternate Panel F Haul/Access Road	300	80	200
2	East Haul/Access Road	600	220	140
3	Modified East Haul/Access Road	600	220	250
4	Middle Haul/Access Road	550	200	370
5	Alternate Panel G West Haul/Access Road	350	150	260
6	Conveyor from Panel G to Mill	300	130	50
7	Crow Creek/Wells Canyon Access Road	200	45	60
8	Middle Access Road	450	160	130

During reclamation activities, the road fills would be pulled up with excavation equipment and piled against the cut slopes to achieve approximate pre-mining topography. In areas with extremely steep natural slopes, the height of the cut slopes would be more than can be fully backfilled, leaving exposed cuts above the reclaimed slopes in certain areas. In some areas of steep natural slopes, the lengths of the fill slopes would preclude reaching the bottoms of the slopes to pull the material up. The remaining toes of the fill slopes would be seeded but not regraded and topsoiled before seeding. These haul/access road cut and fill slopes that would not be regraded are delineated on **Figure 2.6-8b**. The height of the cut slopes that would remain after reclamation would range from about 20 to slightly over 200 feet high. The relative acres of the different haul/access road alternatives are shown in **Table 4.1-2**. Impacts to topography from the alternative transportation corridors would be moderate during operations and minor when reclamation results in slopes that blend with adjacent natural terrain. Remaining road cuts would be a moderate, permanent impact to topography.

TABLE 4.1-2 TRANSPORTATION ALTERNATIVES INITIAL AND FINAL TOPOGRAPHIC DISTURBANCE AREAS

#	ALTERNATIVE	TOTAL DISTURBANCE (ACRES)	AREA NOT REGRADED (ACRES)
	Proposed Action Panel F Haul/Access Road	67	4
	Proposed Action Panel G Haul/Access Road	217	21
1	Alternate Panel F Haul/Access Road	46	5
2	East Haul/Access Road	216	7
3	Modified East Haul/Access Road	276	21
4	Middle Haul/Access Road	192	34
5	Alternate Panel G West Haul/Access Road	226	28
6	Conveyor from Panel G to Mill	61	0
7	Crow Creek/Wells Canyon Access Road	114	55
8	Middle Access Road	99	0

The following narrative utilizes and discusses the values presented in the two preceding tables.

Alternative 1 – Alternate Panel F Haul/Access Road
The Alternate Panel F Haul/Access Road would disturb approximately 21 acres less than the Proposed Action Panel F Haul/Access Road. Its maximum disturbance corridor width would be less than the Proposed Action road, and the location of this disturbance would be further from South Fork Sage Creek than the Proposed Action. The maximum height of the remaining road cuts for this alternative would be less than the Proposed Action (**Figure 2.6.8b**).

Replacing the Proposed Action Panel F Haul/Access Road with Alternative 1 would result in leaving approximately 3 percent of the mineral resource for the entire Proposed Action in place and 6 percent of the mineral resource for Panel F itself. After completion of mining and reclamation of the remaining portion of Panel F, it is unlikely that the tons of phosphate ore left in the lease modification would be economically recovered in the future.

The reduction in ore recovery that could result from adoption of Alternative 1 could shorten the mine life of Panel F by about 0.5 years. Thus, mining in Panel G would need to be moved up from its original schedule.

Alternative 2 – East Haul/Access Road
The East Haul/Access Road would initially disturb approximately the same acreage as the Proposed Action Panel G West Haul/Access Road, but the maximum cut heights would be less than the Proposed Action Panel G West Haul/Access Road, which would result in a lower percentage of unreclaimed area compared to the Proposed Action. There would be one road fill along the East Haul/Access Road in the upper Quakie Hollow drainage that would have a bottom width of 600 feet, while the majority of the road disturbance would be 200 to 300 feet wide for this alternative.

Alternative 3 – Modified East Haul/Access Road
The Modified East Haul/Access Road essentially follows the same corridor as the East Haul/Access Road except for about three miles where the modified road would be built further up Deer Creek Canyon. It would disturb 59 acres more than the Proposed Action Panel G West Haul/Access Road. This section in Deer Creek Canyon would have road fills up to 170 feet wide and would incorporate about 1.6 miles of road cuts in rock with maximum initial cut heights of 250 feet, which would triple the unreclaimed acreage compared to the East Haul/Access Road.

Alternative 4 – Middle Haul/Access Road
The Middle Haul/Access Road would be built through steep, mountainous terrain resulting in a maximum corridor disturbance of about 550 feet and extensive reaches of corridor widths of 300 feet or more. It would disturb 25 fewer acres than the Proposed Action Panel G West Haul/Access Road. The road cuts in the Deer Creek Canyon area would be up to 370 feet high. Almost all the road cuts in the main stem of Deer Creek drainage would be reclaimed with some exposed cut showing. Approximately 1.2 miles of road length in the North Fork Deer Creek drainage would be reclaimed with exposed road cuts showing.

Alternative 5 – Alternate Panel G West Haul/Access Road
The Alternate Panel G West Haul/Access Road would follow the same alignment as the Proposed Action Panel G West Haul/Access Road until a point south of Sage Meadows where the road would veer south about 0.4 mile to connect with the same alignment as the Middle Haul/Access Road. It would disturb 9 more acres than the Proposed Action Panel G West Haul/Access Road. The 0.4 mile connection portion of the road would have ¼ mile of road cuts that would not be reclaimed. The rest of this road alignment would have the same topographic

effects as the Proposed Action Panel G West Haul/Access Road west and south from the connection road to Panel G. It would have the same topographic effects as the Middle Haul/Access Road from the connection road east and north to Panel F.

Alternative 6 – Conveyor from Panel G to Mill
The combined conveyor and maintenance road would be about 50 feet wide throughout the conveyor corridor length. It would disturb 156 fewer acres than the Proposed Action Panel G West Haul/Access Road. The operating characteristics of the conveyor allow it to conform closely to the native topography with minimal cuts and fills except where crossing some ephemeral drainages where most fills would be less than 200 feet wide, and there would be one 300-foot wide fill immediately northeast of Panel G. There would be no unreclaimed acreage for this alternative and no exposed cuts following reclamation.

Alternative 7 – Crow Creek/Wells Canyon Access Road
The Crow Creek Road would be rebuilt to a travel width of 30 feet, which would require building some new road cuts and fill slopes. Most of these road fills and cuts would be less than 20 feet high with one short road cut 60 feet high. All of these slopes would be reseeded upon completion of the road construction. The maximum road corridor disturbance width for this alternative would be approximately 200 feet located in the Wells Canyon section. Maximum cut and fill heights along the Wells Canyon access road would be approximately 60 feet. Again, all road cuts and fills would be reseeded upon completion of construction of this road. Both the Crow Creek and new Wells Canyon roads would remain following cessation of mining operations in Panel G. The existing Wells Canyon road is built close to or within the Wells Canyon stream channel, and this road would be abandoned and reclaimed, and the new Wells Canyon Road would be reclaimed back to a 20-24 foot width. Assuming an average road corridor width of about 12 feet for the existing 2-mile long Wells Canyon Road to be abandoned, the total acreage of existing disturbance that would be reclaimed is about 3 acres.

Alternative 8 – Middle Access Road
The Middle Access Road would follow the same alignment as the Middle Haul/Access Road for most of its length, and building this road would face the same topographic challenges. The maximum road corridor disturbance width would be about 450 feet where the road would cross Deer Creek. The maximum road fill height (160 feet) for this road would also occur at this stream crossing. The maximum road cut for this road would be about 130 feet, which would occur in the upper North Fork Deer Creek drainage. The smaller road width would allow all road cuts and fills to ultimately be reclaimed.

4.1.1.4 No Action Alternative

Under the No Action Alternative, Simplot would not be allowed to proceed with mining of ore in Panels F and G until mining and reclamation plans acceptable to the BLM and USFS were developed and approved. Under the No Action Alternative, there would be no direct impacts to geologic, mineral, and topographic resources of the Project Area, because the phosphate ore and overburden that were proposed for removal would not be mined. This ore would be available for mining in the future.

The No Action Alternative would not result in any alteration to topography or paleontological resources at Panels F and G until a mining and reclamation plan is approved. It would result in the 29-acre open pit in Panel E being left open, which is currently approved as part of the Panel E mine plan.

4.1.2 Mitigation Measures

Project design features, BMPs, and the proposed Reclamation Plan are elements of the Proposed Action designed to reduce environmental impacts to topography. Additional mitigation measures are not deemed necessary.

4.1.3 Unavoidable (Residual) Adverse Impacts

Unreclaimed pit highwalls and road cuts and reclaimed overburden fills would present localized, permanent modifications of topography.

4.1.4 Relationship of Short-term Uses and Long-term Productivity

The local short-term use of the mineral resources and topography for phosphate mining would result in ongoing employment and other economic benefits to the local and regional economies affected by the Smoky Canyon Mine and the Don Plant in Pocatello. It would also provide fertilizer for the agricultural areas supplied by the Don Plant. Backfilling the mine pits with overburden would decrease the potential for future open pit production of the remaining, local phosphate mineral resource, but this is also limited by the lease boundaries.

4.1.5 Irreversible and Irretrievable Commitment of Resources

Phosphate ore would be removed from the Smoky Canyon ore reserves, and this would be an irreversible and irretrievable commitment of mineral resources. This would be a relatively minor loss compared to total phosphate reserves available for future use in Southeastern Idaho.

Impacts to the local natural topographic conditions under the Proposed Action and the Alternatives would be irreversible and irretrievable. Reclamation activities would restore disturbed sites to topographic contours that mimic pre-mining conditions and permanently reduce the impacts to local topography. Disturbed areas that are not regraded during reclamation would have permanent impacts to topography.

Any loss of paleontological resources that occurred under the Proposed Action or mining alternatives would be negligible and would be considered irreversible and irretrievable. Any paleontological resources discovered and properly documented by the Agencies during mining would not be lost.

4.2 Air Resources and Noise

Issue (air):
The Project emissions may cause air quality effects that are different from existing operations due to relocation of mining emissions and from increased traffic on haul roads and possibly offsite access roads.

Indicators (air):
Quantities of exhaust and dust emissions generated from haul trucks and other mining equipment that may impact the air quality in this area;

Change in air quality from Project emissions at Class I Areas in the vicinity of the operations with emphasis on compliance with National Ambient Air Quality Standards (NAAQS).

Issue (noise):
Noise from mine operations, mine traffic on haul roads, and traffic on access roads may affect Project Area residents.

Indicators (noise):
Estimated noise levels from mining operations; haul truck traffic related to mining, and access road traffic.

4.2.1 Air Resources – Direct and Indirect Impacts

Air emissions from the Proposed Action and alternatives are regulated by the Idaho Department of Environmental Quality (IDEQ) and U.S. EPA regulations. Smoky Canyon mine operates under an IDEQ permit issued July 6, 1983 (State of Idaho 1983). This permit addresses the mill boiler, fugitive dust control measures, haul truck speed limits, blasting and drilling dust suppression, and other air pollution control requirements.

All Federal Class I Areas are greater than 70 miles from the Proposed Action and all Action Alternatives. Therefore, the air quality impacts to these Class I Areas do not require evaluation for regional haze, visibility and air impacts and will not be evaluated further in this section.

The majority of emissions are from fugitive (dust) and mobile equipment (tailpipe) sources. Emissions from these types of operations are controlled by fugitive dust control plans and, for vehicles, manufacturer's emission standards. Fugitive dust emission standards are based on the State Implementation Plan (SIP), adherence to IDAPA 01.01.650, and are regulated based on opacity standards.

Processing the ore at the mill produces very little particulate matter. The ore usually has moisture content greater than 15 percent and enters the wet process through a below-grade grizzly. The mill operates at an annual rate of 2.7 million tons per year. Annual emissions from the mill would remain essentially constant for the Proposed Action and alternatives, except for the No Action Alternative, where the life of the mill is potentially reduced.

Mining emissions from the ore/overburden extraction and handling would peak under the Proposed Action when both panels would be undergoing active mining.

4.2.1.1 Proposed Action

The air emissions from in-pit and transportation activities are assessed in this section. In-pit activities include drilling, excavation, loading, blasting, and grading. Transportation and dumping of overburden within the pit and external overburden fills are also included in fugitive emissions. The transportation emission assessment included emissions from tailpipes and fugitive dust along the haul/access roads and conveyor. These emission estimates were calculated assuming Simplot's adherence to the State of Idaho's IDAPA 58.01.01.651 and 799.02 for fugitive dust controls. The majority of emissions from these operations are in the form of particulate matter (PM). Emission estimates for particulate matter less than 10 microns in size (PM-10) are reported because this subset of PM is a criteria pollutant. Pollutants from the combustion of fossil fuel from mobile equipment, vehicles, and generators were also estimated. A measurable amount of criteria pollutants, such as nitrogen oxides (NOx), sulfur dioxide (SO_2), carbon monoxide (CO), and volatile organic compounds (VOCs) would be emitted during operations. The estimates of controlled emissions (including application of BMPs and state-required emission controls) presented in the following sections were prepared with standard emission factors (EPA 2003c and USAF 2004).

Metal and other potential pollutants (i.e., selenium) that make up a small percentage of the dust generated from mining operations were reviewed to determine effects from the addition of contaminants to the environment and potential health effects (JBR 2006b; see **Section 6.3.1**). Calculations using local COPC concentrations in ore and overburden. It was determined that the addition of selenium to surface runoff, to the soil profile, and to vegetation would be negligible to minor for Panel G and even less for Panel F. Given local selenium and mercury concentrations, resultant dust would be 3.5% of the 0.2 mg/m^3 health standard for selenium and 0.017% of the allowable ACGIH TLV for mercury (0.025 mg/M^3). These effects are considered insignificant.

The air emissions would occur only during active operations and would be completely dispersed or deposited at the conclusion of operations. A large percentage of the fugitive particulate emissions generated from mining and transportation activities would settle out quickly near their point of generation. The intensity of the air emission impacts would be minor (see page 4-1 for definition) at the site-specific perspective and negligible at the local and regional perspective. This general description of the context and intensity of air emission impacts would be applicable to the Proposed Action and all Action Alternatives.

Panel F, Including Lease Modifications (Component of Agency Preferred Alternative)
Table 4.2-1 shows the air emissions estimates for Panels F and G of the Proposed Action. These emissions are totals for the entire duration of the Proposed Action. Tailpipe emissions from mining equipment operating in the pit boundaries and emissions from blasting are considered fugitive.

TABLE 4.2-1 TOTAL PROPOSED ACTION AIR EMISSIONS (TONS)

POLLUTANT	PANEL F	PANEL F HAUL/ACCESS	PANEL G	PANEL G WEST HAUL/ACCESS	TOTAL (TONS)
PM-10	969	314	1,626	467	3,376
NOx	1,631	418	1,814	491	4,354
SO_2	152	38	169	45	404
CO	809	392	948	449	2,598
VOC	144	45	160	52	401
Total	3,705	1,207	4,717	1,504	11,133

These estimates of air emissions are comparable to those estimated for the current mining operations at Smoky Canyon Mine in the Final SEIS (FSEIS) for Panels B and C (BLM and USFS 2002). The EPA-approved Industrial Source Complex Short Term, Version 3 (ISCST3) model was used in 2002 to determine the ambient air impacts from mining activities at Smoky Canyon Mine. These mining activities would be relocated further south in the Proposed Action and Alternatives. Thus, the local ambient air impacts and associated effects to air quality would be approximately the same as for the existing Smoky Canyon mining operations, only relocated further south.

Air quality impact modeling conducted for the Smoky Canyon Mine Panels B and C FSEIS indicated that particulate matter effects at 5-mile radius receptors from the operations were approximately 6 percent of the NAAQS at those locations. With the annual emission estimates being similar in annual quantity for PM, it is unlikely that the NAAQS thresholds would be approached. The same modeling indicated that Class I PSD increments were not exceeded for the annual and 24-hour averaging periods at the nearest Class I Area (Bridger Wilderness Area). Due to the proximity of the Proposed Action operations to the existing Smoky Canyon Mine operations that were evaluated in the FSEIS and the similarity in emission rates between the two, the modeling results for the FSEIS are considered applicable to the proposed Panels F and G mining operations.

<u>Panel F Haul/Access Road (Component of Agency Preferred Alternative)</u>
The Panel F Haul/Access Road emissions include emissions from the combustion of fuel from vehicles and mining equipment on the haul/access road. The dust generated from the roadways as a result of mining traffic on the haul/access road is also estimated in mobile emissions. The emissions shown in **Table 4.2-1** are for the entire duration of the Proposed Action and are based on the average distances from the middle of the active pit to the end of the new haul road. Overburden hauled to Panel E is included in these mobile emissions.

<u>Panel G (Component of Agency Preferred Alternative)</u>
Panel G mining air emissions were estimated in the same manner as for Panel F. The results of these estimates are shown in **Table 4.2-1**.

<u>Panel G West Haul/Access Road (Component of Agency Preferred Alternative)</u>
Panel G West Haul/Access Road emissions were estimated in the same manner as for the Panel F Haul/Access Road. Total emissions for the Proposed Action Panel G West Haul/ Access Road are shown in **Table 4.2-1**.

<u>Power Line Between Panels F and G</u>
Air emissions from construction of the power line would consist of vehicle exhaust emissions from operation of line-bed trucks to drill the power pole holes and erect the pole structures. Small amounts of dust might be caused during drilling of the power pole holes. Helicopter engine exhaust would be produced during construction of the power line in Deer Creek Canyon. All these emissions are considered to be negligible, localized, and short-term.

4.2.1.2 Mining Alternatives

Mining Alternative A - No South and/or North Panel F Lease Modifications
Recoverable phosphate ore would be reduced by 13.7 percent, and the active disturbance area would be reduced by 140 acres for open pits and potentially another 21 acres if the Alternative Panel F Haul/Access Road were selected. These decreases affect total emissions for transfers, hauling, disturbance areas, and mobile equipment. The life of mine is estimated to be 2.3 years shorter with this alternative. Alternative A's total emission estimates from mining and implementation of the Alternative Panel F Haul/Access Road would be 8.4 percent or 931 tons less than the Proposed Action. Associated with the reduced transportation and equipment operation duration, there would be proportional reductions in combustion emissions. This alternative would result in slightly lower air pollutant concentrations compared to the Proposed Action. **Table 4.2-2** shows the estimated emissions from Panels F and G and associated transportation components under Alternative A.

TABLE 4.2-2 ALTERNATIVE A AIR EMISSIONS (TONS)

POLLUTANT	PANEL F	ALT. PANEL F HAUL/ACCESS	PANEL G	PANEL G WEST HAUL/ACCESS	TOTAL (TONS)
PM-10	725	242	1,626	467	3,060
NOx	1,369	332	1,814	491	4,006
SO_2	128	30	169	45	372
CO	679	319	948	449	2,395
VOC	121	36	160	52	369

<u>No Panel F North Lease Modification</u>
The reduction in total emissions from not mining the North Lease Modification would be 9.4 tons.

<u>No Panel F South Lease Modification</u>
The reduction in total emissions from not mining the South Lease Modification would be 922 tons.

Mining Alternative B - No External Seleniferous Overburden Fills
Alternative B would have an increase in particulate emissions due to the double handling of 4.7 MM LCY of overburden and a 6.5-month increase in reclamation time. Total emissions would increase by 1.1 percent or 124 tons over the Proposed Action during the life of mine. This would produce a negligible increase in air pollutant concentrations compared to the Proposed Action. Mobile combustion emissions increase less than a percent, collectively. **Table 4.2-3** shows the estimated emissions from both panels and associated haul/access roads under Alternative B.

TABLE 4.2-3 ALTERNATIVE B AIR EMISSIONS (TONS)

POLLUTANT	PANEL F	PANEL F HAUL/ACCESS	PANEL G	PANEL G WEST HAUL/ACCESS	TOTAL (TONS)
PM-10	980	355	1,647	479	3,461
NOx	1,634	445	1,812	491	4,382
SO_2	152	41	169	45	407
CO	810	406	948	440	2,604
VOC	145	47	159	52	403

Mining Alternative C – No External Overburden Fills at All
Alternative C would involve double handling of 10.1 MM BCY of overburden, while maintaining the same area of disturbance. Reclamation activities would extend an additional 12.5-months. Loading, unloading, and transportation of the overburden would increase the amount of PM-10 and tailpipe emissions. Total emissions would increase by 2.5 percent or 273 tons over the Proposed Action. This would produce a slight increase in air pollutant concentrations compared to the Proposed Action. **Table 4.2-4** shows the estimated emissions for both panels and associated transportation components under Alternative C.

TABLE 4.2-4 ALTERNATIVE C AIR EMISSIONS (TONS)

POLLUTANT	PANEL F	PANEL F HAUL/ACCESS	PANEL G	PANEL G WEST HAUL/ACCESS	TOTAL (TONS)
PM-10	994	389	1,661	503	3,547
NOx	1,638	471	1,819	491	4,419
SO_2	153	43	170	45	411
CO	812	418	950	440	2,620
VOC	146	50	161	52	409

Mining Alternative D – Store and Release Covers on Overburden Fills

The significant change in Alternative D would be the mining and hauling of the Dinwoody shale to be used for the store and release covers. The extension of the disturbance area of Panel F and Panel G, plus the excavation, hauling, and unloading of the shale would increase fugitive and tailpipe emissions for this alternative. Total emissions would increase by 1.7 percent or 191 tons over the Proposed Action for the life of the mine. This would produce a negligible increase in air pollutant concentrations compared to the Proposed Action. **Table 4.2-5** shows the estimated emissions for both panels, all the Dinwoody borrow pits, and associated haul/access roads under Alternative D.

TABLE 4.2-5 ALTERNATIVE D AIR EMISSIONS (TONS)

POLLUTANT	PANEL F	PANEL F HAUL/ACCESS	PANEL G	PANEL G WEST HAUL/ACCESS	TOTAL (TONS)
PM-10	994	345	1,716	478	3,531
NOx	1,635	418	1,814	520	4,382
SO_2	152	38	169	48	407
CO	811	392	949	469	2,601
VOC	145	45	160	55	403

Mining Alternative E- Power Line Connection from Panel F to Panel G Along Haul/Access Road (Component of Agency Preferred Alternative)

The air emissions from building the power line along the haul/access roads would result from drilling the power pole holes along the existing haul road. The change in emissions from the Proposed Action would be negligible.

Mining Alternative F- Electrical Generators at Panel G

Electrical generators located at Panel G would be considered stationary sources of air emissions and would initiate a permit modification to the existing Smoky Canyon Mine Air Quality Permit. The stationary exhaust emission from these generators would be a significant increase over the current stationary air emissions from the Smoky Canyon Mine, and a Title V air emissions permit issued by the State of Idaho would be required. Emissions were estimated based on one generator operating full time for the life of Panel G mining operations. The annual NOx estimate for a single generator is 119 tons. Major source threshold levels are set at 100 tons per year; PSD permitting has a threshold of 250 tons per year. All stationary sources co-located at the facility are considered when determining major source threshold values. A reduction in active disturbance was accounted for because the 25kV power line between Panel F and Panel G would not be necessary with this alternative. **Table 4.2-6** shows the estimated emissions from Panels F and G, including the generator operation at Panel G. The total emissions would change from just fugitive and mobile to a mixture of stationary, fugitive, and mobile sources. The total emissions for this alternative would increase by 12.2 percent or 1,364 tons over the Proposed Action. The additional annual, stationary emissions for the generator operations would be: 21 tons of PM-10; 955 tons of NOx; 175 tons of SO_2; 254 tons of CO; and 25 tons of VOCs. This would produce an increase in air pollutant concentrations compared to the Proposed Action.

TABLE 4.2-6 ALTERNATIVE F AIR EMISSIONS (TONS)

POLLUTANT	PANEL F	PANEL F HAUL/ACCESS	PANEL G	PANEL G WEST HAUL/ACCESS	TOTAL (TONS)
PM-10	968	263	1,647	452	3,330
NOx	1,631	418	2,769	491	5,309
SO_2	152	38	344	45	579
CO	809	393	1,202	449	2,853
VOC	144	45	185	52	426

4.2.1.3 Transportation Alternatives

Emissions estimates for transportation of ore for the Proposed Action include the combined fugitive and tailpipe emissions for both the Panel F Haul/Access Road and the Panel G West Haul/Access Road (**Table 4.2-7**). Emission estimates for the transportation alternatives also include transportation-related emissions from both mine panels (**Table 4.2-8**). Length of travel (fugitive dust and tailpipe emissions) and area of disturbance (fugitive dust) were the main factors used to estimate the effects from these alternatives. Emissions from in-pit activities are not included in these estimates. Direct comparisons can be made between the transportation alternatives in **Table 4.2-8** and the Proposed Action haul/access roads in **Table 4.2-7**. The alternatives shown in **Table 4.2-8** include emissions from the appropriate Proposed Action haul road, i.e. Alternative 1 emissions also include the Panel G West Haul/Access Road emissions. Alternatives 2 – 6 also include the emissions from the Panel F Haul/Access Road.

TABLE 4.2-7 PROPOSED ACTION AIR EMISSIONS-ROADS (TONS)

POLLUTANT	PANEL F HAUL/ACCESS	PANEL G WEST HAUL/ACCESS	TOTAL (TONS)
PM-10	314	467	781
NOx	418	491	909
SO_2	38	45	83
CO	392	449	841
VOC	45	52	97
Total			2,711

Alternative 1 – Alternate Panel F Haul/Access Road

The Alternate Panel F Haul/Access Road would have a slight decrease (0.3 miles) in distance traveled, 21 acres less disturbance, and 1.2 MM tons less of recoverable ore (North Lease Modification). These decreases would result in a 9.1 percent (247 ton) decrease in emissions compared to the Proposed Action Panel F Haul/Access Road. This would produce a minor decrease in air pollutant concentrations compared to the Proposed Action.

TABLE 4.2-8 TRANSPORTATION ALTERNATIVE EMISSIONS (TONS)

POLLUTANT	ALT.1	ALT.2	ALT.3	ALT.4	ALT.5	ALT.6	ALT.7 (ACCESS ROAD)	ALT.8 (ACCESS ROAD)
PM-10	710	765	807	723	790	452	24	9
NOx	823	901	918	885	911	565	7	3
SO_2	75	82	84	81	83	52	0.3	0.1
CO	768	823	863	782	847	584	274	106
VOC	88	96	99	94	98	62	9	4
Total	2,464	2,667	2,771	2,565	2,729	1,716	315	123

Note: Emissions from either Alternative 7 or 8 should be added to those from Alternative 6.

Alternative 2 – East Haul/Access Road

The East Haul/Access Road would be less in distance (0.4 miles) than the Panel G West Haul/Access Road. Total disturbance outside the pit area is estimated to be 216 acres compared to 217 acres for the Proposed Action Panel G West Haul/Access Road. The small decrease in active disturbance and decrease in travel distance would result in a 1.6 percent (44 tons) decrease in emissions compared to the Proposed Action (see **Table 4.2-8**). This would produce a negligible decrease in air pollutant concentrations compared to the Proposed Action. Because this road is closer to Crow Creek than the other transportation alternatives, air emission effects to the Crow Creek area would be greater than for the Proposed Action and other transportation alternatives.

Alternative 3 – Modified East Haul/Access Road

The Modified East Haul/Access Road would result in a 0.6-mile increase in road length compared to Proposed Action West Haul/Access Road. An increase in disturbance area of approximately 60 acres would also increase the amount of airborne PM-10. An increase of 2.2 percent (60 tons) in total emissions over the Proposed Action is estimated (see **Table 4.2-8**). Fugitive dust impacts from the Modified East Haul/Access Road to residents along Crow Creek Road would be similar to Alternative 2. Combustion emissions would increase by less than 1 percent. This alternative would result in approximately the same air pollutant concentrations as the Proposed Action.

Alternative 4 – Middle Haul/Access Road

The Middle Haul/Access Road would be 6.4 miles long compared to 7.8 miles for the Proposed Action Panel G West Haul/Access Road. The total acres disturbed are estimated to be 192 compared to 217 for the Panel G West Haul/Access Road. This alternative would have 5.4 percent (146 tons) less air emissions compared to the Proposed Action. This would produce a minor decrease in air pollutant concentrations compared to the Proposed Action.

Alternative 5 – Alternate Panel G West Haul/Access Road

Alternative 5 would have a slight increase in total haul distance (0.2 miles) and 9 acres more active disturbance over the Proposed Action Panel G West Haul/Access Road. The increase in total emissions over the Proposed Action for this alternative is negligible (18 tons). This would produce a negligible increase in air pollutant concentrations compared to the Proposed Action.

Alternative 6 – Conveyor from Panel G to Mill

A reduction in air pollutants for moving ore from Panel G to the mill would occur if a conveyor system were used to transport G Panel ore to the mill. Haul road traffic from Panel G to the mill would be eliminated; however, particulate emissions from the conveyor operations would occur, as would haul truck emissions for the Panel F ore haulage. The operation of a conveyor could warrant having a crusher at Panel G to process the ore prior to loading it onto the conveyor. To conservatively estimate the emissions, the conveyor was assumed to have four-drop points. The emission factor used is applicable for a controlled (water sprays or enclosures) transfer point and crusher for high moisture ore. An air permit modification would be likely for transportation Alternative 6. Depending on the combination with either Alternative 7 or 8, there would be either a 25 percent (680 tons) or 32 percent (872 tons) respectively reduction of total ore transportation-related emissions using this alternative. This would produce a moderate decrease in air pollutant concentrations compared to the Proposed Action.

Alternative 7 – Crow Creek/Wells Canyon Access Road

This alternative would include upgrading the Crow Creek and Wells Canyon roads, which would be used for access to the Panel G mining operations. Traffic on this road under this alternative would consist of an average of 105 light vehicle and 15-vendor truck round trips per day. This traffic operating on the gravel-surfaced roads would contribute to the local air emissions for the access road traffic only as listed in **Table 4.2-8**. Total emissions for this access road would be 315 tons.

The location of this access road would result in the greatest air emission effects to houses and inhabitants along Crow Creek compared to any of the other transportation or mining alternatives. Fugitive dust and combustion emissions would be similar to a light-use secondary highway. When combined with the total air emissions from the conveyor alternative (Alternative 6), total Project transportation emissions including this alternative would be 2,031 tons, approximately 25 percent (680 tons) less than the Proposed Action Transportation emissions (**Table 4.2-7**).

Alternative 8 – Middle Access Road

Alternative 8 would reduce the travel distance for access to Panel G from 15.1 miles for the Crow Creek/Wells Canyon roads to 5.9 miles, and total road acres disturbed from 114 to 99 acres. This would result in a reduction of access road emissions compared to Alternative 7 (**Table 4.2-8**). When combined with the total air emissions from the conveyor alternative (Alternative 6), total Project transportation emissions including this alternative would be 1,839 tons, approximately 32 percent (872 tons) less than the Proposed Action Transportation emissions (**Table 4.2-7**).

4.2.1.4 No Action Alternative

If the No Action Alternative were selected, the air emissions from the Proposed Action would not occur, and the existing air emissions at the Smoky Canyon Mine would continue until the mine shut down and reclamation activities ceased. Simplot would possibly open other phosphate mining operations elsewhere in Southeast Idaho, shifting the long-term air emissions to that location.

4.2.2 Noise – Direct and Indirect Impacts

Sound travels out uniformly from sources unless it is blocked by a solid surface or until it is attenuated (decreased) by passage through geometric divergence, atmospheric absorption, or ground and vegetation absorption between the source and receptor.

To determine whether or not noise from an activity is causing undesirable impact at a receptor location, the existing background sound levels at the receptor to the sound level at the receptor due to the activity must be compared. If the sound levels of the noise at the receptor are similar to the background sound level, the noise does not affect the receptor. If the noise exceeds the background sound level, the degree of impact depends on the amount of the exceedance. Sound quality also affects the impact on receptors. For this evaluation all sound is referred to as "noise", although it is recognized that noise from wind is usually considered an acceptable noise, while the same noise level from a haul truck engine may be unwanted noise.

The typical person generally cannot detect a sound level increase of 1 dBA. Although noise differences of 2 to 3 dBA can be detected with instruments, they are difficult for people to discern in an active outdoor environment. Most people, under normal listening conditions, can perceive an increase in noise of 5 dBA.

Because sound level measurements (decibels) are logarithmic values, they cannot be combined using normal addition. For example, adding two 50 dBA sources results in a combined sound level of 53 dBA not 100 dBA.

EPA has identified outdoor limits of 55 dBA Leq as desirable to protect against interference with speech or disturbance of sleep in residential areas. Outdoor sites are generally acceptable to people if they are exposed to noise levels of 65 dBA Leq or less, potentially unacceptable if they are exposed to sound levels of 65-75 dBA Leq, and unacceptable if exposed to sound levels of 75 dBA or greater (EPA 1981).

Neither Caribou County, Idaho nor Lincoln County, Wyoming have direct regulations or ordinances in regard to noise from this Project.

Sound pressure levels at different distances from stationary sources of noise decrease approximately by 6 dBA for every doubling of distance from the source. The accuracy of this estimation approach depends on intervening vegetation, topography, atmospheric conditions, and noise barriers. For line sources, such as roads, sound pressure levels decrease by 3 dBA per doubling of the perpendicular distance from the road (King County 2003).

To predict noise levels associated with the proposed mining activities, noise level measurements were made at the existing Smoky Canyon Mine and at the potential human receptor areas along the Crow Creek Valley. These measurements are described in **Section 3.2.3**. In addition to these sources, noise measurements were made of a 72-inch conveyor belt traveling 900 feet per minute that is comparable to the proposed conveyor belt for Alternative 6. The noise levels attributed to the potential sources for the Proposed Action and Alternatives are shown in **Table 4.2-9**.

TABLE 4.2-9 MEASURED SOUND LEVELS FOR APPLICABLE NOISE SOURCES

SOURCE	LEQ* (DBA)	LMAX (DBA)	DESCRIPTION
Access Road Traffic	47.4	66.6	120 feet from edge of road
Open Pit Mining	81.7	85.9	130 feet from drill
Haul Truck Traffic	70.4	87.5	120 feet from haul truck
Blasting	NA	74.4	3,200 feet from blast
Conveyor	70.0	71.1	40 feet from conveyor

*15-minute timeframe

Mining operations would occur 24 hours per day, 7 days per week. Hauling ore from the mine panels to the mill would occur on the same schedule as mining. Blasting would occur only during daylight, typically every 2 to 3 days. However, blasting could occur any day of the week except Sundays and typically around noon or early afternoon.

Shift changes for the current mine crew, mill crew, and admin/engineering staff occur at different times during the day. Shift change for the mine crew occurs at 5:30 AM and 3:30 PM, 7 days per week. Hours for the admin/engineering staff are approximately 7 AM to 4 PM, Monday through Friday. Each of these shift changes would be accompanied by personal vehicle traffic along the access roads to the mining operations. Vendor and visitor vehicles can arrive at the operations at any time but mostly during daylight hours Monday through Friday. These access traffic schedules would apply to the Proposed Action and Alternatives.

The noise impacts at specific locations along Crow Creek from the Proposed Action and Alternatives were estimated in general accordance with procedures of the International Organization for Standardization (ISO) Standard 9613-2. Noise impacts on residences in Crow Creek Valley were determined for specific locations that were closest to the noise sources.

4.2.2.1 Proposed Action

Panel F, Including Lease Modifications (Component of Agency Preferred Alternative)
The closest approach of the east border of the Panel F pit to the Crow Creek Road is 1.9 miles. Intervening ridges screen all of the Panel F mining area from straight-line mining noise exposure to current residences along Crow Creek. In addition, most of the mining operations would be conducted within a below-grade open pit that itself would provide topographic screening between the mining activities and Crow Creek Valley. Consequently, mining equipment noise from Panel F to residents along Crow Creek would typically be negligible. If mining noise did carry from the mine to the Crow Creek area during initial mine development when topographic screening of noise would be the least, or due to isolated gaps in topographic screening or other reasons, the effects of distance, geometric diversion, and atmospheric/ground absorption would reduce this noise to an estimated 52.4 dBA outdoors at the Osprey Ranch compared to a baseline condition of approximately 36 to 39 dBA. Vegetation or foliage attenuation was not taken into consideration in this estimate and would be expected to further reduce this value. This noise exposure would be a localized, short-term, minor to moderate (see page 4-1 for definitions) increase in noise to residences along Crow Creek. This noise level is less than EPA's recommendation of 55 dBA as desirable to protect against interference with outdoor activities or disturbance of sleep in residential areas. Once the mine pit was deep enough such that all mining activity was occurring below original grade, noise exposure from mining equipment noise to Crow Creek residents would consistently be negligible.

Episodic blasting noise from the Panel F area at the Osprey Ranch house is estimated to be 52.1 dBA.

Panel F, Haul/Access Road (Component of Agency Preferred Alternative)
The closest approach of the Panel F Haul/Access Road to the Crow Creek Road is 1.4 miles. There is an intervening topographic ridgeline between the Crow Creek Valley and Sage Valley, but there is a potential straight-line exposure between the canyon mouth for Sage Creek and the eastern limit of the haul/access road that could allow noise from this section of the proposed road to enter the Crow Creek Valley. A small intervening hill immediately southeast of the haul/access road may help to attenuate traffic noise from the road.

The maximum estimated noise from the proposed road operations to the residence northeast of the mouth of Sage Creek Valley is 52.4 dBA compared to a baseline condition of approximately 36 to 39 dBA. This considers natural attenuation from divergence and absorbance factors, but excludes foliage attenuation. A factor for noise screening due to the road berm (5 feet) was included in the calculation. Noise impacts from Panel F Haul/Access Road traffic on residents along Crow Creek would be negligible to minor, local, and short-term.

Panel G (Component of Agency Preferred Alternative)
The closest approach of the east border of the Panel G mining area to the Crow Creek Road is 1.3 miles. Intervening ridges screen all of the Panel G mining area from straight-line mining noise exposure to current residences along Crow Creek. In addition, most of the mining operations would be conducted within a below-grade open pit that would itself provide topographic screening between the mining activities and Crow Creek Valley. At the early stages of mining when activities are occurring at the top of the hill, there could be straight-line noise exposure to persons along Crow Creek Road. The maximum estimated noise level from the Panel G mining activity at the mouth of Nate Canyon is 50.2 dBA compared to a baseline condition of approximately 36 to 39 dBA. While this is predicted to be an increase of over 14 dBA from existing conditions, the EPA (Noise Abatement and Control, 1981) describes 50 dBA as "quiet suburban or rural community, not located near industrial activity". Geometric divergence, atmospheric and ground absorption, a 20-foot high screen (ridge topography), and noise reflection were taken into account in this calculation. Vegetation or foliage attenuation was not included and would be expected to reduce the noise impact.

Episodic noise from blasting from the Panel G area at the mouth of Nate Canyon is estimated to be no more than 51.6 dBA and would be less once the mining operations are fully contained with the depth of the pit. Noise impacts from mining operations in Panel G on residents along Crow Creek would be negligible to minor, local, and short-term.

Panel G West Haul/Access Road (Component of Agency Preferred Alternative)
The closest approach of the Proposed Action Panel G West Haul/Access Road to the Crow Creek Road is 2.3 miles. Intervening ridgelines and mountains separate the entire haul/access road from residents along Crow Creek. There would be no noticeable increase in existing sound levels (35.7 dBA) along the Crow Creek road from traffic noise along this haul/access road.

Power Line between Panel F and Panel G
During construction, power poles in Deer Creek Canyon would be set with helicopter assistance. This would occur over a period of a few days during the overall power line construction period and only during daylight hours. This helicopter noise would be noticeable at residences along Crow Creek, and its sound level would depend greatly on flight patterns used by the helicopter and the wind direction during the few days a helicopter would be used for construction. This construction-related noise impact would be minor to moderate, local, and short-term.

4.2.2.2 Mining Alternatives

Mining Alternative A – No South and/or North Panel F Lease Modifications

No Panel F North Lease Modification

The North Lease Modification area is 2.3 miles from the closest portion of Crow Creek Road. The actual mining area in this north lease modification is well down within South Fork Sage Creek Canyon and is topographically screened from all current residences along Crow Creek. There should, therefore, be no noticeable change from the Proposed Action (52.4 dBA) in sound levels at residences along Crow Creek from a change in mining activities in the North Lease Modification area.

No Panel F South Lease Modification

The eastern edge of the actual mining area in the South Lease Modification is 1.9 miles from the closest portion of Crow Creek Road. Intervening ridges screen all of the Panel F mining area, including the portion of the mining in the South Lease Modification area, from straight-line mining noise exposure to current residences along Crow Creek. Under Alternative A there should be a negligible reduction in noise at the Osprey Ranch from Panel F mining equipment noise, compared to the Proposed Action (52.4 dBA). The duration of Panel F noise would be reduced by 2.3 years compared to the Proposed Action due to the shorter mine life.

Mining Alternative B – No External Seleniferous Overburden Fills

This alternative would not modify the mining configuration for Panel F, so the noise impacts from that panel on residences along Crow Creek would be the same as the Proposed Action (52.4 dBA). The east overburden fill for Panel G would be reduced in size under this alternative, but it is already screened from straight-line noise exposure to residences along Crow Creek Valley. The potential for noticeable decrease in sound levels at residences along Crow Creek from mining activities for Panel G under this alternative would be negligible.

Mining Alternative C – No External Overburden Fills At All

The noise effects on residences along Crow Creek from this alternative would essentially be the same as for the Proposed Action (52.4 dBA) for the same reasons described for Alternative B.

Mining Alternative D – Store and Release Covers on Overburden Fills (Component of Agency Preferred Alternative)

The construction of the store and release cover on the overburden fills as part of the overburden cover would not introduce any increased noise to the Panels F and G mines areas compared to the Proposed Action (52.4 dBA).

Mining Dinwoody Shale along the highwall of Panel F would be part of the overall mining plan for that panel, and the noise impacts would be the same as for the Proposed Action. For Panel G, the Dinwoody Shale would be obtained from the mine overburden or areas around the Panel G South Overburden Fill, so the noise effects from this mine panel on residents in Crow Creek would be the same as the Proposed Action.

Mining Alternative E – Power Line Connection from Panel F to Panel G Along Haul/Access Road (Component of Agency Preferred Alternative)

Under this alternative, power poles would be installed along the selected haul/access road with utility-type line trucks that are commonly used in residential areas. The noise from these trucks would be temporary and is much less intense compared to mining equipment operating along the haul/access roads. The noise effects of this construction to residences along Crow Creek

Valley are expected to be negligible. The noise from helicopter-assisted power line construction would be eliminated under this alternative.

Mining Alternative F – Electrical Generators at Panel G

Under this alternative, two 1,100-KW generators would provide the electric power at Panel G. One generator would be operating at all times with the other one on standby status. These generators would be diesel-powered and located at the Panel G hot starts area. Noise from these generators would be controlled with enclosures around the generators and motor exhaust mufflers. The location of the generators would be separated from all residences along Crow Creek by intervening topography. There would be no noticeable increase in sound levels at current residences along Crow Creek from generator noise at Panel G.

4.2.2.3 Transportation Alternatives

Noise generated by the transportation of ore, access traffic, and service vehicles would continue along the Proposed Action and/or alternative routes at various degrees of intensity, frequency, and power. The majority of overburden would stay in the pit areas or in nearby external overburden pits, thus not being hauled along the haul routes. Transportation noise evaluation takes into account geometrical divergence, atmospheric absorption, ground effect and screening. Attenuation due to indigenous foliage was not considered when predicting noise impacts and would be expected to reduce the noise impacts.

Alternative 1 – Alternate Panel F Haul/Access Road

The noise associated with this alternative would be essentially the same as for the Proposed Action Panel F Haul/Access Road. Noise effects to residences along Crow Creek would also be the same as for the Proposed Action Panel F Haul/Access Road.

Alternative 2 – East Haul/Access Road

The closest approach of this haul/access road to the Crow Creek Road is less than 0.1 mile. The portion of this road from about halfway down Nate Canyon to a point about 0.8 mile north of the Deer Creek crossing would have a straight line exposure to the Crow Creek Road with distances ranging from 0.1 to about 0.8 mile. The grade from the Deer Creek crossing to both the above-described points is uphill, so haul trucks would be pulling up these grades on their trips in and out of Panel G. The closest residences to this portion of the haul/access road are the Stewart Ranch, Osprey Ranch, and the Riede house. The Stewart Ranch residence is 2.2 miles from this reach of the haul road and is located behind a topographic ridge, shielding it from the greater part of haul road noise. The Riede house is located 0.4 mile from this portion of the haul/access road and has some straight-line exposure to the haul road in this area.

There is a topographic ridge between the Osprey Ranch and the haul road in Nate and Deer Creek Canyons so there is no straight-line noise exposure to the ranch from these sections of the proposed haul/access road. A 0.25-mile long portion of the haul/access road where it crosses upper Quakie Hollow has straight-line exposure to the Osprey Ranch house. The road at this point is 0.9 mile from the ranch house. Peak sound levels at these residences from haul truck traffic along the haul/access road are estimated to be 61.7 dBA for Riede's house and 57.9 dBA for Osprey Ranch. These would produce moderate to major noise impacts outdoors at these residences. These impacts would be short-term and would occur when haul trucks pass this stretch of the haul road. Noise levels impacting Crow Creek Road at the mouth of Deer Creek Canyon, the closest straight-line distance, are estimated to be 71.5 dBA.

Alternative 3 – Modified East Haul/Access Road

The Modified East Haul/Access Road follows the same general alignment as the East Haul/Access Road except in lower Deer Creek Canyon. The haul road there has a switchback from lower Nate Canyon leading up Deer Creek to a stream crossing that is 0.9 mile upstream of where the East Haul/Access Road would cross the stream. The modified haul road alignment then stays on the north slope of Deer Creek Canyon to where it meets the alignment for the East Haul/Access Road about 0.8 mile uphill of the Deer Creek crossing. The modified alignment would reduce the length of exposure of the road noise to the Riede house, compared to Alternative 2, but the sound pressure at the house for the modified road alignment would be approximately the same as for the East Haul/Access Road. Exposure of the Stewart Ranch and the Osprey Ranch house to the noise from the modified haul road alignment would be the same as for the East Haul/Access Road (Alternative 2).

Alternative 4 – Middle Haul/Access Road

The closest approach of the Middle Haul/Access Road to the Crow Creek Road is 2.2 miles. The entire haul/access road is topographically separated from current residences by intervening ridgelines and mountains. A portion of the haul/access road is directly aligned with lower Deer Creek Canyon, so there is the potential for haul traffic noise to be transmitted to the mouth of the canyon. The estimated maximum noise level from the Middle Haul/Access Road at the Crow Creek Road in front of the canyon mouth is 50.6 dBA. There would be no noticeable increase in sound levels at residences along the Crow Creek road from traffic noise along the haul/access road.

Alternative 5 – Alternate Panel G West Haul/Access Road

The closest approach of the Alternate Panel G West Haul/Access Road to the Crow Creek Road is 2.2 miles. Intervening ridgelines and mountains topographically separate the entire alternate haul/access road from current residences along Crow Creek. The estimated noise level at the Crow Creek Road from this alternative would essentially be the same as the Panel G West Haul/Access Road. There would be no noticeable increase in sound levels along the Crow Creek road from traffic noise along this haul/access road.

Alternative 6 – Conveyor from Panel G to Mill

The closest approach of the conveyor to the Crow Creek Road is 1.7 miles. Intervening ridgelines and mountains topographically separate the entire conveyor from all residences along Crow Creek. A portion of the conveyor is directly aligned with lower Deer Creek Canyon, so there is the potential for conveyor noise to be transmitted the 2.1-mile distance to the Crow Creek Road at the mouth of the canyon. The estimated noise level from the conveyor at the Crow Creek Road in this location is 40 dBA. There would be no noticeable noise effects at current residences along the Crow Creek Road from conveyor noise.

Alternative 7 – Crow Creek/Wells Canyon Access Road

Under this alternative, the conveyor would be built to move the ore from Panel G to the mill, and employee/vendor access to Panel G would occur via the upgraded Crow Creek and Wells Canyon roads. There are a number of residences along the Crow Creek Road. The distance between the edge of the road and these residences varies. The noise from traffic on this road to the residences would vary with the distance, topography, and intervening vegetation or other barriers to sound. Approximate road noise levels at different distances from the road have been estimated and are listed below in **Table 4.2-10**.

Based on the estimated sound levels shown in **Table 4.2-10**, the episodic road noise at the Riede house would be a maximum of approximately 70 dBA; at the Osprey Ranch it would be a maximum of approximately 42 dBA. Road noise at other houses along the Crow Creek Road would vary with their distance from the road and intervening noise attenuation conditions. These increases in noise would be most prevalent during shift changes. The noise impacts would be minor to moderate, local, and short-term.

TABLE 4.2-10 SOUND LEVELS FOR ACCESS ROAD

DISTANCE	LEQ (DBA)	LMAX (DBA)
60 ft from roadside	48.8	70.5
120 ft	47.4	66.6
200 ft	39.9	57.1
300 ft	Background	53.9
500 ft	Background	50.9

Alternative 8 – Middle Access Road

The closest approach of the Middle Access Road to the Crow Creek Road is 2.2 miles. The entire access road is topographically separated by intervening ridgelines and mountains from all residences along Crow Creek. A portion of the access road is directly aligned with lower Deer Creek Canyon, so there is the potential for access traffic noise to be transmitted to the Crow Creek Road at the mouth of the canyon. The estimated noise level from the access road at the Crow Creek Road is a negligible increase over baseline (36 to 39 dBA). There would be no noticeable increase in sound levels at current residences along the Crow Creek Road from traffic noise along the haul/access road.

4.2.2.4 No Action Alternative

Under the No Action Alternative, impacts from mining noise on the Project Area would not increase beyond current levels.

4.2.3 Mitigation Measures

<u>Air</u>

Under Mining Alternative F, IDEQ would require Simplot to use low-nitrogen oxide generators or ‘ignition timing retard” practices to reduce the NOx emissions.

Mitigation to be applied to Transportation Alternative 7 for dust abatement includes providing bus service for Panel G mine employees once per shift.

For all mining and transportation alternatives, dust would be controlled on roads and mining areas with applications of water and/or magnesium chloride.

<u>Noise</u>

For Mining Alternative F, Simplot would control noise from these generators with enclosures around the generators and motor exhaust mufflers.

For either Transportation Alternative 2 or 3 (East Haul/Access Road and Modified East/Haul Access Road), preserving forest vegetation noise buffers to the greatest extent possible would be implemented.

For Transportation Alternative 7 (Crow Creek/Wells Canyon Access Road), noise mitigation would include utilizing a bus service once per shift for Panel G mine employees.
For all mining alternatives, Simplot would not conduct blasting operations during typical sleeping hours.

4.2.4 Unavoidable (Residual) Adverse Impacts

Air

All the emissions estimates included in this analysis assumed typical control practices and BMPs would be employed. Dust emissions for Alternative 7 could potentially be reduced if bus service was provided. Following cessation of operations, air pollutant levels would promptly drop and return the local air quality to background conditions by dispersion of air pollutants or settling of the particulate matter.

Noise

Effects of noise mitigation measures listed above have not been modeled but would be expected to result in reductions in noise levels estimated in the previous sections. Noise levels at receptor locations would be reduced by the mitigative measures.

When mining activity ceases, mining noise in the Project Area would be reduced to low levels associated with reclamation work and then cease altogether. There would be no long-term residual adverse impacts on the environment from noise generated during the Proposed Action and Alternatives.

4.2.5 Relationship of Short-Term Uses and Long-Term Productivity

The local short-term use of the mineral resources for phosphate mining would result in ongoing employment and other economic benefits to the local and regional economies. Air emissions during Project operations would not affect long-term productivity of the other resources of the affected area. When mining ceases, air quality would return to natural conditions. Long-term productivity of the land in the Project Area would not be affected by the mining air emissions.

Mining noise would affect the area immediately adjacent to the mine operations and have a lesser effect on residents along Crow Creek. When the mining is completed, the mining noise would cease. Long-term productivity of the land in the Project Area would not be affected by the mining noise.

4.2.6 Irreversible and Irretrievable Commitments of Resources

There would be no irreversible or irretrievable commitments of resources due to air emissions or noise generated from the Project.

4.3 Water Resources

Issue:

The mining operations and related transportation activities may cause changes to the quantity and quality of surface water or groundwater in the Project Area and within the Crow Creek watershed area.

Indicators:

Changes in the volume and timing in surface runoff water caused by the operations;

Increases in suspended sediment, turbidity, and contaminants of concern in downgradient streams, ponds, and other surface waters, with regards to applicable surface water quality standards;

Reduction in available groundwater to supply existing baseline flow of streams and springs in the Project Area from pumping the Panel G water supply well;

Increases in concentrations of contaminants of concern in groundwater under and downgradient of pit backfills and overburden fills, with regards to applicable groundwater quality standards;

Length of roads that occur on the Meade Peak Shale member outcrop and could contribute selenium in runoff to nearby streams.

4.3.1 Groundwater – Direct and Indirect Impacts

Technical studies used to support the water resources impact analyses in this FEIS are summarized in this section, including:

Buck B., A. Mayo, and R. Schmiermund. 2005. Seepage Characterization for Groundwater Modeling. Technical Memorandum, May 24, 2005.

Enviromin Inc. 2006. Agrium Dry Valley Mine adsorption batch test results, Phase I data, Report prepared for Agrium Conda Phosphate Operations, May 31, 2006.

JBR Environmental Consultants, Inc. (JBR). 2006. Selenium Data for Southeast Idaho, October 2006.

JBR Environmental Consultants, Inc. (JBR). 2007. Groundwater Flow and Solute Transport Modeling Report, Smoky Canyon Mine, Panels F and G Extension Area.

J.R. Simplot Company. 2007. Smoky Canyon Mine Panels F & G Cover Design Development Report.

Knight Piésold and Company. 2005. HELP Modeling for Simplot Panels F and G. Prepared for JBR Environmental Consultants, Inc.

NewFields. 2006a. Engineering Evaluation/Cost Analysis, Smoky Canyon Mine, Caribou County, Idaho. Prepared for J.R. Simplot Company, May 2006.

NewFields 2006b. Technical Memorandum. Water Quality Monitoring Data Report May – June 2006. Smoky Canyon Mine Area A. July 20, 2006.

NewFields 2006c. Final Report Smoky Canyon Mine Panels F and G Batch Sorption Test Results. August 1, 2006.

NewFields. 2007a. Technical Memorandum. Water Quality Monitoring Data Report – Fall 2006. Smoky Canyon Mine Area A. January 29, 2007.

NewFields. 2007b. Technical Memorandum No.2. Evaluation of Recent Water Quality Trends at Hoopes Spring and South Fork Sage Creek Springs – Smoky Canyon Mine Area A. March 2007.

For reviewers who would like to obtain complete copies of the reports of these studies, the BLM will provide this information on a CD upon request.

Groundwater Flow to Open Pits

As described in **Section 3.3.5**, exploration drilling and groundwater monitoring wells in the Panels F and G area have indicated that the bottom of the proposed mine panels would be from about 100 to 800 vertical feet above the Wells formation aquifer in this area, so groundwater from the regional aquifer would not flow into the open pits.

Drilling records also indicate that measurable groundwater was typically not encountered while drilling in the vicinity of the proposed pits. Several monitoring wells that intercepted fault zones in the Meade Peak shale encountered groundwater within the Meade Peak shale and the Rex Chert members (**Figures 3.3-4 to 3.3-7**). The relatively low hydraulic conductivity and the perched water table elevations measured in the monitoring wells indicate that some minor perched groundwater flow could occur from the hanging walls of the proposed Panels F and G. This would be observed as small seeps along the highwalls that would drain fractures and perched saturated zones near the highwalls. The amount of water added to the open pits from these potential seeps is considered to be much smaller than the net percolation through the surface of the pit backfills.

The Smoky Canyon Mine has continuously conducted open pit mining operations in the same formations and similar hydrogeologic conditions since 1985, excavating over 5.6 linear miles of highwall in the process, and has not encountered any sustained, measurable groundwater inflow to the open pits from the highwalls. This is expected to be the case for Panels F and G.

Groundwater Recharge

The areas of the proposed Panels F and G are within the existing outcrop area of the Phosphoria formation. As described in **Section 3.3**, the Meade Peak member is considered to be an aquitard that covers the underlying Wells formation and Brazer Limestone and essentially limits recharge from areas overlying the base of the Meade Peak. Limited amounts of groundwater in the Meade Peak member are known to occur within fractures in the shale, but these yield little groundwater to wells or mine pits (Ralston et al. 1977 and Ralston 1979). This means that very little to no recharge to the Wells formation aquifer is currently occurring within the footprints of the proposed open pits, and only small amounts of groundwater flow to the open pits from the Meade Peak member are expected.

Removal of Phosphoria formation rocks in the footprint areas of the proposed pits would remove the aquitard formed by these rocks. This would allow groundwater recharge of the Wells formation to occur in the proposed open pit area (763 acres) where recharge naturally did not occur. This would be a 7 percent increase in the local recharge area (10,536 acres) of the Wells formation and Brazer Limestone. Recharge in these pit backfills, and any external overburden disposal areas to the east of the pits, would enter Wells formation rocks and eventually enter the aquifer contained in the Wells formation.

As discussed in **Section 3.3**, the Rex Chert member and the overlying Dinwoody formation can contain aquifers of local importance. These rocks in the Project Area are contained within the Webster syncline and groundwater recharged at the outcrops of these units is contained within the folded rocks of the syncline. Groundwater movement is likely controlled by elevation and bedding of the rocks within this area, so groundwater recharged at the Panels F and G locations would move westward toward the center of the syncline and then northward due to the northward plunge of the syncline. Because the proposed open pits are located at the eastern edge of the Dinwoody and Rex Chert outcrops, all these materials overlying the open pits would be removed during mining. This would eliminate the potential for groundwater in the Dinwoody formation and Rex Chert to flow into the open pits from the east. Because these units directly south of Panel F and Panel G have been removed naturally during formation of the Deer Creek and Wells canyons respectively, groundwater flow into the pits from the south from these materials is also not expected.

Groundwater recharged in the Rex Chert outcrop of the Panel F area would move toward the center of the syncline where it is isolated from the surface environment by the overlying Dinwoody. A decrease in recharge of this unit in the Panel F area would produce no effects to springs or surface streams. Groundwater recharged in the Rex Chert of the Panel G area likely supports a number of small springs in the area identified in **Section 3.3.9**. Potential effects of reduced recharge to these springs are discussed in the following specific impacts analysis for Panel G.

<u>Infiltration Through Reclaimed Mine Panels</u>
In determining the potential impacts to groundwater quality, it is important to estimate the amount of water migrating through backfill and external overburden fills. To do this the EPA's HELP3, a surface infiltration model, was used.

The natural recharge rate at any location depends on many factors including ground elevation, vegetation cover, soil characteristics, topographic aspect and slope, climate, latitude, and geology. Recharge rates have not been directly measured in the Webster Range but have been estimated to range from about 11 to 18 percent of average annual precipitation (JBR 2005). A site-specific estimate of recharge, for the final topography of the reclaimed Panels F and G was prepared using the EPA HELP3 model, a quasi-two-dimensional water balance model of water movement through layers of materials (Hydrologic Evaluation of Landfill Performance, Schroeder et al. 1994). The model has been used on previous phosphate mine EISs by the BLM and was used in this case to estimate recharge rates through the proposed Panels F and G pit backfills and external overburden fills (Knight Piésold 2005). HELP3 model runs were used to estimate runoff, soil infiltration, evapotranspiration, soil moisture storage, lateral subsurface drainage, and vertical percolation through layers of materials with specific material properties.

The proposed topography of the reclaimed Panel F was divided into 12 subareas based on slope and aspect to separately determine runoff, evapotranspiration, and percolation for each subarea. The same approach was taken for Panel G, which was divided into 13 subareas. The cover design used for the Proposed Action was previously shown in **Figure 2.5-1** with approximately 1 to 2 feet of topsoil over 4 feet of chert placed over all areas of run-of-mine overburden. Runoff from upland watersheds was assumed to be minimal due to installation of permanent runoff collection and diversion ditches along the upper (west) edge of the Panel F pits during mining (see **Section 2.5.5**). Material properties for the rock layers were established through testing samples of the same overburden materials at the Smoky Canyon Mine (Appendix 4C, BLM and USFS 2002). Soil characteristics were established through materials testing of the soil resources existing at the Panels F and G areas (Maxim 2004f). Vegetation cover was matched to the prescribed reclamation species of primarily grasses, forbs, and some shrubs and varied from no cover density on bare, unvegetated surfaces, through increased cover density on south, east, and west-facing slopes, to a maximum cover on north-facing slopes. The results for the infiltration modeling are shown in **Table 4.3-1**.

TABLE 4.3-1 RESULTS OF INFILTRATION MODELING FOR PROPOSED ACTION (INCH/YEAR)

SUBAREA	PERCOLATION RATE	WTD AVG PERCOLATION
Panel F Pit 4 Open Pit	21.5	21.5
All Other 11 Panel F Areas	1.98 – 3.05	3.0
All Other 12 Panel G Areas	1.94 – 2.97	2.8

The results of the HELP3 modeling determined that the individual percolation rates through the cover and into the top of the run of mine overburden varied from slightly less than 2 inches per year for south-facing slopes to about 3 inches per year for north-facing slopes. Weighted averages for each mine panel were determined by weighting percolation rates by the acreage of each subarea. The Panel F Pit 4 would not be reclaimed at the end of mining (see **Figure 2.4-4**), so there would be little potential for soil moisture storage and evapotranspiration of water. Subsequently, the estimated percolation rate is over 21 inches per year over the unreclaimed pit floor.

Steady State Unsaturated Flow

A description of how water flows through waste rock, whether as backfill or external fills, is needed to predict the conditions under which water is in contact with fill.

A study was conducted of the site-specific hydrogeology for the Panels F and G pit backfills wherein the unsaturated flow of water (percolation) was modeled through the ground surface of the pit backfills for both the unmitigated case and the Alternate D mitigation case all the way to the water table in the Wells formation aquifer (OKC 2006c). The 1-D model SEEP/W was used to calculate water percolation rates at various depths in the ROM pit backfill material over a 10-year model time frame. For the base case (no store and release cover) with a mean percolation rate of 3.1 inch/year at the top of the ROM, the range of results was 15.4 inches with a standard deviation of 4.0. At a depth of 66 feet in the ROM, the range had decreased to 10.7 inches, with a standard deviation of 2.6. At a depth of 131 feet in the ROM, the range had decreased to 7.0 inches, with a standard deviation of 1.8. This demonstrated that variability in the range of percolation rate through the ROM was decreased significantly with depth in the backfill.

Modeling was then conducted to evaluate the variability in the recharge rate (percolation entering the water table) at the aquifer water table located from about 200 to 750 feet below the bottom of the proposed pit backfills. Ten different scenarios were modeled assuming different wetting conditions in the backfill, and a variety of material permeabilities and net percolation sequences. The mean percolation at the surface of the pit backfill for these runs was 3.0 inch/year with a standard deviation of 4.4 and a 16.9 inch/year range over the 100-year time frame. For the scenarios with an initial surface flux rate of 3.0 inch/year, the range of the recharge rate at the water table was 2.4 to 4.2 inch/year, with a standard deviation of 1.0 or less. This indicated that recharge rate at the water table was relatively uniform even though significant variability in percolation rate occurred at the ground surface.

For the Alternative D design (store and release cover) with a mean surficial net percolation rate of 0.6 to 0.7 inch/year, the mean recharge rate at the aquifer was 0.5 inch/year with a range of 0.5 and a standard deviation of 0.1. This indicated the mean recharge rate was slightly less than the mean surficial percolation rate and the recharge rate was essentially steady state.

What these modeling runs showed is that the recharge rate at the deep water table is approximately the same as the long-term average annual net percolation rate into the top of the pit backfills. The short-term variations in percolation rates from year to year may be significant at the ground surface but do not affect the recharge rate at the deep water table.

Uniform flow through the overburden fills (wetting 100 percent of the overburden) is not expected, and preferential flow of water in overburden fills and heap leach piles has been well documented in laboratory and field investigations (JBR 2005). Studies of preferential flow suggest that about 20 to 70 percent of an overburden fill will come into contact with percolating vadose zone water. Because overburden fills as thick as anticipated at the Panels F and G (about 200 feet) would encourage formation of preferential flow paths, it is reasonable to assume that 50 percent or less of the volume of the proposed Smoky Canyon Mine overburden fills would host flow paths for percolating meteoric water due to preferential flow. For a unit square-foot area on the 200-foot thick backfills proposed for Panels F and G with an approximate recharge rate of 3.0 inches per year, the estimated time for each pore volume of water to infiltrate into the fills is 146 years. The significance of this is that COPC concentrations used in the groundwater impact assessment decrease over time as described below.

This time period per pore volume is conservative because flow through the overburden fills may occur faster along fewer preferential flow paths than is assumed above. If pore volume flow wets less than 50 percent of the overburden as assumed, flushing of the smaller amount of wetted material along preferential flow paths would occur faster and solute concentrations in the seepage would decrease faster over time. This could be important for Alternative D where net percolation into the overburden would likely move along preferential flow paths through the finest material in the overburden and likely wet less than 50 percent of the total overburden volume. Keeping the time frame for a pore volume to pass through the overburden under the conditions of Alternative D at 146 years is considered to be conservative. Empirical evidence from external overburden fills in Southeastern Idaho indicates that infiltration of precipitation moves through the overburden fills within just a few years and establishes stable (perennial) seep discharge points at the bases of certain fills. The timing and stability of these seeps is indicative of preferential flow paths that are apparently established rapidly, wet a relatively small volume of the fills, and are stable over a range of flow rates.

Monitoring of existing overburden seeps has indicated that their flow rates and seepage chemistry respond rapidly (weeks to months) to the varying recharge rates of the seasons and significant precipitation events. Water quality monitoring of these seeps indicates that solute concentrations vary with flow rates and selenium concentrations are as much as 2 to 10 times higher at maximum flow in the spring than during the summer or fall when flow rates are at a minimum (Buck, Mayo, and Schmiermund 2005). The fact that net percolation through the Alternative D cover would be roughly 20 percent of the net percolation rate for the other mining alternatives without the cover would suggest that selenium concentrations used as inputs to the groundwater impact analysis should be lower for Alternative D. This was not done in the groundwater impact analysis because there is not a proven adjustment factor to make this adjustment to the column test results (see below). This introduces an element of conservatism into the groundwater impact analysis for Alternative D.

Predicted Infiltration Chemistry – Column Tests

Once the amount of water and how it flows through waste rock have been described, groundwater quality impact analysis requires the Agencies to estimate the amount of COPCs that could be dissolved and then released through the percolation process. This is done through column testing.

Overburden is exposed to surface weathering conditions when it is removed from the pit, transported, and placed in an overburden disposal site. The exposure to these conditions can start oxidation of minerals in the overburden that can mobilize soluble forms of various elements contained in the rock. Infiltrating water provides a pathway for the transportation of soluble constituents within the mass of the overburden. Metals, selenium, and other constituents that may be mobilized from the overburden through the action of infiltrating water are transported by the water movement to other locations within the overburden deposit and, potentially, to the environment beneath the overburden. Along this pathway, the concentrations of dissolved constituents may subsequently be changed by dissolution, sorption, or precipitation reactions as chemical conditions change along the flow path. The effects of these reactions are difficult to accurately estimate for any overburden fill.

The infiltration rate of water through an overburden fill is quite variable and controlled by the material properties of the overburden fill. As described under the previous subheading, the infiltrating water is likely to follow preferential flow paths through the material, accelerating the leaching of overburden along these flow paths while other material is more slowly leached. The result of this would be an unpredictable pattern of different seepage rates and chemistries across the entire area of overburden.

It is difficult to estimate the final chemistry of water discharged from the bottom of an overburden pile because of the variability and uncertainty in predicting these causal factors. A key consideration in this chemistry is the concentration of soluble COPCs that may be contained in leachate produced in phosphate mine overburden.

Leach column testing was conducted on representative samples of overburden rocks to obtain leachate chemistry information on the COPCs (Maxim 2004l). Twelve columns were constructed: eleven columns of drill cuttings from Panel F and G drill holes representing each of the major lithologic units, and one control. A total of 255 individual samples were composited in the construction of the columns. Efforts were made to ensure that the selection of rock samples to be used in each column were representative of that lithology for the entire mine panel. Laboratory water was applied to the tops of the columns and allowed to percolate down through the rock samples to the bottoms of the columns, where the leachate water was collected for laboratory analyses. The effluent from each column was collected in a closed container until a volume of water roughly equal to the column porosity (a pore volume) was accumulated. Samples were collected for pore volumes 1, 2, 3, 5, 7, 9, and 10. After each pore volume had been run, air was circulated through the column to reflect an unsaturated, oxygen-rich environment. The pore volume samples were analyzed for specific parameters selected from those shown in **Table 4.3-2**. These parameters were selected to help understand the chemical interactions between the overburden and the leachate and to be consistent with COPC information from previous studies.

TABLE 4.3-2 COLUMN LEACHATE ANALYTICAL PARAMETERS

GENERAL
pH, Eh, Alkalinity, Sodium, Potassium, Calcium, Magnesium, Chloride, Sulfate, Fluoride, Phosphate, Total Organic Carbon, Turbidity, Sulfide, Nitrate+Nitrite
METALS
Aluminum, Arsenic, Antimony, Barium, Chromium, Cadmium, Copper, Iron, Manganese, Mercury, Nickel, Zinc
SELENIUM
Dissolved and Total Selenium, Selenite, Selenate

Chemical analyses of pore volumes were examined to determine concentrations of COPCs from pore volume 1 (PV1) through pore volume 10 (PV10) for all columns. Some columns were run up to 20 pore volumes. Concentrations of dissolved constituents were always highest in PV1 and typically decreased until about PV2 or PV3 after which they stayed relatively low through PV10 and beyond.

Analytical data from the leachate testing were compared to applicable surface water and groundwater regulatory standards to identify analytical parameters that should be modeled in the groundwater impact assessment. **Table 4.3-3** shows the number of pore volume analytical results that exceeded a surface water standard or a groundwater standard.

TABLE 4.3-3 NUMBER OF SAMPLE RESULTS EXCEEDING REGULATORY STANDARDS

PARAMETER	PANEL F SW/GW	PANEL G SW/GW	SW/GW STANDARD*
pH	0 / 0	0 / 0	6.5-9.0
Arsenic	0 / 0	1 / 1	0.05 / 0.05
Antimony	0 / 1	0 / 0	4.3 / 0.006
Barium	0 / 0	0 / 0	NS / 2.0
Chromium	8 / 0	6 / 0	0.01 / 0.1
Cadmium	9 / 2	7 / 5	0.001 / 0.005
Copper	0 / 0	0 / 0	0.011 / 1.0
Manganese	0 / 15	0 / 14	NS / 0.05s
Mercury	0 / 0	0 / 0	1.2E-5 / 0.002
Nickel	2 / 0	3 / 0	0.160 / NS
Selenium	30 / 11	24 / 11	0.005 / 0.05
Sulfate	0 / 4	0 / 8	NS / 250s
Zinc	22 / 0	12 / 0	0.105 / 5.0s

SW=Surface Water, GW=Groundwater

*The SW standard is the lowest concentration for cold water biota for Criteria Maximum Concentration, Criteria Continuous Concentration, or Criteria Human Consumption or organisms. The SW standard for chromium is for chromium VI. SW standards for cadmium, chromium, copper, nickel, and zinc are expressed as a function of hardness at 100 mg/L and water effect ratio of 1.0. GW standards followed by an "s" are secondary and not health-based.

The single Panel G column test leachate exceedance of the surface water and groundwater standards for arsenic (**Table 4.3-3**, 0.065 mg/L) was not considered problematic because it was only slightly above the standards (0.05 mg/L), and initial dilution in the groundwater immediately under the overburden fills would reduce this concentration to well under the applicable standards. The single groundwater standard exceedance for antimony for the Panel F column test leachate (0.008 mg/L) was also not considered problematic because initial dilution in the groundwater would reduce this concentration to below the applicable groundwater standard (0.006 mg/L). The nickel concentrations in column leachate that exceeded the surface water standard (0.16 mg/L) ranged from 0.17 to 0.81 mg/L. The nickel concentrations were not considered problematic because there is no groundwater standard for nickel and dilution in the groundwater flow pathway between the source and potential points of groundwater discharge to the surface environment would reduce these concentrations to below the applicable surface water standard.

The leach column pore volume results for cadmium, chromium, manganese, selenium, sulfate, and zinc were considered potentially problematic because of the number of samples that were significantly above an applicable surface water and/or groundwater standard. These COPCs were therefore selected for further impact analysis.

Particle-size Adjustment

The column tests were conducted on drill cuttings, which are ground up during the drilling process to particle sizes that were generally much finer than the particle sizes expected for the actual overburden from the mine panels, based on experience at the Smoky Canyon Mine. It is well known that leaching of rock is strongly affected by the particle size of the material being leached with greater leaching efficiency occurring with finer particle size. USGS studies conducted on samples of Meade Peak shale from Southeastern Idaho suggest that dissolution reactions of water with the shale are sensitive to grain size with higher rates of release associated with finer grain sizes (Herring 2004).

Representative bulk samples (55-gallon drums) of run of mine (ROM) chert and Center Waste Shale were obtained from the Smoky Canyon Mine. These were tested for particle size gradation, as were samples of the solids tested in the column leach tests. The Panels F and G column test results were adjusted to account for the difference between the fine gradation of the rock particles in the leach columns and the coarser gradation of the overburden fills as follows (JBR 2007):

1. Determine mass of COPC released (mg/PV) by multiplying leach column effluent concentration by the volume of effluent collected (i.e., one pore volume).

2. Determine mass of COPC released per unit mass (mg/Kg) of overburden drill cuttings in leach column by dividing result of #1 by the mass of drill cuttings in column.

3. Determine mass of COPC released per unit surface area (mg/m^2) by dividing result of #2 by the specific surface area (SSA, the area per unit mass) of leach column samples as determined by sieve data using GRAIN 3.0 specific surface area calculation spreadsheet (MDAG 2005).

4. Determine mass of COPC released per unit mass (mg/Kg) of ROM overburden backfill by multiplying result of #3 by the SSA of ROM overburden backfill.

5. Determine the mass of COPC released (mg) from ROM backfill by multiplying result of #4 by the mass of overburden backfill lithology in backfilled mine panel.

6. Determine COPC concentration in ROM backfill effluent (mg/L) by dividing result of #5 by the pore volume of the ROM backfilled overburden lithology.

7. The surface area correction factor (unit-less) is then determined by dividing the result of #6 by the concentration of COPC in column effluent.

The calculations summarized above, and specifically for step #6, were determined on a pore volume basis rather than using annual site infiltration data in order to avoid bias that could be introduced based on assumptions of retention time, solute breakthrough, and the affect that these factors may have on dilution.

Particle size correction factors for a range of specific surface areas (SSA) were considered, one based on the full range of ROM Center Waste Shale gradation data (all sizes), one based on the 50th percentile gradation of the overburden bulk sample (excluding all overburden greater than 2-inch size), and one excluding all plus ½-inch overburden material (roughly equal to the 30th percentile gradation). This considered the full range of ROM gradations as the least conservative approach and assumed that water percolating through the overburden would equally wet all the material. This yielded the lowest particle size adjustment factor and therefore the lowest adjusted selenium concentrations for use in the impact analysis (**Table 4.3-4**). The 2-inch particle size (50th gradation percentile) was more conservative than using 100 percent of the ROM gradation and was considered to be in concert with the preferential flow estimate described previously. It resulted in a higher particle size adjustment factor than the full ROM gradation and a higher (more conservative) selenium concentration for use in the impact analysis (**Table 4.3-4**). This selenium concentration was closer to the geometric mean value of selenium concentrations observed in external overburden seeps in Southeastern Idaho (JBR 2006). The ½-inch was considered because it provided a more conservative particle size adjustment factor than the other two and yielded a more conservative (higher) selenium concentration (**Table 4.3-4**) for the groundwater impact analysis that was closer to those observed at certain comparable sites at Smoky Canyon Mine and the average of selenium concentrations observed in external overburden seeps in Southeastern Idaho (JBR 2006)

TABLE 4.3-4 PARTICLE SIZE ADJUSTMENTS FOR SELENIUM CHEMISTRY (MG/L)

PANEL	ALL SIZES	MINUS 2-INCH	MINUS ½-INCH	NO ADJUSTMENT
Panel F	0.185	0.291	0.532	0.874
Panel G Backfill	0.213	0.343	0.640	0.802
Panel G External	0.248	0.399	0.739	0.924

Concentrations shown are for initial (PV1) selenium chemistry.

It was decided to use the correction factor based on exclusion of the plus ½-inch material because: 1) it was more comparable to the material in the leach columns which was 100 percent minus ½-inch; 2) although a large percentage of the ROM overburden mass is plus ½-inch size, it will likely have much less affect on the solution chemistry than the fine material; 3) preferential flow of unsaturated seepage through ROM overburden tends to follow paths through fine grained material, and 4) the estimated selenium concentrations for the particle size adjustment excluding the plus ½-inch ROM material appeared to be corroborated by applicable field evidence at Smoky Canyon Mine and in the wider area of Southeastern Idaho. The estimated selenium concentrations for the particle size adjustment including all the ROM gradation appeared to be lower than the empirical data.

It was recognized from the information in **Table 4.3-4** that the selenium concentrations were sensitive to the maximum particle size included in the adjustment. Adopting the adjustment including all sizes of overburden did not fit the physical flow condition estimated for the overburden fills where percolating water would likely follow preferential flow paths and therefore contact 50 percent or less of the total volume of overburden. This adjusted value was not accepted for the impact analysis. Using the column test data with no adjustment for particle size differences was considered to be incorrect because the finely ground material in the column tests was not representative of field conditions where particle sizes were larger. This left consideration of the minus 2-inch and ½-inch gradations for use in the environmental impact analysis. A selection was made based on comparison of these selenium concentrations with field observations at existing phosphate mines in Southeastern Idaho.

A selenium database for monitoring data collected at phosphate mines in Southeastern Idaho was included in the Simplot Panels B&C SEIS and listed selenium concentrations for ponds, overburden seeps, and French drains (BLM and USFS 2002). These publicly available data are from monitoring conducted by various mines and Agencies throughout Southeastern Idaho. The data were screened to eliminate those sample locations that did not represent water chemistry affected by contact with seleniferous materials. The remaining data were grouped into the categories of ponds, (external) overburden seeps, and French drains and then evaluated statistically. None of the external overburden fills included in the database incorporated mitigative features such as infiltration barrier caps. The data in the early versions of the database were updated to include monitoring results through 2004 (JBR 2006). The revised database indicated the average selenium concentration for overburden seeps at phosphate mines in Southeastern Idaho was 0.64 mg/L with a geometric mean of 0.132 mg/L. The geometric mean value from the database was closer to the selenium concentrations from the minus 2-inch particle size adjustment while the average value was closer to the selenium concentration for the minus ½-inch particle size adjustment. The values in the database for overburden seeps are strongly skewed suggesting that the geometric mean or median (0.145 mg/l) would be more representative of more values in the database than is the average. Stated another way, the average is representative of fewer, but bigger data values in the database than the other statistics. Using the average value would therefore be more conservative (higher selenium value) than using either the geometric mean or median values.

The Agencies also evaluated field data from the Smoky Canyon Mine for selenium concentrations at overburden seeps (Buck, Mayo, and Schmiermund 2005). Some overburden seeps at the mine are clearly not representative of large percentages of infiltration water into the overburden fills or large volumes of overburden fills. The evaluation of the seeps at the mine indicated that the Panel D seep was potentially representative of almost 90 percent of the water that infiltrates into the Panel D external overburden fill and the water discharged at the toe of the Pole Canyon overburden fill was also representative of a large portion of the water that enters the fill annually. At the time of the evaluation the average selenium concentration in these two locations was 0.7 and 0.67 mg/L respectively. The hydrology of these two overburden fills is significantly different than the proposed Panels F and G overburden fills. The existing fills at Smoky Canyon Mine receive more water infiltration annually because they were built prior to the understanding of the selenium issue and do not incorporate the BMPs (store and release cover) included in the mine expansion proposal. It is possible that these existing overburden fills therefore are undergoing more severe leaching than would occur in Panels F and G. However, the selenium concentrations from these two sites appear to be comparable to the Panels F and G column leachate data adjusted to the ½-inch particle size.

Both the minus 2-inch and ½-inch particle size adjustments have technical merit but review of empirical data from Southeastern Idaho and Smoky Canyon Mine suggests that the ½-inch particle size adjustment is more conservatively comparable to these data. The ½-inch particle size adjustment was preferred by the Agencies for decision-making but the impact analysis did review the effect of the minus 2-inch particle size adjustment to evaluate a range of input values.

For selenium, the ½-inch particle size concentrations were approximately 20 to 39 percent lower than the unadjusted column leachate concentrations and about 1.8 times higher than the 2-inch particle size adjusted concentrations.

The column test results represented single, homogeneous lithologies within the overburden of Panels F and G. The actual ROM overburden fills would be a mixture of these different lithologies. This would affect the seepage chemistry predicted by the column testing because the different lithologies exhibited different leachate chemistries. The anticipated seepage chemistries from the potential overburden mixtures were determined by weighting the pore volume leachate chemistries by the relative percentages of different lithologies in each mine panel. These weighted averages are shown in **Table 4.3-5**.

TABLE 4.3-5 WEIGHTED AVERAGE PORE WATER CHEMISTRIES FOR ROM OVERBURDEN (MG/L)

ANALYTE	PV1	PV2	PV3	PV5	PV7	PV9	PV10
PANEL F BACKFILL AND EXTERNAL FILL							
Cd	0.0577	0.0011	0.0003	0.0006	0.0010	0.0004	0.0011
Cr	0.009	0.006	0.006	0.003	0.003	0.009	0.005
Mn	0.256	0.057	0.046	0.046	0.026	0.023	0.055
Se	0.532	0.136	0.100	0.055	0.059	0.046	0.080
SO_4	359	118	62	46	56	53	66
Zn	0.70	0.15	0.16	0.10	0.11	0.15	0.27
PANEL G BACKFILL							
Cd	0.0695	0.0030	0.0019	0.0019	0.0030	0.0019	0.0025
Cr	0.039	0.007	0.005	0.002	0.002	0.002	0.002
Mn	0.566	0.093	0.051	0.041	0.040	0.180	0.155
Se	0.640	0.119	0.067	0.037	0.030	0.028	0.017
SO_4	713	354	136	101	115	146	216
Zn	0.84	0.29	0.20	0.16	0.17	0.19	0.21
PANEL G EAST EXTERNAL FILL							
Cd	0.0750	0.0034	0.0021	0.0021	0.0034	0.0021	0.0028
Cr	0.062	0.010	0.006	0.002	0.002	0.002	0.002
Mn	0.515	0.104	0.054	0.043	0.041	0.113	0.106
Se	0.739	0.138	0.078	0.043	0.034	0.032	0.020
SO_4	833	414	161	119	138	181	261
Zn	0.95	0.32	0.20	0.18	0.19	0.21	0.23

To model the potential change in seepage chemistry over time, the weighted average column test results for the COPCs were plotted on graphs. Polynomial curves were calculated for the pore volume data for each COPC. The curve for selenium for the Panel G backfill chemistry is shown in **Figure 4.3-1** as a typical example of the curves.

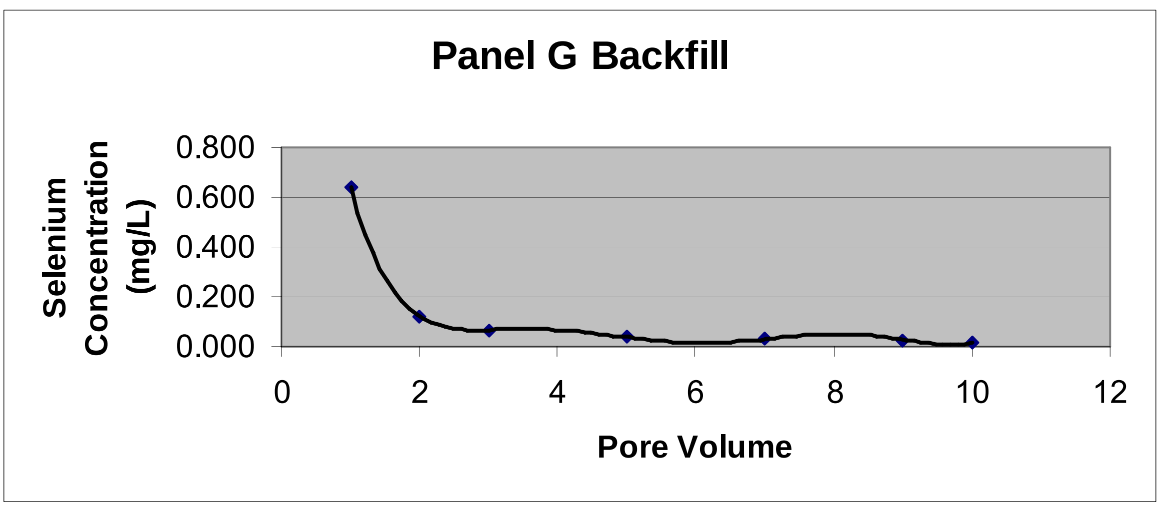

Figure 4.3-1 Weighted Average Panel G Backfill Selenium Concentration

Even though the column test data produced in the laboratory were adjusted as described above to take into consideration the differences between the laboratory test conditions and field-scale conditions in the proposed overburden fills, there is uncertainty as to the accuracy of the final weighted average COPC concentrations used as inputs to the groundwater fate and transport modeling.

Inspection of **Figure 4.3-1** shows that the concentration of selenium in the leachate from the Panel G ROM backfill is calculated to have an initial concentration of between 0.6 and 0.7 mg/L at the beginning of leaching (PV1) and decrease to 0.119 mg/L by PV2. The concentration remains well below 0.1 mg/L for the rest of the leaching (PV3 to PV10). The trends in selenium concentrations for the other ROM backfills are similar (**Table 4.3-5**).

Groundwater impact analysis using the trendlines of the leachate concentrations would result in higher concentrations being input to the impact analysis at the beginning of the evaluated time frame (500 years) followed by steadily decreasing input concentrations until approximately constant (and low) concentrations are reached at about PV2 to PV3. This approach puts the highest leachate concentrations (and therefore the highest contaminant loads) into the groundwater relatively early in the impact analysis. An alternative approach would be to average leachate concentrations for PV1 to PV10 to obtain a long-term mean value for selenium loading to the groundwater. The average selenium concentrations for the overburden leachate (**Table 4.3-5**) range from 0.118 to 0.162 mg/L. Using long-term average leachate concentrations may be suitable for site conditions where groundwater flow velocity is relatively slow and there are no receptors of potential groundwater contamination that could be affected by the changed water quality. For Panels F and G, it was estimated that groundwater flows from under the proposed mine panels to points of discharge (springs) within about 50 years (JBR 2007). Therefore, it was decided to use the trendline data values for the leachate concentrations in the groundwater quality impact analysis, which resulted in a more conservative impact analysis than if the long-term average leachate concentrations were used. This is because the initial selenium leachate concentrations used in the impact analysis ranged from 0.6 to 0.7 mg/L and were about four times greater than the long-term average concentrations of 0.12 to 0.16 mg/L that could have been used.

The leachate chemistry used in the impact analysis was therefore based on the trendlines, which correlated leachate concentration with pore volume. The impact analysis needed to relate the leachate concentrations to time, because the groundwater impact modeling simulates conditions over the specified time frame of 500 years. A time frame for each pore volume to move through the overburden fills had been established as being approximately 146 years per pore volume and this was used to assign a time to the changing leachate concentrations in the trendline curves for the contaminant loading inputs to the groundwater impact analysis.

The COPC concentrations in chert were much lower than those in the ROM overburden, and they did not have nearly the same degree of variability over time as the ROM overburden (**Table 4.3-6**). In addition, chert fills used in overburden caps and the Panel G South Overburden Fill had smaller thicknesses (4 – 50 feet) than the ROM pit backfills, thus they would have smaller timeframes for each pore volume to enter them compared to the ROM overburden fills. For these reasons, averages of all the pore volumes for each COPC are considered representative of the pore water chemistry for chert fills.

TABLE 4.3-6 PORE WATER CHEMISTRIES FOR CHERT OVERBURDEN (MG/L)

ANALYTE	PV1	PV2	PV3	PV5	PV7	PV9	PV10	AVG
PANEL G CHERT								
Cd	0.0240	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0037
Cr	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Mn	0.708	0.012	0.027	0.020	0.028	0.476	0.372	0.235
Se	0.007	0.003	0.003	0.003	0.003	0.003	0.003	0.003
SO_4	44	5.0	2.0	1.0	1.0	1.0	1.0	8.0
Zn	0.04	0.07	0.16	0.03	0.02	0.02	0.04	0.05
PANEL F CHERT								
Cd	0.0003	0.0003	0.0003	0.0003	0.0012	0.0003	0.0003	0.0004
Cr	0.0015	0.021	0.016	0.007	0.007	0.037	0.011	0.014
Mn	0.239	0.022	0.063	0.108	0.045	0.030	0.138	0.092
Se	0.036	0.018	0.005	0.011	0.006	0.005	0.0025	0.0119
SO_4	48.9	7.1	2.0	1.3	1.0	0.5	1.0	8.8
Zn	0.06	0.11	0.25	0.18	0.15	0.17	0.43	0.19

Selenium Attenuation in the Wells Formation

A review was made of literature and empirical data collected from the Smoky Canyon Mine related to potential chemical attenuation of selenium and cadmium in the flow paths being modeled from the Panels F and G overburden sources to the points of groundwater discharge to the surface environment (JBR 2007). There is abundant information in the literature supporting chemical attenuation of selenium in specific chemical and biological environments. However, at the time the DEIS was prepared, it was concluded that there was insufficient evidence that these specific chemical environments exist to the degree necessary within the modeled flow paths for Panels F and G to allow estimation of significant chemical attenuation of selenium. The DEIS indicated, "*Although there may be some chemical attenuation of selenium in these flow paths, none has been used in the fate and transport modeling for the groundwater impact assessment*." Since the DEIS was completed, additional information has been obtained on selenium attenuation in the Wells formation that can be used in this impact analysis and is described in the following section.

There is also abundant literature showing that dissolved cadmium is quite reactive in the environment and is readily attenuated chemically (Allen et al. 1993; Fuller and Davis 1987; Hinz and Slim 1994; Papadopoulos and Rowell 1988, Zachara et al. 1991). The resulting reaction of cadmium solutions in alkaline environments causes precipitation of the cadmium carbonate mineral Otavite. Dissolved cadmium is also attenuated by sorption to clays, carbonates, and other minerals. Cadmium attenuation is enhanced in neutral to alkaline pH conditions, which are prevalent in the Project Area. Review of water quality monitoring data for Smoky Canyon Mine (JBR 2007) also showed that water issuing from seeps and springs at overburden fills typically have cadmium concentrations that are near or below the surface water standard (0.001 mg/L). Where cadmium concentrations were above surface water standards at overburden fills (Pole Canyon Dump and Panel A backfill), the cadmium concentrations in groundwater downgradient from these sources were below groundwater and surface water standards levels. All this evidence points to the conclusion that dissolved cadmium in overburden seepage at Smoky Canyon Mine is readily attenuated chemically once the seepage leaves the overburden fills and contacts the underlying rocks in the groundwater flow path. For this reason, it was concluded that cadmium would be fully attenuated chemically in the flow paths down gradient from the Panels F and G overburden fills. Work done at the Dry Valley Mine has shown that dissolved cadmium originating in overburden leachate is fully attenuated by contact with Wells formation aquifer matrix (Enviromin 2006).

Scientific literature includes descriptions of mechanisms and efficiencies of selenium attenuation from solutions to various solid matrices. Evidence for attenuation of selenium from phosphate mine overburden is available from field evidence at Smoky Canyon Mine, laboratory testing conducted with seleniferous overburden leachate and Wells formation aquifer material collected at Smoky Canyon Mine (NewFields 2006c), and groundwater and Wells formation material collected at the Dry Valley Mine (Enviromin 2006).

Selenium Attenuation in Scientific Literature

Balistieri and Chao (1990) tested adsorption of selenite and selenate on amorphous iron hydroxide and manganese dioxide as a function of pH. They found that increase in pH should cause a decrease in the amount of selenium adsorbed. At a given pH, selenite was found to adsorb more strongly than selenate on iron oxides and selenate did not adsorb at all on manganese dioxide. Amorphous iron oxyhydroxide had a stronger affinity for both selenium species than did manganese dioxide. At an iron hydroxide concentration of 4.4 mg/L about 40 percent of the selenite was adsorbed from solution.

Cowan et al. (1990) studied adsorption of selenite on calcite. They did not test calcite sorption on selenate. They found that calcite could be an important adsorbent phase for selenite in calcareous and calcareous/gypsiferous geochemical systems. They said that oxides and clays are expected to be the primary sorbents for selenite in most situations but calcite may be an important sorbent in calcareous and limestone dominated aquifer material. They measured selenite sorption from solution to calcite from 25 to 29 percent at a solution pH of about 7.8 (similar to Wells Formation aquifer).

Bar-Yosef and Meek (1987) tested the adsorption of selenite and selenate to kaolonite and montmorillonite clay under pH levels ranging from 4 to 8. The adsorption decreased with increasing pH values and became negligible above pH 8. At the pH levels expected in the Wells formation (7.3 – 7.8) selenite adsorption to clays was about 13 percent and for selenate about 11 percent, respectively.

Singh et al. (1981) studied adsorption of selenite and selenate to different soils including: normal, calcareous, high organic carbon, saline, and alkaline types. They found that adsorption of both selenite and selenate was influenced positively by organic carbon, clay content, calcite, and cation exchange capacity. Adsorption was negatively influenced by high salt content, alkalinity, and pH. The highest amount of selenium was retained by the soil that had the high organic carbon content followed by the calcareous, normal, saline, and alkaline soils. The amount of selenate sorbed per gram of soil was higher than selenite. At the highest level of selenium added, the normal soil adsorbed 23.7 to 40 percent of the selenium and the calcareous soil adsorbed 32 to 46 percent.

In addition to descriptions of selenium attenuation in the literature, there are several other lines of field evidence of selenium attenuation in the Wells formation. The following information was not available at the time the DEIS was prepared.

Smoky Canyon Mine Pole Canyon – Hoopes Spring Flow Path

As part of the Smoky Canyon Mine Site Investigation Report (SIR), water balance and selenium and sulfate mass balance calculations were performed for the Pole Canyon overburden disposal area (NewFields 2005b). These calculations, based on detailed continuity equations, are summarized in Technical Memorandum No. 2 (NewFields 2004a). The results of these calculations provided a range of potential selenium and sulfate loading rates to the Wells formation aquifer downgradient of Pole Canyon. Monitoring data for water chemistry and flow at Hoopes Spring allowed calculation of the annual discharge loading rate for sulfate and selenium at the spring. Comparing the discharge loads at Hoopes Spring to the ranges of added loads at Pole Canyon indicated that there was a significant decrease in the selenium load between Pole Canyon and Hoopes Spring and a significant increase in sulfate.

Between the time when the Technical Memorandum No. 2 and the Final Site Investigation Report were completed, NewFields used additional field data to refine the mass loading balance for the Pole Canyon overburden. The results of these refined calculations for selenium are discussed in Section 8 of the SIR (NewFields 2005b). Comparing the revised selenium and sulfate loadings at Pole Canyon to the selenium load and the adjusted sulfate load at Hoopes Spring indicates that the selenium load decreases by about 50 percent and the sulfate load increases by over 3 times.

As NewFields indicates in the SIR, the apparent decrease in selenium load between Pole Canyon and Hoopes Spring can be due to a variety of reasons including:

- The calculated mass loading to the Wells formation aquifer from the Pole Canyon overburden is incorrect;
- There is a time lag between the concentrations at Pole Canyon and Hoopes Spring;
- Only a portion of the selenium load is physically transported from Pole Canyon to Hoopes Spring; and
- Dissolved selenium is chemically attenuated between Pole Canyon and Hoopes Spring.

With regard to the effects of potential error in the mass loading calculations for the Pole Canyon overburden fill, such error would affect the absolute values of the calculated loads, hence the difference between the loads at Pole Canyon and Hoopes spring would also change. The sources of errors can be multiple but uncertainties related to the hydrology of the alluvial and Wells formation aquifers are likely the greatest sources of error. This would affect the estimated, apparent amount of selenium attenuation derived from the difference in loads between Pole Canyon and Hoopes Spring. Because sulfate and selenium are calculated by the same equations for Pole Canyon, any error in calculating the selenium load released from the overburden would affect sulfate in the same manner. Within a realistic range of potential errors in the calculated load, the observed selenium load at Hoopes Spring is still likely to be smaller than that calculated for Pole Canyon and sulfate load at Hoopes Spring is still likely to be greater than that at Pole Canyon.

The same could be true about the time lag effect. The load calculated for Pole Canyon can take years before it is discharged at Hoopes Spring. Thus, it might be more realistic comparing Pole Canyon loads estimated for earlier time frames with current discharge loads at Hoopes Spring. This type of comparison would likely show a smaller difference in selenium loads between the two locations. Again the same adjustment would affect the sulfate load in a similar manner. The fact that sulfate loads between Pole Canyon and Hoopes Spring are comparable and greater than the selenium loads suggests that time lag is not solely responsible for the decrease in load between Pole Canyon and Hoopes Spring.

With regard to the question if only a portion of the Pole Canyon load is physically transported to Hoopes Spring, the difference in selenium loading between Pole Canyon and Hoopes Spring can be attributed to geochemical attenuation if one assumes that most of the Wells formation groundwater under Pole Canyon is discharged at Hoopes Spring. Hoopes Spring is located along the West Sage Valley Branch Fault and is very likely connected to the fault zone hydraulically (BLM and USFS 2002). The discharge at Hoopes Spring is approximately six cfs, which previous workers in the area have concluded is much too large to be supplied by only local recharge and therefore must gather groundwater from along the fault trace (Ralston 1979, Mayo et al. 1985, JBR 2001c, NewFields 2005b). The assumption in the NewFields report that selenium contamination added to the Wells formation under Pole Canyon flows east is supported by previous work including the Smoky Canyon SEIS.

Wells formation groundwater under the Webster Range in the area between South Fork Sage Creek and Deer Creek has been shown to flow from west to east, is gathered by the West Sage Valley Branch Fault, and flows northward in the highly transmissive fault damage zone to discharge at South Fork Sage Creek Spring (JBR 2007, BLM, USFS, IDEQ 2005). This flow path along the fault zone is approximately 3.0 miles long and the discharge at South Fork Sage Creek Spring is variable but likely at least about 4.5 cfs.

The flow path along the same West Sage Valley Branch Fault from Pole Canyon to Hoopes Spring is 2.3 miles long. Assuming the groundwater flow conditions are the same along this flow path as in the north end of the Panels F and G groundwater model domain, (recharge and flow patterns) the flow at Hoopes Spring should at least be about 3.5 cfs but it is actually about 6 cfs. It is reasonable to assume that the flow path from Pole Canyon to Hoopes Spring along the fault could easily be collecting most or all of the Wells formation groundwater from this area of the aquifer. This argues against significant flow of groundwater from under Pole Canyon in a northward direction along the fault. It also suggests that there is little leakage of Wells formation groundwater across the fault into Sage Valley. The location of large springs at the lowest elevations along the fault trace is also evidence of the lack of groundwater flow across the fault.

To test whether or not the apparent decrease in selenium loads between Pole Canyon and Hoopes Spring could be due to chemical attenuation, similar calculations were performed using sulfate as a non-attenuating surrogate for selenium in the same flow path. The sulfate and selenium loadings were compared at Pole Canyon and Hoopes Spring using the same approach used by NewFields. If selenium is being attenuated along this flow path, the hypothesis was that sulfate should not be attenuated and the sulfate loadings at both ends of the flow path should be roughly equal. A significant deficit of sulfate load at Hoopes Spring compared to the calculated load at Pole Canyon would suggest that not all the load from Pole Canyon is physically transported to Hoopes Spring. However, calculations showed that the annual sulfate load at Hoopes Springs was actually greater than the calculated sulfate load discharged from the Pole Canyon overburden. This suggests that most of the selenium load from Pole Canyon could be physically transported to Hoopes Spring. The fact that the sulfate load discharged at Hoopes Spring is apparently greater than that contributed by the Pole Canyon overburden could be due to seepage from other overburden fills south of Pole Canyon where sulfate is being added to the Wells formation aquifer, is transported east to the fault, and then south to Hoopes Spring, but the selenium is being attenuated.

Based on the above, it is reasonable to assume that the deficit in selenium load between Hoopes Spring and the Pole Canyon overburden can mostly be attributed to chemical attenuation along the flow path. For the reasons raised by NewFields in the SIR, the apparent 50 percent reduction in selenium load along this flow path may be the upper limit of chemical attenuation that can be expected along this flow path but this is not likely the correct, actual value. The actual value is more likely lower than 50 percent.

Smoky Canyon Mine Panel A to Culinary Well Flow Path

In May and June 2005, the Smoky Canyon Mine received 7.4 inches of rainfall, much of which came in several storm systems. Runoff from areas of exposed shale overburden was reportedly diverted to runoff control basins in the Panel A backfill area near the runoff recharge area (RRA) that was under construction. This collected water reportedly infiltrated into the underlying shale overburden and then was collected in the RRA. The Culinary and Industrial wells are directly down gradient of the part of Panel A in question. Because of the presence of the RRA, it is likely that much of the water infiltrating through the overburden in the vicinity of this RRA could reach the Wells formation in a short period of time. Shortly afterwards, the selenium concentration in the Culinary Well rose from 0.0158 mg/L in March 2005 to a peak of 0.0492 mg/L in June and then fell back to 0.0178 mg/L in October, which is consistent with a limited amount (slug) of contamination being added to the Wells formation aquifer previous to this change in selenium concentrations in the Culinary Well.

The Summers equation was used to back calculate the selenium concentrations in the source (RRA water) that would result in the observed increase in Culinary Well selenium concentrations. The calculations were based on the calculated water influx from the Panel A during the high precipitation period in the spring of 2005. These calculated values were then compared with various assumed selenium concentrations in the RRA water to determine if selenium attenuation is possibly indicated. The Summers equation is:

$$Cgw = Ci * Qi/(Qi + Qgw)$$

Where:

Cgw = concentration in groundwater
Ci = concentration in water entering the aquifer (i.e., Panel A)
Qi = flux of water entering the aquifer
Qgw = groundwater flux under the source area (i.e., Culinary well)

This is an approximate analysis because the only measured characteristic is the selenium concentration in groundwater at the Culinary Well. All the other inputs to the calculations were estimated. The calculated selenium concentration in recharge water captured by the RRA could be no higher than 0.164 mg/L (assuming all 5.6×10^6 ft^3 of surface runoff reached the RRA), and 0.22 mg/L if only 70% of surface runoff reached the RRA.

These concentrations are appreciably less than the selenium concentrations in PV1 of the Panels B and C column leaching tests (0.33 mg/L), and Panels F and G (0.6 to 0.7 mg/L), which is the concentration one might expect in this RRA water if it first percolated through some shale overburden. However, if the selenium concentration of the water entering the RRA was diluted with surface runoff, data from other phosphate mines suggests this could dilute the RRA water to a lower selenium concentration. Assuming the input assumptions and calculations are correct, the calculations suggest that selenium attenuation occurred in the Wells formation beneath the pit backfill and this attenuation could range from about 30 to 60 percent.

Attenuation at Smoky Canyon Mine Overburden Seeps

The field data presented in the Simplot Site Investigation Report show that selenium concentrations in certain overburden seeps are affected by overland flow and storage in detention basins. Interpretation of these data that selenium is chemically attenuated in these surface flow paths is consistent with information in the general literature on selenium chemistry.

Potential chemical attenuation mechanisms might be adsorption to iron oxides in the soils of these surface pathways and other mechanisms might be responsible such as adsorption on clays, carbonates, and organic materials. These observations support selenium attenuation when seepage water from Smoky Canyon overburden contacts native soils. The Wells formation rock also contains iron oxides and these iron oxides might also be effective in attenuating selenium. Assay data produced for the Wells formation rock in the Panels F and G area shows iron concentrations averaging 0.26 to 0.37 percent (Maxim 2004b). This suggests that selenium attenuation due to iron oxides in the Wells formation is possible.

Laboratory Testing of Smoky Canyon Mine Overburden Seepage with Wells Formation

Simplot conducted batch testing of overburden seepage from the Smoky Canyon Mine with Wells formation drill hole cuttings composited from five boreholes in the Wells formation at the Smoky Canyon Mine (NewFields 2006c). 24-hour bottle-roll tests were conducted of the water and rock with rock:water ratios varying from 1:4 to 1:200. At high selenium concentrations (4 mg/L), essentially no selenium attenuation was observed. This was attributed to excessive selenium load in the solution compared to the available adsorption sites on the rock samples. When the solution was diluted with lab deionized water to a concentration of about 0.4 mg/L, selenium attenuation was approximately 21 to 26 percent at rock:water ratios of 1:4 and 1:10 respectively. Attenuation of selenium at rock:water ratios of 1:20 to 1:200 ranged from about 5 to 15 percent.

Laboratory Testing of Dry Valley Mine Groundwater with Wells Formation

The Agrium Conda Phosphate Operations investigated the potential migration of dissolved solutes in groundwater within backfilled pits into the downgradient Wells formation aquifer (Enviromin 2006). A sample of limestone drill cutting was used along with a groundwater sample obtained from the saturated portion of a backfilled pit. The selenium concentration in the groundwater was 0.015 mg/L and cadmium was at 0.012 mg/L. 24-hour bottle-roll tests were conducted of the water and rock with rock:water ratios varying from 1:4 to 1:500.

Cadmium was completely attenuated at all but the most dilute rock:water ratios. Ninety percent of the manganese was attenuated at the 1:4 rock:water ratio with the attenuation decreasing to 13 percent with increasing dilution. Selenium attenuation with the 1:4 rock:water ratio was 64 percent also declining with higher ratios. No sulfate attenuation was observed.

Application of Selenium Attenuation to Panels F and G

Selenium contained in overburden leachate at Panels F and G would need to pass through a significant thickness of unsaturated Wells formation before entering the Wells formation aquifer. Estimated thickness of the Wells formation vadose zone under Panels F and G range from 200 to 1,200 feet. This unit includes the upper Grandeur Limestone member of the Park City formation, fine-grained sandstone with interbeds of limestone and dolomite and cherty limestone with sandstone interbeds. There is abundant calcareous rock in this flow path, which could provide attenuation reaction media as described in the literature. Iron and minor clay content of the unit could also contribute to the selenium attenuation.

Literature and empirical data indicate that selenium in leachate from seleniferous phosphate mine overburden is likely to be attenuated in the flow path through the Wells formation vadose zone and aquifer. The types of evidence and potential attenuation effectiveness are shown in **Table 4.3-7**.

TABLE 4.3-7 SELENIUM ATTENUATION SUMMARY

ATTENUATION EVIDENCE	EFFECTIVENESS (%)
Literature	11 - 46
Smoky Canyon Mine – Pole Canyon to Hoopes Spring	50
Smoky Canyon Mine – Panel A to Culinary Well	30 - 60
Smoky Canyon Mine – Batch Tests (1:4 to 1:10 rock:water ratio)	21 - 26
Dry Valley Mine – Batch Tests (1:4 rock:water ratio)	64

In addition to the above, information provided in comments on the DEIS described column testing conducted with samples of Panels F and G overburden and Wells formation rock that indicated potential attenuation of 30 to 80 percent of the selenium in leachate from the overburden in contact with Wells formation material. The Agencies have not accepted these column test results but have included this last line of attenuation evidence for completeness sake. Commenters recommended that the column test results plus the Pole Canyon to Hoopes Spring, Panel A to Culinary Well, and attenuation at overburden seeps indicated a selenium attenuation factor of 30 percent should be used in the groundwater quality impact evaluation.

Taking all the available evidence of selenium attenuation under consideration the Agencies have determined that attenuation of selenium is likely to occur in the vadose zone under the proposed pit backfills and that it would reduce concentrations of selenium at the water table. For decision-making purposes, the Agencies have adopted a selenium attenuation range of 15 to 25 percent to be used in the groundwater impact modeling. The range of selenium attenuation selected by the Agencies is less than what is indicated from literature and empirical data and is therefore considered to be conservative. The groundwater quality impact analysis also reviewed the effect 0 and 30 percent selenium attenuation to evaluate a wider range of input values.

Groundwater Quality Impact for Wells Formation

A groundwater solute transport computer model was prepared to simulate migration of COPCs contained in leachate from the overburden disposal facilities in the Proposed Action and Alternatives. The two-dimensional flow model, MODFLOW, that was used for the groundwater impact modeling was described in **Section 3.3.6**. This same groundwater model was used for the fate and transport modeling of the COPCs from the overburden fills using the computer code MT3DMS. The following assumptions were made in the fate and transport model:

1. Infiltration chemistry for runs of the model consisted of column test values for the COPCs: cadmium, chromium, manganese, selenium, sulfate, and zinc. The model runs were conducted in 1-year increments using the weighted average COPC concentrations of the leachate chemistry for each specific overburden area determined from the polynomial curves of the weighted average pore volume chemistries. In summary, the sequence of decisions and calculations made to adjust the selenium concentrations that were measured in the original column test to the concentrations used to represent infiltration over the entire footprint of the overburden fills are:

    a. Adopt test results from unsaturated, monolithologic column tests as the basis for characterizing expected leaching conditions in overburden fills. This is a conservative input approach because the test columns were aerated in between each pore volume with blown air, which will not occur in the actual overburden pit backfills. The aeration of the test columns might enhance liberation of higher solute concentrations in the leachate than might occur in the actual pit backfills.

b. Starting with PV1, adjust the concentrations measured in leachate samples collected from the unsaturated columns using the surface area calculated for the finer materials in the overburden (less than ½ inch particle size). This is a conservative input approach for the model runs with the higher net percolation values (Proposed action and Alternatives A – C), because more of the total overburden may be involved in the unsaturated flow under these conditions than just the minus ½-inch gradation. An adjustment up to the 2-inch particle size would result in solute concentration inputs that are about 50 percent lower than were used in the modeling.

c. Use the adjusted concentrations for each of the pore volumes from each of the different monolithologic column tests to compute the weighted average leachate concentrations based on the relative proportions of the different lithologies expected in the future overburden fills.

d. Compare model input chemistries to local and regional field data.

e. For each overburden disposal area, plot the weighted mean concentrations for each pore volume and fit a polynomial equation (trendline) to these data.

f. Assign a timeframe of 146 years to each pore volume represented by the trendline data. This is a conservative approach because preferential flow through the overburden could wet less than 50 percent of the material, which would result in smaller timeframes for each pore volume to penetrate the overburden. This would result in a more rapid drop in selenium concentrations over time than were modeled, which would translate into lower solute concentrations in groundwater.

g. Use the trendline equation to compute a concentration for each year along the trendline of concentrations and input these into the fate and transport model over the 500-year modeled timeframe. This is a conservative approach because it assumes that all leachate from the entire footprint of the overburden fills would have the same concentration and that all of the leachate would start out having the high concentrations predicted at the beginning of the trendline and gradually decrease over time as controlled by the trendline equation. Empirical data from various phosphate mines in Idaho indicate a wide variation in selenium concentration from overburden fills with an overall median value approximately 3 to 5 times less than the PV1 concentrations used in the modeling.

2. Percolation through the overburden for the Proposed Action and Mining Alternatives A though C was the quantity estimated with the HELP3 model for the pit backfills and the external overburden disposal areas (**Table 4.3-1**). The net percolation rate for Alternative D was that predicted by infiltration modeling for the specific design (0.6 inch/year).

3. Steady-state conditions for the percolating water consisted of the estimated infiltration rates impinging directly on the water table with no attenuation of water flow in the overburden fill or the vadose zone between the base of the fill and the water table.

4. Infiltrated water was assumed to move vertically through the overburden fills and then through the vadose zone of the Wells formation, which was assumed to be homogeneous. Once in the saturated zone, groundwater flow was assumed to be through a homogeneous and isotropic aquifer.

5. COPCs were uniformly mixed with upper Layer 1 of the aquifer under the overburden sources and down gradient. COPCs that migrated from Layer 1 to the underlying Layer 2 by advection and dispersion were also uniformly mixed with Layer 2.

6. Dispersion and dilution in a homogeneous and isotropic aquifer were the only processes that reduced concentrations; effects of bedding and any chemical or sorption attenuation were not modeled.

7. Transverse dispersivity was equal to 0.3 times the longitudinal dispersivity, which was set at 100 feet. These are typical literature values for similar aquifers (Zheng and Bennett 1995). Vertical dispersivity was equal to 0.1 times the longitudinal dispersivity.

8. Background chemical concentrations in groundwater were set at zero, so model results indicate estimated increases in groundwater concentrations over background.

9. Model runs simulated time periods that were as great as 500 years. This was done to determine the maximum COPCs concentrations where groundwater from the Wells formation discharges to the surface, i.e., South Fork Sage Creek Spring, Books Spring, Lower Deer Creek, and Crow Creek.

10. Selenium input concentrations shown in **Table 4.3-5** were reduced by a range of 0, 15, 25, and 30 percent to account for geochemical attenuation. Cadmium was considered to be fully chemically attenuated due to precipitation reactions with carbonate minerals in the vadose zone under the overburden fills.

The groundwater flow and fate and transport modeling description is provided in the Groundwater Flow and Solute Transport Modeling Report (JBR 2007). Solute concentrations in groundwater at specific locations within the model domain were calculated. These specific locations are listed below and shown on **Figure 4.3-2**.

- East boundary of the northern Manning Lease area (Observation Point A)
- East boundary of the southern Manning Lease area (Observation Point B)
- East boundary of the South Manning Lease Modification area (Observation Point C)
- East boundary of the Deer Creek Lease area (Observation Point D)
- Point of groundwater discharge to Lower Deer Creek
- Books Spring
- South Fork Sage Creek Spring
- Point of groundwater discharge to Crow Creek

Peak modeled concentrations and times are shown for the COPCs at the above listed locations in **Tables 4.3-8** and **4.3-9**. Concentrations that exceed an applicable groundwater or surface water standard are shown in bold face. The Idaho groundwater standards are based, in part, on

EPA MCLs for drinking water. Groundwater primary standards are based on protecting human health and secondary standards are aesthetically based.

The values shown in **Table 4.3-8,** for the Proposed Action**,** show that manganese and selenium peak concentrations at observation points A and D are estimated to exceed groundwater standards at the listed times. It is because of these exceedances with the Proposed Action, that the Agencies developed Mining Alternative D with protective measures sufficient to decrease water quality impacts to below groundwater and surface water standards.

TABLE 4.3-8 PEAK CONCENTRATIONS AT GROUNDWATER OBSERVATION POINTS FOR PROPOSED ACTION

SOLUTE	POINT A		POINT B		POINT C		POINT D	
	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)
Cr	54	0.001	22	0.0003	23	0.0004	23	0.005
Mn	47	0.032	20	0.008	21	0.011	23	0.06
SO4	50	48	21	12	22	16	26	87
Zn	46	0.08	19	0.02	21	0.03	24	0.1
Se 0% Atten.	47	0.067	20	0.017	21	0.023	23	0.070
Se 15% Atten.	47	0.057	20	0.014	21	0.019	23	0.059
Se 25% Atten.	47	0.050	20	0.013	21	0.017	23	0.053
Se 30% Atten.	47	0.047	20	0.012	21	0.016	23	0.049

Groundwater secondary standard for manganese is 0.05 mg/L. The groundwater primary standard for selenium is 0.05 mg/L.

TABLE 4.3-9 PEAK CONCENTRATIONS AT GROUNDWATER DISCHARGE POINTS FOR PROPOSED ACTION

SOLUTE	SF SAGE CREEK SPRING		BOOKS		DEER CREEK		CROW CREEK	
	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)
Cr	108	0.0003	69	0.0003	51	0.0009	80	0.0003
Mn	96	0.005	70	0.004	52	0.012	81	0.004
SO4	100	7	317	7	56	18	371	6
Zn	95	0.01	361	0.01	53	0.02	394	0.01
Se 0% Atten.	97	0.010	70	0.004	52	0.014*	81	0.004
Se 15% Atten.	97	0.009	70	0.0037	52	0.012*	81	0.0036
Se 25% Atten.	97	0.008	70	0.003	52	0.011*	81	0.003
Se 30% Atten.	97	0.007	70	0.0028	52	0.010*	81	0.0028

* Concentration in groundwater discharge to creek before mixing groundwater discharge with stream water.
Surface water quality standard for selenium is 0.005 mg/L.

Calculated selenium concentrations in groundwater decrease with increasing amounts of applied selenium attenuation but would still exceed groundwater standards within the range of attenuation selected by the Agencies for the impact analysis. This would be a major, local effect on groundwater quality for a long-term. It should be noted that the groundwater standard for manganese is a secondary standard based on aesthetic reasons and not human health. Maximum concentrations of chromium, sulfate, and zinc are calculated to be below the groundwater standards at the downgradient lease boundaries. **Figure 4.3-3** shows the maximum extent of the area within the aquifer where the estimated selenium concentration

Figure 4.3-2 Location of Points for Modeled COPC Concentrations

Figure 4.3-3 0.05 mg/L Selenium Plume at 47 yrs., Proposed Action

exceeds the groundwater standard for selenium (i.e., groundwater plume with no selenium attenuation). This would occur at 47 years after selenium seepage began to enter the groundwater under the mine panels. The plumes for the model cases with increasing amounts of selenium attenuation would be smaller than that shown. The maximum extent of these plumes would be confined to a limited area of the CTNF under steep mountain terrain with no current or likely future groundwater supply wells. Drinking water sources would not be impacted by these plumes, which would have no affect on human health.

The peak values in **Table 4.3-9** for the locations of groundwater discharging to surface water show that selenium in these groundwater discharges is estimated to exceed the surface water standard at South Fork Sage Creek Spring and lower Deer Creek for the Proposed Action. This would be a major, local effect on surface water quality for a long-term. It should be noted that the referenced selenium surface water standard (0.005mg/L) was established for protection aquatic life and is ten times lower than the human drinking water standard for selenium. The peak concentrations of all the other COPCs are estimated to be less than applicable surface water standards at all the discharge locations. Concentrations for sulfate and zinc peak later at Books Spring and Crow Creek because their concentrations in Panel G overburden leachate do not fall as quickly as the other COPCs.

Concentration of selenium in groundwater discharged to lower Deer Creek (**Table 4.3-9**) would be diluted by surface water flow entering lower Deer Creek from above. The main stem and south fork of Deer Creek are intermittent, but there is perennial flow into lower Deer Creek from the north fork of Deer Creek. The groundwater discharged into lower Deer Creek mixes with the water flowing into this reach from the flows from upstream. This surface water flow is lower in selenium concentration than the predicted peak groundwater concentrations under the Proposed Action at lower Deer Creek thus it would dilute the solute concentrations in the groundwater discharge, but not enough to reduce the selenium concentrations shown in **Table 4.3-9** to less than the surface water standard (0.005 mg/L). The groundwater flow rate from the regional Wells formation aquifer is likely relatively constant as evidenced by relatively constant flows, over the long term, at the major Wells formation springs in the area. Flow rates may be expected to vary from the long-term average within short time frames. During spring runoff and intermittent flow from storm water runoff, the dilution factor for the mixed surface water and groundwater in lower Deer Creek is expected to be high, thus selenium concentrations in lower Deer Creek under these flow conditions are expected to be low. During low-flow conditions (summer/fall/winter) the dilution factor would be relatively low and selenium concentrations in the stream would be highest.

The dilution factor during low-flow conditions would vary with the relative proportions of water flowing into lower Deer Creek from upstream and the amount of groundwater discharged to the creek. This ratio would vary seasonally and from year to year. When the DEIS was released, the available streamflow data and chemistry for Deer Creek was used to estimate the diluted concentrations in lower Deer Creek. For this FEIS, the additional streamflow and chemistry data collected in 2005, 2006, and 2007 by Simplot, the Agencies, and Greater Yellowstone Coalition have been used to update the dilution factors for lower Deer Creek and the other surface streams in the Project Area. These are further discussed in **Section 4.3.2** and the predicted surface stream values are shown in **Tables 4.3-19, 22,** and **23**).

Figure 4.3-4 shows the selenium groundwater plume at 100 years for the surface water standard (0.005 mg/L). The time frame of 100 years is roughly coincident with the longest time for the peak concentration of selenium at the groundwater discharge locations. Local recharge from seasonal stream infiltration is the cause of the small area of lower selenium concentration under Manning Creek.

It should be noted that the term groundwater "plume" as used in this EIS means that the modeled concentration of selenium in the Wells formation aquifer everywhere within the boundary of the plume is greater than the referenced standard. When showing the plume for the surface water standard, this means that inside the plume area, selenium concentrations in the aquifer are greater than 0.005 mg/L. This plume only affects overlying surface streams at specific locations where groundwater from the Wells formation aquifer discharges to the surface. Concentrations of selenium in the groundwater that are less than 0.05 mg/L are in compliance with the state groundwater standard of 0.05 mg/L which is a human health standard based on drinking water. Comparison of the plume shapes in **Figures 4.3-3 and 4.3-4** indicates that most of the plume areas shown in **Figure 4.3-4** contain selenium concentrations that are less than 0.05 mg/L.

The model was run to simulate sufficiently long timeframes to observe the increase in concentration of solutes at the discharge locations to the peak concentration times and then observe the decrease in concentrations thereafter. For the lower Deer Creek and South Fork Sage Creek Spring groundwater discharges, selenium concentrations rise from background levels to the peak concentrations in approximately 40 and 80 years respectively and then steadily decrease to about half the peak concentration in about 300 years from the beginning of the model period (JBR 2007).

The peak times estimated in the modeling assume steady-state conditions that are established at the start of the modeling. That is, all flows through the overburden fills and unsaturated zones beneath the overburden fills are fully established at the beginning of the modeled period. This is an artificial simplification made for modeling purposes that would not be expected in the real field conditions because it will take some time for seepage from the top of the overburden to reach the bottoms of the fills and percolate through the unsaturated zone between the base of the overburden fills and the aquifer water table. This time lag is difficult to accurately estimate. Field observations in Southeastern Idaho of phosphate mine overburden fills have indicated that some overburden fills have not yet developed any noticeable seepage from their bases whereas seepage has been observed from specific locations at the bases of other overburden fills in less than 10 years. For these reasons, estimating a lag time for the peak concentrations in the groundwater due to wetting up the overburden fills was not included in the groundwater impact analysis, and the time estimates to arrive at the peak concentrations shown in this impact analysis do not include lag times for unsaturated flow in the overburden fills and underlying unsaturated zones in the Wells formation. It is likely that actual times to maximum concentrations in the groundwater would be longer than indicated by the modeling.

Figure 4.3-4 0.005 mg/L Selenium Plume at 100 yrs., Proposed Action

The agencies also acknowledge that the steady-state conditions used for groundwater fate and transport modeling do not represent potential ground water or surface water impacts during active mining operations; rather they describe predicted impacts to water resources after completion of reclamation activities. Portions of the mine expansion area will be developed and then reclaimed over an estimated 16-year period. The agencies have observed episodic flushes of selenium into the groundwater within the existing extraction areas at Panel A, and more recently at Panel E, most likely caused by meteoric water contacting seleniferous material during rain storms and/or snow melt events and then entering the groundwater system. It is possible there could be some short-term impacts as the Panels F and G pits are excavated. However, there are numerous environmental protection measures (**Section 2.5, and Appendix 2D**) in the mine plan to limit contact between meteoric water and seleniferous material including: excavated portions of the pits would be reclaimed as soon as possible through concurrent reclamation; clean run-on water would be diverted around the mine; run-off water would be directed to settling ponds to encourage evaporation; run-off and sediment control facilities would located off of seleniferous overburden; and accumulated snow would not be placed on seleniferous material.

As unforeseen, short-term impacts may still occur, they would be dealt with as part of the mine oversight program. The mine's response and the agency response and enforcement actions would focus on specific occurrences and determination of respective causes and solutions. Practices would be modified and new mitigative measures may have to be developed and added to the Mine and Reclamation Plan to address these unforeseen short-term issues (**Appendix 2E**).

<u>Groundwater Model Sensitivity Analysis</u>
There is uncertainty related to the accuracy of the model inputs, including aquifer parameters. All model results are based on these inputs. The effects of the uncertainty of the aquifer parameters are discussed in the modeling report as well as sensitivity analyses that were conducted (JBR 2007).

The following groundwater flow parameters were tested for sensitivity: hydraulic conductivity, recharge, and porosity. The model was least sensitive to hydraulic conductivity, as either doubling or halving the hydraulic conductivity varied the estimated groundwater discharge by less than 6 percent.

Changing recharge in the model domain had a greater impact than changing hydraulic conductivity. Doubling and halving the areal recharge increased and decreased total discharge by about 31 percent. Doubling underflow into the model along the south and west model boundaries increased total discharge by 113 percent while halving the same underflow caused a reduction in total flow of 24 percent. Such large perturbations in recharge to the model domain are not considered likely in actual fact because the water balance used in the model was based on measured discharges from the regional aquifer, and these flows are known to be relatively stable.

Varying porosity in the body of the groundwater model had a pronounced effect on the estimated flow velocities of groundwater in the model. Decreasing porosity of the Wells formation aquifer by 10 percent to 0.01 decreased the advective time from the edge of the Phosphoria formation to the east edge of the model to only 5 years. The porosity used in the model, 0.10, yielded flow durations of about 30 to 60 years, which is consistent with the isotopic results for the groundwater discharges indicating recharge of water occurred within about 50 years (JBR 2007). The values of hydraulic conductivity and porosity estimated from previous pump tests at the Smoky Canyon Mine appeared to produce reasonable results in the groundwater model.

The following solute transport parameters were tested for sensitivity: solute concentration in seepage, seepage quantity, dispersion, and relative amount of preferential flow. The model was most sensitive to solute concentration in seepage. Doubling and halving the concentrations resulted in changes in concentrations at the groundwater discharge points of plus and minus 67 percent. Based on comparisons of the column test selenium concentrations used in the modeling with seep chemistry data from Southeastern Idaho and Smoky Canyon Mine (Buck, Mayo and Schmiermund 2005), it is more likely that actual selenium concentrations in the overburden seepage would be less than those used in the analysis. This is one reason why the modeling is considered to be conservative (over predicts water quality impacts).

The model was slightly less sensitive to changes in seepage quantity through the overburden fills. Doubling and halving the seepage rate resulted in changes in groundwater concentrations of 40 to 60 percent respectively. Inasmuch as the modeling was conducted with recharge rates that assumed no mitigation of water infiltration into the overburden, it is considered more likely that a reduction in seepage rate would occur instead of increasing it.

The model is not very sensitive to changes in dispersivity. Dispersivity is a measure of the mechanical dispersion property of an aquifer and is dependent on vertical and horizontal permeability differences. Doubling dispersivity caused concentrations at discharge points to generally decrease by 16 to 36 percent. Halving dispersivity generally increased concentrations at these points by 10 to 21 percent.

Groundwater quality at the discharge points is not very sensitive to the amount of preferential flow through the overburden, or the time frame for each pore volume to pass through the overburden. Changing the amount of overburden wetted from 50 percent to 75 percent increased selenium concentrations at the discharge points by 6 to 11 percent. Halving the amount of wetted overburden to 25 percent reduced selenium concentrations by 14 to 25 percent. It is more likely that the amount of overburden that is actually wetted is less than the value used in the modeling (50 percent), which is one reason why the modeling is considered to be conservative.

Groundwater Quality Impact for Wells Formation due to Panel E Pit Backfill

The groundwater effects of backfilling the E-0 pit were not modeled as this area was outside the model domain. However, there are very strong similarities between Panels E and F that can be used to estimate the effects on groundwater as a result of backfilling this pit.

The overburden backfill and groundwater flow characteristics in Panel E are expected to be very similar to those under the northern portion of the Panel F backfill. The lithology and leaching characteristics of the overburden used in the backfill in both panels is similar material. The characteristics of the seepage through the Panel E backfill, both in rate and chemistry, are expected to be very similar to those estimated for Panel F. The groundwater regime under the Panel E backfill is also similar to that under Panel F. In both cases, the groundwater that could be affected is contained in the Wells formation and is flowing toward the east. Past studies of the groundwater at the Smoky Canyon Mine suggested the groundwater flowing under Panel E discharges at Hoopes Spring (JBR 2001c) and more recent data indicates that some portion of the groundwater below Panel E discharges at South Fork Sage Creek Spring (NewFields 2007b).

The similarities in seepage chemistry and groundwater flow for the E-0 pit suggest that groundwater chemistry impacts downgradient of the E-0 pit backfill alone would be similar to those estimated for the northern part of Panel F.

A big difference between the existing E-0 pit site and the proposed Panel F backfill is that the area surrounding Panel E has already been used for overburden disposal in upgradient (west) pit backfills and an external overburden fill downgradient (east) of the E-0 pit. The overburden placed in these locations was mined at Panel E and may not have exactly the same lithology and geochemistry as Panel F. The COPCs in seepage through the existing Panel E overburden fills are expected to be the same as Panel F but the concentrations in the seepage could be different. This seepage through the existing overburden fills around the E-0 pit would affect groundwater chemistry in addition to any effects caused by the E-0 pit backfill. The groundwater effects from the existing Panel E overburden fills are outside of the scope of this EIS and are being studied under separate AOC studies being conducted under the authority of the USFS, IDEQ, and other agencies. Taken in concert with the existing situation around the E-0 pit, the effect of the seepage through the E-0 pit backfill would likely be minor, local, and long-term.

Proposed Action Effects on Springs

Certain springs or seeps could be affected by the proposed disturbance; their locations relative to the Proposed Action components are shown in **Figure 3.3-3**. These are described in **Table 4.3-10** and are discussed in the following sections.

TABLE 4.3-10 GROUNDWATER DISCHARGES POTENTIALLY AFFECTED BY THE PROPOSED ACTION

SPRING/SEEP	FLOW (CFS)	POTENTIAL EFFECT
PANEL F		
SP-UTSFSC-100	0.01	Physically disrupted by mining Panel F
SP-UTSFSC-200	0.01	Physically disrupted by mining Panel F
SP-MC-300	0.04	Physically disrupted by mining Panel F
SP-UTNFDC-400	0.005	Physically disrupted by mining Panel F
SP-UTNFDC-600	0.007	Physically disrupted by mining Panel F
SP-SFSC-750	4.5*	Water quality affected by seepage from overburden
SP-UTSC-850	0.0007	Water quality affected by seepage from overburden
SP-UTNFDC-540	0.014	Reduced upgradient recharge by mining Panel F
SP-UTNFDC-530	NM	Reduced upgradient recharge by mining Panel F
PANEL G		
SP-UTDC-800	0.002	Physically disrupted by mining Panel G
SP-UTDC-700	0.003	Reduced upgradient recharge by mining Panel G
SP-UTWC-300	0.09	Covered by overburden from Panel G
SP-UTSFDC-500	0.002	Covered by overburden from Panel G
SP-DC-100	0.004	Covered by road fill from West Haul/Access Road
SP-DC-120	NM	Covered by road fill from West Haul/Access Road
SP-WC-400	0.3	Water quality affected by seepage from overburden
SP-UTSFDC-600	Wet	Water quality affected by seepage from overburden
SP-Books	2.9*	Water quality affected by seepage from overburden
Lower Deer Creek	0.9*	Water quality affected by seepage from overburden
Crow Creek	1.8*	Water quality affected by seepage from overburden

Note: Flow rates are approximate averages from measurements in Maxim (2004d) except where indicated with "*", which are flow rates used in groundwater modeling.
One cfs = 449 gpm, NM=not measured, Wet=immeasurable low flow

4.3.1.1 Proposed Action

Groundwater and Surface Water Impacts on Public Health

The water quality impacts of the Proposed Action on the Wells formation aquifer are shown by the modeling to exceed the state primary groundwater standard for selenium (0.05mg/L) under and downgradient of the lease boundaries in two defined areas (plumes), Panel G and the northern end of Panel F (**Table 4.3-8** and **Figure 4.3-3**). Within the area of these plumes the concentration of selenium in groundwater would be greater than the primary groundwater standard and outside of these plumes the groundwater concentration would comply with the standard. The modeling also shows that these plumes of potential exceedance extend less than ½ mile downgradient from the lease boundaries. These areas of potential groundwater contamination would not pose a threat to public health because there are no water supply wells located on the CNF downgradient of the leases in these areas. The rough, mountainous terrain and the federal land management of the land surface over these plumes makes it extremely unlikely that any drinking water wells would be drilled in the future within the area of the plumes. There are no discharges of groundwater from the Wells formation aquifer to the surface environment within the boundaries of these plumes. For these reasons, there would be no risk to human health from these plumes.

The calculated peak selenium concentrations in groundwater at discharges to surface streams downgradient of the Proposed Action mining operations are shown in **Table 4.3-9**. The peak selenium concentrations would be greater than the surface water standard of 0.005mg/L. This standard was established by the EPA for protection of aquatic life and is 10 times less than the drinking water standard established for protection of human health (0.05mg/L). The selenium concentrations shown in **Table 4.3-9** are at the groundwater discharge points to the streams and these concentrations would be less in Crow Creek downstream. Although surface water downstream of the Proposed Action is not used as a drinking water source for human consumption, the selenium concentration in the surface water resulting from the Proposed Action is predicted to be well below the drinking water standard for selenium. Thus, there would be no risk to human health from selenium due to consumption of this water.

Selenium in surface streams can bioaccumulate in various media within aquatic habitats leading to concentrations in fish that are higher than in the water. The potential for this to occur in the Project Area and the possible impacts to human health are described in **Section 4.8**.

Panel F, Including Lease Modifications (Component of Agency Preferred Alternative)

Groundwater quality impacts to the Wells formation aquifer from meteoric water leaching of the Panel F backfill has been described above in **Tables 4.3-8** and **4.3-9** and **Figures 4.3-3** and **4.3-4**. Quality of groundwater under and immediately downgradient of the mine panel backfill would be affected by increased concentrations of COPCs. The modeled peak concentrations of these solutes were less than the applicable groundwater quality standards at the down gradient lease boundaries with the exception of selenium at Observation Point A.

Much of the Wells formation groundwater that discharges at South Fork Sage Creek Spring (SP-SFSC-750) flows under Panel F and quantities of COPCs added to this groundwater under the mine panel would flow eastward toward the thrust fault and then north along the fault to discharge at South Fork Sage Creek Spring. Modeled peak concentrations of COPCs at this spring for the Proposed Action were all less than the applicable surface water quality standards with the exception of selenium. Selenium concentrations are estimated to peak at about 100 years from when the COPCs are added to the groundwater and the calculated peak selenium concentration of water impacted by Panel F at the spring discharge (0.007 to 0.010 mg/L) would exceed the surface water standard (0.005 mg/L). Baseline data indicate the selenium concentration in Wells formation groundwater upgradient of the spring at MC-MW-1 is below the detection limit for selenium (Maxim 2004d, NewFields 2007a). The effect of the Proposed Action on the water quality of this spring would be major, long-term, and local (see page 4-1 for definitions).

The small spring (SP-UTSC-850) located along the Meade Thrust Fault south of South Fork Sage Creek Spring (**Figure 3.3-3**) was not included in the groundwater modeling because of its small flow and uncertainty if it was connected to the Wells formation aquifer. If the spring is supported by shallow, alluvial groundwater flow, it might not be affected by the mining activities. If it is connected to the same groundwater flow system along the fault zone as South Fork Sage Creek Spring, it is expected to exhibit similar water quality effects to water chemistry.

The springs/seeps that are described in **Table 4.3-10** as being physically disrupted by mining Panel F would be excavated by the mining activity and the ground at the seep/spring site broken up and removed. Reclamation would replace overburden back into these locations but the hydraulic conditions that naturally supported the spring/seeps could not be restored to pre-mining conditions. Therefore, it is assumed that these springs/seeps would be permanently removed by the mining. Panel F mining operations would disrupt five small springs located within the disturbance footprint of the mine panel. One of these springs, SP-MC-300 is located just west of the Panel F highwall and could potentially be outside the disturbance limits but is assumed for this impact analysis to be likely disrupted by the mining operations. The effect of the Proposed Action mining on these disrupted springs would be moderate to major, site-specific, and long-term.

For the two Panel F springs and seeps identified in **Table 4.3-10** as potentially being affected by reduced upgradient recharge, mining would excavate the Rex Chert and/or Meade Peak members uphill from the seep or spring location. This would replace part of the existing, shallow groundwater flow conditions upgradient of the seep or spring with a backfilled mine pit that would likely redirect most recharge downward to the Wells formation. This redirection of the recharge could reduce lateral, shallow groundwater flow to the spring/seep in question. Backfilling the pit against the Rex Chert highwall could result in seleniferous pit backfill leaching small quantities of COPCs into the Rex Chert. Any added amounts of these COPCs could potentially flow to the downhill springs. These effects are uncertain because the exact groundwater sources and upgradient flow conditions for the listed springs/seeps are not known. The effect of the Proposed Action mining on these springs with reduced recharge would be moderate to major, site-specific, and long-term.

<u>Panel F Haul/Access Road (Component of Agency Preferred Alternative)</u>
The Panel F Haul/Access Road would largely be built over the outcrop area of the Wells formation with clean fill obtained from cuts in that lithology. There should be no impacts to groundwater quality or flow from this road. There are no mapped seeps or springs that would be affected by construction of this road.

<u>Panel G (Component of Agency Preferred Alternative)</u>
Groundwater quality impacts in the Wells formation aquifer from meteoric water leaching of the Panel G backfill has been described above in **Tables 4.3-8** and **4.3-9** and **Figures 4.3-3** and **4.3-4**. Quality of groundwater under and immediately downgradient of Panel G at the lease boundary would be affected by increased concentrations of COPCs. The modeled peak concentrations of these solutes were less than the applicable groundwater quality standards at Observation Point D with the exception of selenium and manganese, which are estimated to

exceed their respective groundwater standards (**Table 4.3-8**). The effect of mining on the groundwater quality under and down gradient of Panel G under the Proposed Action would be major, local, and long-term.

Field observations and the groundwater modeling indicate that Wells formation groundwater flowing under Panel G in the Wells formation aquifer can discharge to the surface environment at lower Deer Creek, Books Spring, and Crow Creek upstream of Books Spring. Modeled peak concentrations of all COPCs at Books Spring and discharge to Crow Creek are greater than background and lower than applicable surface water standards (**Table 4.3-9**). Modeled peak concentrations of COPCs at lower Deer Creek indicate all COPC concentrations in groundwater at the spring discharge would be less than the applicable surface water quality standards with the exception of selenium. Selenium concentrations in groundwater affected by the Proposed Action are estimated to peak at about 50 years from when the COPCs are added to the groundwater, and the resulting peak selenium concentration in the groundwater discharged to the creek (0.010 to 0.014 mg/L) is estimated to exceed the surface water standard (0.005 mg/L). This groundwater discharge would be diluted by stream water to lower concentrations as discussed in **Section 4.3.2**. The effect of mining Panel G on the water quality of this reach of Deer Creek would be major, local, and long-term.

The Panel G South Overburden Fill would be located over outcrop of the Rex Chert and would be constructed of chert with a topsoil cover. Baseline studies have shown that the Rex Chert member in this location contains groundwater (**Section 3.3.5**). Aquifer parameters and average water quality chemistry for the Rex Chert aquifer in this area have been determined from well DC-MW-3 located a short distance north of the South Overburden Fill (**Figure 3.3-8**).

The Rex Chert is contained on top of the Meade Peak member aquitard within the downward-folded Webster Syncline (Section D-D', **Figure 3.1-3**). This fold plunges toward the north-northeast, meaning the bottom of the Rex Chert is inclined toward the north-northeast, and the groundwater within the Rex Chert is also moving in that direction. The Panel G South Overburden Fill is located over an outcrop area of the Rex Chert in the narrow portion of the syncline. Downward percolating recharge water through the overburden placed in this fill would eventually enter the groundwater in the Rex Chert and affect its water chemistry.

Column testing of the Panel G chert overburden material indicated the results shown in **Table 4.3-6**. The average pore volume analytical results shown in **Table 4.3-9** were used to characterize the seepage from the Panel G South Overburden Fill to the deep groundwater system. As discussed before, cadmium was determined to be fully attenuated by reaction with alkalinity in the soil and bedrock underlying the overburden fill.

Seepage from the overlying chert overburden (annual average 11.6 gpm) was mixed with the amount of Rex Chert groundwater estimated to flow under the overburden fill (3.8 gpm), having the baseline water quality shown in **Table 4.3-11** yielding the final concentrations shown in the table.

These results indicate that COPC concentrations in the Rex Chert groundwater after mixing with the overburden seepage (total concentration) are expected to be greater than background but would not exceed any surface water or primary (health-based) groundwater standards. Manganese is estimated to exceed the secondary (aesthetics-based) groundwater standard. The effect of this overburden fill on the water quality of the Rex Chert aquifer would be minor, local, and long-term.

TABLE 4.3-11 COPC CONCENTRATIONS IN REX CHERT GROUNDWATER UNDER THE PANEL G SOUTH OVERBURDEN FILL

ANALYTE	BACKGROUND CONC.	MODELED SEEPAGE CONC.	MODELED FINAL CONC.	SW/GW STANDARDS
Cr	0.00015	0.002	0.0015	0.01 / 0.1
Mn	0.0135	0.235	0.181	NS/0.05s
Se	0.00058	0.003	0.0024	0.005 / 0.05
SO_4	38.1	8	15.4	NS/250s
Zn	0.00073	0.05	0.04	0.105 / 5.0s

Note: Background groundwater concentrations shown are the average of samples obtained from DC-MW-3 on 10/11/03 and 6/30/04 (Maxim 2004d). Seepage concentrations are average of PV1 – PV10 for Panel G Chert. Final concentrations are equal to: background conc. x 0.247 + seepage conc. x 0.753.

SP-WC-400 is described as discharging from the Rex Chert at the contact with the Meade Peak member (Maxim 2004c). This spring is located about 200 feet downhill from the proposed toe of the Panel G South Overburden Fill **(Figure 3.3-3**). The potential groundwater chemistry impact to the Rex Chert aquifer under this overburden fill was previously described. The water chemistry of groundwater discharging at SP-WC-400 could be affected the same as the Rex Chert aquifer under the Panel G South Overburden Fill in this area (**Table 4.3-11**). The actual chemistry effect to this spring would likely be less than to the groundwater under the overburden fill because Rex Chert groundwater under the overburden fill is thought to be moving toward the northeast, and the spring is located south of the overburden fill. Effects would be primarily from manganese; the other COPCs could be above baseline but below applicable standards.

SP-UTSFDC-600 is a very small seep located immediately north of the Panel G South Overburden Fill within an area underlain by Rex Chert (**Figure 3.3-3**). If the water discharged at the seep is only from the Rex Chert aquifer, its chemistry could be affected the same as the Rex Chert aquifer under the nearby Panel G South Overburden Fill (**Table 4.3-11**).

In addition to impacting water quality, the Proposed Panel G would also impact water quantity. A small spring located within the footprint of the Panel G pit (SP-UTDC-800) would be physically disrupted by mining and would be eliminated (**Figure 3.3-3**). Another small spring downhill of Panel G (SP-UTDC-700) could have its flow reduced or eliminated because the Panel G excavation would decrease the uphill recharge area. The effect of mining on these springs would be major, local, and long-term.

Groundwater flow to the springs/seeps that would be covered by overburden or road fills would not necessarily be physically disrupted, but the seeps/springs would be buried and removed from their current surface environment. Groundwater flow could still discharge at these locations under the overburden or road fill material. Whether or not these springs/seeps would eventually discharge again to the surface environment through the fill material cannot be accurately predicted. Groundwater discharging at these new downslope locations may be chemically affected by passing through the overburden or road fill material. Two springs that would be covered with the Panel G South Overburden Fill (SP-UTWC-300 and SP-UTSFDC-500) would be covered with chert that has low potential to generate problematic concentrations of COPCs. The effect of mining Panel G on these springs would be major, site-specific, and long-term.

For mining Panel G, Simplot proposes to install a water supply well at the west side of the panel that would obtain an average of 100 gpm from the Wells formation (**Figure 2.4-1**). Water for dust control and other uses at Panel F would be hauled in water trucks from the existing Smoky Canyon Mine. This well would be pumped as needed (primarily in summer and fall) during the life of that mine panel. An estimate of the extent of the draw down from this well on the Wells formation aquifer was made using the same groundwater model described in **Section 3.3.6**. For this modeling, it was estimated that the well pumped at 100 gpm, and the maximum extent of the draw down was delineated for the steady state condition. This showed that maximum draw down at the well would be approximately 20 feet. Modeled draw down was negligible at the nearest points of discharge for the Wells formation aquifer, Stewart Spring, and Lower Deer Creek, over two miles away from the pumping well. There are no other water wells or springs tapping this aquifer within the predicted area of noticeable draw down. The amount of water removed from the well each year, assuming constant pumping, approximately 161 acre-feet per year, is about 1.5 percent of the estimated annual recharge for the model area, 11,100 acre-feet per year. The Proposed Action well would produce a negligible, local and short-term effect on the water table in the Wells formation aquifer.

Panel G West Haul/Access Road (Component of Agency Preferred Alternative)
The Panel G West Haul/Access Road would not affect groundwater quality or flow. The road fill may cover two springs, SP-DC-100 and SP-DC-120 in the upper reaches of the Deer Creek drainage (**Figure 3.3-3**).

Power Line Between Panels F and G
The power line from Panel F to Panel G would not affect groundwater quality or flow.

4.3.1.2 Mining Alternatives

The effects of the different Mining Alternatives on water quality in the Wells formation aquifer were modeled separately and are discussed in the following narrative. The selenium concentrations were estimated by the groundwater model at the same observation points and groundwater discharges discussed for the Proposed Action (**Table 4.3-12**).

TABLE 4.3-12 MODELED PEAK SELENIUM CONCENTRATIONS IN GROUNDWATER FOR MINING ALTERNATIVES A TO C (MG/L)

LOCATION	TIME (YR)	PA	ALT. A	ALT. B	ALT. C
Point A	47 - 60	0.067	0.067	0.051	0.052
Point B	20 - 22	0.017	0.017	0.017	0.017
Point C	18 - 23	0.023	0.000	0.023	0.023
Point D	23 - 26	0.070	0.070	0.056	0.056
SF Sage Sp.	85 - 109	0.010	0.008	0.009	0.010
Books Sp.	70 - 326	0.004	0.004	0.004	0.004
Deer Creek	52 - 55	0.014*	0.014*	0.013*	0.013*
Crow Creek	81 - 374	0.004	0.004	0.003	0.003

* Concentration in groundwater discharge to creek before mixing groundwater discharge with stream water.

Note that the results shown in **Table 4.3-12** do not include the effect of selenium attenuation. This was done to allow a less complicated comparison between the Alternatives than showing all the results for the complete range of selenium attenuation. The effects of selenium attenuation on the Alternatives would be similar in nature and degree to that shown for the Proposed Action (**Tables 4.3-8 and 4.3-9**). For example the effect of 30% selenium attenuation on the Proposed Action concentration for groundwater affected by Panel F discharging at South Fork Sage Creek Spring would be to reduce it from 0.010 mg/L to 0.007 mg/L. A similar effect on the selenium concentration at the same location and attenuation value for Mining Alternatives A and B would be to reduce those concentrations from 0.008 and 0.009 mg/L to approximately 0.006 mg/L. The effect on selenium concentration for Alternative C would be the same as that for the Proposed Action, i.e., a reduction from 0.010 mg/L to 0.007 mg/L. After applying the maximum selenium attenuation to all the Mining Alternatives, the selenium concentration for groundwater affected by Panel F discharging at South Fork Sage Spring is still greater than the surface water standard of 0.005 mg/L

Mining Alternative A – No South and/or North Panel F Lease Modifications
Groundwater quality impacts from Panel F would be reduced under this alternative compared to the Proposed Action because the surface area of ROM backfill would be reduced by the portion of the open pits that would be in the North and South Lease Modification areas.

No Panel F North Lease Modification
The reduction in pit backfill surface area for the North Lease Modification is only 2 acres compared to the 435 acres of the rest of the Proposed Action Panel F mine area. This 0.5 percent reduction would have a negligible effect on the groundwater quality impact for Panel F compared to the Proposed Action.

No Panel F South Lease Modification
The reduction in pit backfill surface area for the South Lease Modification is 138 acres, or about 32 percent of the Proposed Action Panel F backfill area. The groundwater model was run for this alternative to estimate the groundwater quality impacts.

The only COPC modeled in Alternatives A, B, and C was selenium because its groundwater impacts in the Proposed Action were greater than other COPCs and none of the other COPCs exceeded any applicable surface water standards. The main difference in source characterization for Alternative A is the elimination of the pit backfill in the South Lease Modification area. The peak selenium concentrations and times at the groundwater observation point for Alternative A are shown in **Table 4.3-12**.

Modeled concentrations exceeded the groundwater standard at observation points A and D in Alternative A. **Figure 4.3-5** shows the selenium plumes with no selenium attenuation for the groundwater standard at 48 years when concentrations peaked in Observation Point A. These results at the observation points are essentially the same as for the Proposed Action. The effects of selenium attenuation on these results would be the same as for the Proposed Action, i.e., the groundwater standard for selenium would still be exceeded with 15 to 25 percent attenuation and would be slightly less than the standard for 30 percent attenuation.

Modeled selenium concentrations exceeded the surface water standard of 0.005 mg/L at South Fork Sage Creek Spring and lower Deer Creek. **Figure 4.3-6** shows the selenium plume with no selenium attenuation at the surface water standard concentration at 100 years, which is approximately the time the concentrations peak at South Fork Sage Creek Spring. The groundwater discharge result at lower Deer Creek is the same as for the Proposed Action (0.014 mg/L) for no selenium attenuation down to 0.010 mg/L with 30 percent attenuation. This would be diluted to lower concentrations in the stream as is discussed in **Section 4.3.2**. The maximum selenium concentration for groundwater affected by Panel F discharging at South Fork Sage Creek Spring in Alternative A (0.008 mg/L) is less than the result for the Proposed Action (0.01 mg/L) and occurs a few years sooner, 85 years in Alternative A compared to 97 years for the Proposed Action. Incorporating selenium attenuation in this result would reduce this concentration to as low as 0.006 mg/L, which is still just over the surface water standard. The effect of this alternative on the groundwater quality under and down gradient of the mine panels would be major, local, and long-term.

The most noticeable difference between Alternative A and the Proposed Action results is the size and distribution of the Panel F plume. The southern portion of the Panel F plume in Alternative A is essentially gone compared to the Panel F plume for the Proposed Action, and the peak selenium concentration at South Fork Sage Creek Spring is less. These reductions occur because the contaminant source in the South Lease Modification Area of Panel F is eliminated in Alternative A compared to the Proposed Action. This is also likely the reason why the concentration peaks in South Fork Sage Creek Spring a little earlier in Alternative A compared to the Proposed Action.

If the South Lease Modification was not mined, four springs (SP-UTNFDC-400, SP-UTNFDC-530, SP-UTNFDC-540, and SP-UTNFDC-600) that would or could be affected by the Proposed Action would be left unaffected.

Groundwater impacts to water quality and quantity from Panel G would remain the same under this alternative as for the Proposed Action.

Mining Alternative B – No External Seleniferous Overburden Fills

The only COPC modeled in Alternative B was selenium for the same reasons as Alternative A. The main difference in source characterization between this alternative and the Proposed Action is that long-term disposal of seleniferous overburden is eliminated from external overburden fills for both panels. The peak concentrations and times for selenium are shown in **Table 4.3-12**.

Modeled selenium concentrations exceeded the groundwater standard at Observation Points A and D in Alternative B. **Figure 4.3-7** shows the selenium plumes with no selenium attenuation for the groundwater standard at 50 years, when concentrations peaked in Observation Point A. The shapes of these plumes are very similar to those for the Proposed Action. The peak concentration at Observation Point A under this alternative (0.051 mg/L) is less than the Proposed Action (0.067 mg/L). The peak concentration at Observation Point D (0.056 mg/L) is less than the Proposed Action (0.07 mg/L). These reductions are due to reduced surface area of seleniferous overburden up gradient of these observation points. Incorporating 15 to 30 percent selenium attenuation in these results would reduce them to the point where the groundwater standards would be complied with at all observation points for all attenuated results. However, these reductions in groundwater concentrations may be overstated because the model runs assumed there would be no seleniferous overburden in the external overburden fills at any time, whereas there would be temporary storage of seleniferous overburden in the overburden fills during mining, and this seleniferous material would be relocated to the pit backfills at the end of mining.

Modeled selenium concentration exceeded the surface water standard of 0.005 mg/L at South Fork Sage Creek Spring and lower Deer Creek. The result at South Fork Sage Creek Spring (0.009 mg/L) is less than the Proposed Action (0.01 mg/L). The selenium concentration for the groundwater discharge at Lower Deer Creek in Alternative B (0.0127 mg/L) is less than for the Proposed Action (0.0143 mg/L). Again, this difference may be overstated. The estimated groundwater selenium concentration discharged to Deer Creek is 0.013 mg/L with no subsurface selenium attenuation and 0.009 mg/L with 30 percent attenuation. This would be diluted in the stream to lower concentrations as is discussed in **Section 4.3.2**. If the effects of 15 to 30 percent selenium attenuation are included, the resulting selenium concentrations for groundwater affected by the proposed mining operations discharging at South Fork Sage Creek Spring and lower Deer Creek would still be over the surface water standard.

Figure 4.3-5 0.05 mg/L Selenium Plume at 48 yrs., Alternative A

Figure 4.3-6 0.005 mg/L Selenium Plume at 100 yrs., Alternative A

Figure 4.3-7 0.05 mg/L Selenium Plume at 50 yrs., Alternative B

Figure 4.3-8 shows the selenium plume at the surface water standard with no selenium attenuation at 100 years, which is approximately the time the concentrations peak at South Fork Sage Creek. The shape of this plume is very similar to that for the Proposed Action. Like the Proposed Action, the effect of this alternative on the groundwater quality under and down gradient of the mine panels would be major, local, and long-term.

Mining Alternative C – No External Overburden Fills At All

As in Alternatives A and B, the only COPC modeled for Alternative C was selenium. The main difference in source characterization between this alternative and the Proposed Action is that seleniferous overburden is eliminated from the external overburden fills, which is the same effect as for Alternative B. The peak concentrations and times for Alternative C for selenium are shown in **Table 4.3-12**.

Similar to the Proposed Action and Alternative B, modeled selenium concentrations exceeded the groundwater standard at observation points A and D in this alternative. Incorporating 15 to 30 percent selenium attenuation into the impact analyses showed that selenium concentrations were below the groundwater standard at all Observation Points for all levels of attenuation. **Figure 4.3-9** shows the selenium plume with no selenium attenuation for the groundwater standard at 50 years when concentrations peak in Observation Point A. The shapes of these plumes are very similar to those for the Proposed Action and are essentially the same as Alternative B.

Modeled selenium concentrations in groundwater exceeded the selenium surface water standard of 0.005 mg/L for groundwater affected by the proposed mining operations discharging at South Fork Sage Creek Spring and Deer Creek. The concentration at lower Deer Creek is the same as for Alternative B. The concentration at South Fork Sage Creek Spring is slightly higher than Alternative B and the same as the Proposed Action. This is because Pit 4 of the Proposed Action and Alternative B would be filled with seleniferous overburden in Alternative C. This negates the beneficial effect of eliminating seleniferous overburden from the Panel F external overburden fill. Incorporating 15 to 30 percent selenium attenuation reduced the concentrations at the discharge points but they were still greater than the surface water standard for all levels of attenuation.

Figure 4.3-10 shows the selenium plume with no selenium attenuation at the surface water standard at 100 years, which is approximately the time the concentrations peak at South Fork Sage Creek. The shape of this plume is very similar to that for the Proposed Action and the same as Alternative B. Like the Proposed Action, the effect of this alternative on the groundwater quality under and down gradient of the mine panels would be major, local, and long-term.

Mining Alternative D – Store and Release Cover on Overburden Fills (Component of Agency Preferred Alternative)

In the DEIS the net percolation rate was established for the cover design by iterative runs of the groundwater model with sequentially lower net percolation rates to the Wells formation aquifer until the selenium concentrations at the discharge locations were just lower than the surface water standard (0.005 mg/L). This percolation rate turned out to be 0.8 inch/year for the northern portion of Panel F (Pits 1 and 2), 1.5 inch/year for Panel F Pit 3, and 1.2 inch/year for Panel G. The maximum concentrations of all the COPCs at the observation points and discharge locations were then obtained for the model runs with these maximum percolation rates. These values are shown in **Tables 4.3-13** and **4.3-14**. There were no exceedances of the standards for any COPC anywhere in the model for Alternative D.

TABLE 4.3-13 MODELED PEAK CONCENTRATIONS IN GROUNDWATER AT OBSERVATION POINTS FOR ALTERNATIVE D IN THE DEIS

PROPOSED ACTION	POINT A		POINT B		POINT C		POINT D	
	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)
Cr	65	0.0004	23	0.0002	24	0.0002	25	0.0021
Mn	59	0.011	22	0.004	23	0.006	26	0.027
Se	60	0.023	22	0.009	23	0.011	26	0.032
SO_4	62	16	22	6	23	8	29	38
Zn	59	0.03	21	0.01	22	0.01	27	0.04

TABLE 4.3-14 MODELED PEAK CONCENTRATIONS IN GROUNDWATER AT DISCHARGE POINTS FOR ALTERNATIVE D IN THE DEIS

PROPOSED ACTION	SF SAGE		BOOKS		DEER CREEK		CROW CREEK	
	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)
Cr	119	0.0001	322	0.0002	55	0.0004	370	0.0002
Mn	109	0.002	325	0.003	55	0.005	372	0.002
Se	109	0.0048	326	0.0029	55	0.0048*	374	0.0026
SO_4	112	3	376	5	65	7	413	5
Zn	108	0.01	361	0.01	57	0.01	399	0.004

* Concentration in creek after mixing groundwater discharge with stream water

As can be seen from the results presented in the DEIS, at the target net percolation rates for the Alternative D cover, all COPCs were less than their applicable groundwater and surface water standards at all observation points and groundwater discharge locations. All COPCs including selenium were lower than their applicable groundwater water standards at all observation points. All COPCs were also lower than their applicable surface water standards except selenium, which was just under the surface water standards at lower Deer Creek and South Fork Sage Creek Spring. Based on the results in the DEIS and the fact that the net percolation rates in Alternative D had been significantly reduced between the DEIS and this FEIS it was determined that selenium was the only COPC requiring further evaluation in the impact analysis of this FEIS. Concentrations of all other COPCs were expected to continue to be less than their applicable water standards for the more protective design of Alternative D.

The design net percolation rate for the Alternative D cover in this FEIS was established through infiltration modeling using the Vadose/W model (Simplot 2007). The 100-year average net percolation rate ranged from about 0.6 inch/year on west- and south-facing aspects and just under 0.7 inch/year for north-facing aspects. The majority of the slope aspects are west-facing. To determine impacts of Alternative D with the reduced infiltration rates, the 0.6 inch/year percolation value was used in the Modflow groundwater model for the areas of the overburden fills within the model. The lower net percolation rate would result in increased time to wet up the overburden fills and begin seepage from the bottoms of the fills compared to the Proposed Action and Mining Alternatives A through C. This would tend to delay water quality impacts and spread introduction of the COPCs into the water table out over time, resulting in lower groundwater concentrations. The drastic reduction in flow through the cover design would effect flow paths, likely rendering chemical inputs based on high-flow columns to be conservative.

Figure 4.3-8 0.005 mg/L Selenium Plume at 100 yrs., Alternative B

Figure 4.3-9 0.05 mg/L Selenium Plume at 50 yrs., Alternative C

Figure 4.3-10 0.005 mg/L Selenium Plume at 100 yrs., Alternative C

A range of selenium leachate chemistry inputs was introduced into the modeling of Alternative D for this FEIS in response to requests from commenters to better describe potential variability in results. One end of the range was established by the same chemistry inputs as were described in the DEIS for Alternative D (½-inch particle size adjustment and no selenium attenuation) but applied with the lower net percolation rate determined for the alternative (0.6 inch/year). These included no effects of geochemical attenuation for selenium; these are the 0 percent attenuation results in **Tables 4.3-15 and 4.3-16**. This analysis and the results are considered to be the most conservative end of the spectrum modeled and negate the effects of selenium attenuation in the vadose zone under the overburden fills.

The effects of applying selenium attenuation to the chemistry inputs were also modeled at attenuation rates of 15, 25, and 30 percent for a net percolation rate of 0.6 inch/year, again with the ½-inch particle size adjustment. These results are shown in **Tables 4.3-15** and **4.3-16**. As indicated previously, there is credible evidence for all these selenium attenuation rates in the vadose zone under the proposed overburden fills. The Agencies prefer to use a conservative range of 15 to 25 percent for decision-making.

Finally, the effects of revising the particle size adjustment from the ½-inch to the 2-inch size were added with the 30 percent selenium attenuation for the 0.6 inch/year net percolation rate. As previously described, there is credible evidence for adopting the 2-inch particle size adjustment but the Agencies prefer the ½-inch particle size adjustment for decision-making as it better represents local and regional field data. This is a conservative approach.

TABLE 4.3-15 MODELED PEAK SELENIUM CONCENTRATIONS AT OBSERVATION POINTS FOR ALTERNATIVE D STORE AND RELEASE COVER

INPUTS	POINT A		POINT B		POINT C		POINT D	
	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)
No Atten.	64	0.0186	25	0.0037	25	0.00496	27	0.0178
15% Atten.	64	0.0158	25	0.0032	25	0.0042	27	0.0152
25% Atten.	64	0.0140	25	0.0028	25	0.0037	27	0.0134
30% Atten.	64	0.0130	25	0.0026	25	0.0035	27	0.0125
2" + 30% Atten.	64	0.0071	25	0.0014	25	0.0019	27	0.0067

TABLE 4.3-16 MODELED PEAK SELENIUM CONCENTRATIONS AT DISCHARGE POINTS FOR ALTERNATIVE D STORE AND RELEASE COVER

INPUTS	SF SAGE SPRING		BOOKS		DEER CREEK		CROW CREEK	
	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)	TIME (YR)	CONC (MG/L)
No Atten.	118	0.0028	379	0.0022	60	0.0037*	420	0.0018
15% Atten.	118	0.0024	379	0.0019	60	0.0031*	420	0.0015
25% Atten.	118	0.0021	379	0.0017	60	0.0028*	420	0.0013
30% Atten.	118	0.0020	379	0.0015	60	0.0026*	420	0.0012
2" + 30% Atten.	118	0.0011	379	0.0008	60	0.0014*	420	0.0007

* Concentration in groundwater discharged to creek before mixing groundwater discharge with stream water

It can be seen from the range of results **Table 4.3-15** that the Alternative D store and release cover with reduced infiltration causes selenium concentrations to be well below the applicable groundwater standard (0.05 mg/L) everywhere in the model domain including all the observation points. The highest peak groundwater concentration shown in **Table 4.3-15** was for Observation Point A with no selenium attenuation and was just under 40 percent of the groundwater standard. Using the Agency preferred selenium attenuation range of 15 to 25 percent reduced the peak selenium concentration in groundwater to 32 percent (0.0158 mg/L) and 28 percent (0.0140 mg/L) of the groundwater standard respectively. Incorporating the effects of 30 percent selenium attenuation and also the 2-inch particle size adjustment further lowered selenium concentrations at the observation points.

The results in **Table 4.3-16** show that the more protective cover design for the Alternative D store and release cover causes all selenium concentrations for groundwater affected by the proposed mining at all groundwater discharges to surface streams to be well below the selenium surface water standard of 0.005 mg/L, before any dilutions are considered for mixing stream flow with the groundwater discharge. In the selenium attenuation range of 15 to 25 percent the peak selenium concentrations in the groundwater discharges ranged from 34 percent (0.0017 mg/L) to 62 percent (0.0031 mg/L) of the surface water standard respectively. Using a 30 percent selenium attenuation factor resulted in lower selenium concentrations. Using the combined revised particle size adjustment along with the 30 percent attenuation lowered selenium concentrations to concentrations about one quarter of the surface water standard.

The more protective design for Alternative D demonstrates that groundwater and surface water quality would be protected to well below applicable standards thereby providing a significant margin for error to account for uncertainties in the predictions. The lower net percolation rate through the Alternative D cover also results in lower selenium release rates from the overburden at any future time. This responds to public comments on this matter received during review of the DEIS.

The shape of the selenium plume with no selenium attenuation at 100 years for the surface water standard concentration is shown in **Figure 4.3-11**. The plume containing groundwater concentrations greater than the surface water standard is located under mountainous terrain and is nowhere close to any discharges of groundwater to the surface environment. The effect of this alternative on the groundwater quality under and down gradient of the mine panels would be moderate, local, and long-term.

The amount of selenium loading to the groundwater under Alternative D with the store and release cover would be much less than that for the Proposed Action, and the peak selenium concentration in groundwater would be less than the State groundwater standard in all locations under the mine development and downgradient of the lease boundaries. This means that groundwater quality in the Wells formation everywhere in the model domain would comply with the State drinking water standard for selenium and would therefore not pose a risk to human health. The concentration of selenium in groundwater affected by the proposed mining discharging at surface streams downgradient of the alternative would comply with State surface water standards that are protective of aquatic life. Because this surface water standard is ten times less than the State drinking water standard, the concentration of selenium in the surface water would not pose a risk to humans via ingestion.

Mining Alternative E – Power Line Connection from Panel F to Panel G Along Haul/Access Road (Component of Agency Preferred Alternative)

This alternative would route the power line along a haul/access road instead of a direct right-of-way between Panels F and G. This alternative would have no bearing on the potential impacts to groundwater resources.

Figure 4.3-11 0.005 mg/L Selenium Plume at 100 yrs., Alternative D

Mining Alternative F – Electrical Generators at Panel G
This alternative would eliminate the power line to Panel G and replace it with diesel generators. This alternative would have no bearing on the potential impacts to groundwater resources. Potential spills from additional diesel fuel tanks would be avoided through implementation of structural controls and the Smoky Canyon Mine SPCC Plan.

4.3.1.2 Transportation Alternatives

Alternative 1 – Alternate Panel F Haul/Access Road
This alternative would not affect groundwater quality or flow.

Alternative 2 – East Haul/Access Road
The road fill for this alternative would be very close to, and possibly cover, SP-MC-600 where the road crosses the Manning Creek drainage (**Figure 3.3-3**). It would have no effect on groundwater quality or flow.

Alternative 3 – Modified East Haul/Access Road
The road fill for this alternative would be very close to, and possibly cover, SP-MC-600 where the road crosses the Manning Creek drainage (**Figure 3.3-3**). It would have no effect on groundwater quality or flow.

Alternative 4 – Middle Haul/Access Road
Road fill for this alternative would cover a small spring, SP-NFDC-50, in the headwaters of North Fork Deer Creek. It would have no effect on groundwater quality or flow.

Alternative 5 – Alternate Panel G West Haul/Access Road
The road fill for this alternative would cover SP-DC-100 and SP-DC-120, two small springs (0.004 cfs or less) in the upper reaches of the Deer Creek drainage (**Figure 3.3-3**). It would have no effect on groundwater quality or flow.

Alternative 6 – Conveyor from Panel G to Mill
This alternative would not affect groundwater quality or flow.

Alternative 7 – Crow Creek/Wells Canyon Access Road
This alternative would not affect groundwater quality or flow.

Alternative 8 – Middle Access Road
This alternative would cover SP-DC-350 and SP-NFDC-50 with road fill (**Figure 3.3-3**). It would have no effect on groundwater quality or flow.

4.3.1.3 No Action Alternative

Under the No Action alternative, impacts to groundwater at the mine would not change beyond those caused by currently approved mine plans that are already occurring at the Smoky Canyon Mine. Natural dissolution, mobilization, and migration of COPCs in the Project Area would still occur at current rates unaffected by the proposed mining activities.

4.3.2 Surface Water – Direct and Indirect Impacts

Watershed Area Disturbance

The RFP (USFS 2003a) states that not more than 30 percent of a watershed or subwatershed should be in a hydrologically disturbed condition (defined in the RFP 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”) at any one time. The HUC 6 and HUC 5 watersheds wherein disturbances would occur under either the Proposed Action or any of the Alternatives were examined in regard to this RFP guideline. Types of existing disturbances deemed to represent hydrologically disturbed conditions include roads, seedings, utility lines, agricultural fields, homes, mine disturbances, etc. For the additional amount of land that would become hydrologically disturbed under the Proposed Action and the Alternatives, information on disturbed acreage from Chapter 2 was used, including all of the categories of pit, overburden, other, and road disturbance. Once reclamation has been successfully completed, mining areas that would remain as hydrologically disturbed would be minimal. Details of the disturbance effects of each Proposed Action component and the Alternatives on watersheds are described in the following sections. Each of the Proposed Action components and Alternatives would result in different amounts of watershed disturbance, and these impacts are generally considered to be minor (see page 4-1 for definition), local, and have short-term durations limited to the mining period.

In general, the better condition a watershed and its stream channel are in, the more resilient it is to the effects of disturbance. The CNF (USFS 2003b) notes that the EPA and USGS assessed the Salt River watershed (4th scale HUC) overall with the best possible rating, a “1” on their 1 to 5 Index of Watershed Indicators (IWI). This rating indicates that the basin has “low vulnerability to additional stressors such as pollutant loadings.” While this does not mean that individual HUC 5 or HUC 6 subwatersheds within the Salt River watershed would also have a “1” rating, or that the watershed or subwatersheds have the ability to accept any level or type of additional disturbance, it can indicate that the Salt River watershed as a whole may have a better ability to absorb the proposed disturbances than would a different watershed with a higher vulnerability rating.

Runoff Reduction

Precipitation falling within the disturbed areas associated with pits, overburden storage areas, and most topsoil stockpiles would either infiltrate or be retained in constructed runoff/sediment ponds. Water would either evaporate or infiltrate. These ponds would be designed to contain the expected runoff from events up to and including the 100-year, 24-hour precipitation. This means that runoff from these disturbed areas, rather than supplying surface flow to streams as occurs under the undisturbed condition, would be retained during mining and reclamation so that they would not contribute to storm flow. Essentially, these disturbed areas would be withdrawn from the contributing watershed area of a given stream, thereby potentially reducing runoff volumes and peak flows during mining until reclamation is completed and the retention basins are removed. There is not necessarily always a direct one-to-one correlation between contributing area and runoff peak or volume, but generally the greater the percentage by which the watershed area is reduced, the greater the reduction in flows. Therefore, the percent reduction in contributing watershed is used herein to represent the relative percent reduction in stream flows that could occur from the proposed activities. These numbers should be used to compare alternatives, rather than as absolute numbers representing change in stream flows.

Assuming that the runoff/sediment ponds are designed and maintained to contain their design capacity at all times, during the general life of the mine disturbance there should only be an 8 to

10 percent chance that runoff from the mining disturbance would leave the ponds and potentially enter a stream. This percent chance is calculated by a standard calculated risk equation $Pn=1-((Tr-1)/Tr)^n$ (Pn is the probability of occurrence, Tr is recurrence interval in years, and n is design life in years). Information on Simplot's existing activities suggests that ponds do not necessarily always function to capture runoff as intended. The March 15, 2004 SWPPP (Simplot AgriBusiness 2004) indicates that 0.88 inch of rainfall occurred in April 2004, with resultant discharges from two ponds at the D and E Panels. It is not clear whether the discharge of runoff water was due to problems with design, maintenance, or the ponds having insufficient storm capacity due to inflow from dump seeps. However, it is clear that the precipitation event was less than the design precipitation event (3.0 inches), and there is no mention of excessive snowmelt during this period, so it is apparent that the system did not work as intended. The SEIS for Simplot's B&C Panel states that there were six instances of pond overflow between the fourth quarter of 1998 and the second quarter of 1999. Again, there is no indication that design precipitation was exceeded during this time. This is relevant to the current impact analysis because it suggests that there is, in reality, a greater potential than the calculated theoretical chance that discharge from disturbed areas could enter stream channels. However, the impact of these occasional discharges would not have a great effect on flow regimes; the impact to water quality from these occurrences is discussed below.

Once reclamation has been successfully completed, these areas would again function as part of the watershed and regularly contribute runoff to streams. Details of the effects of each Proposed Action component and Alternatives on runoff are described in the following sections. The effects of the Proposed Action components and Alternatives on estimated runoff are different but, in general, the impacts to runoff are considered to be minor, local, and have short-term durations limited to the mining period.

Base Flow Reductions

As noted, the stream flow reductions discussed above would be due to withholding surface runoff generated on the disturbed area. Additional reductions in stream base flows would occur if groundwater discharge to these stream channels is reduced or eliminated, either as a result of destroying or drying up a spring, or diminishing diffuse groundwater inflow intercepted by a channel. **Section 4.3.1** describes this potential in more detail, but in summary, the predictions in that section are that dispersed groundwater flow contributions to area streams would not be diminished by mining, but several small springs would be eliminated or measurably diminished. The resultant implications to stream base flow as a result of lost spring flows are discussed in more detail in the individual Panel F, Panel G, and Mining Alternatives subsections below. Where stream base flow is reduced due to disruption of certain springs, the impacts would be minor, local, and long-term.

Peak Flow Alterations

Haul and access roads have the potential to affect peak stream flows through two primary mechanisms. First, the road drainage network that consists of in-slope ditches and cross drains can 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). However, Simplot has committed to minimizing this potential by reducing the amount of hydrologically-connected road as much as possible. Hydrologically-connected road is 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 culvert cannot pass all stream flow either because it becomes blocked or because the design event is exceeded, overflow may overtop the crossing fill, course down the road and be redirected to a tributary channel other than the intended one, which results in locally higher peak flows (Furniss et al. 1997). Simplot has addressed this potential impact by committing to design culverts for a high-return period design flow of 100 years, which would reduce the likelihood of culvert capacity being exceeded. Given that the mine-use life for the roads under the Proposed Action and Alternatives is about 16 years, there is a 15 percent chance that the flow capacity of any given (fully functional) culvert would be exceeded. This is well below the 50 percent probability of exceedance suggested by the RFP guideline on page 4-51 of the plan (USFS 2003a). However, in the cases where roads would be left for Forest access (as described under the relevant road sections), probability of failure would increase because these roads would have a much longer life span.

Once reclamation has been successfully completed, these former road areas would no longer have the potential to cause peak flow alterations, with the exception of the roads that would remain in use as Forest roads. The impacts to peak flow from the Proposed Action and Alternatives are considered to be minor to moderate, local, and have short-term durations limited to the mining period. Where certain road sections would be retained for long-term public use, the impacts would be long-term.

Sediment In Runoff

As described above, runoff/sediment ponds would be in place to retain sediment and runoff generated from mining disturbance (excluding roads) from all events up to and including the 100-year, 24-hour precipitation. Under these circumstances, the mining disturbance would not likely increase sedimentation levels in the Project Area streams. Should discharge from a pond occur, however, there could be two ways that sediments could be introduced to a stream. First, the pond discharge could convey sediments that have not settled out during detention. Available data from the two overflow events in 2002 described above shows negligible TSS concentrations (6 and 7 mg/L-- much less than the permit's benchmark level of 100 mg/L). Second, should discharge not be controlled, soil eroding between the pond and the receiving channel -- or within the stream channel itself -- could contribute a pulse of sediments during the runoff event. Simplot's SWPPP (Simplot Agribusiness 2004) calls for constructed and armored outflows from ponds in order to minimize this possibility, but in any case, such isolated instances of sediment contributions would not be expected to be problematic for overall water quality at the watershed scale. Nor would such instances represent exceedances of numeric water quality criteria, as there are none for sediment. For Simplot's B&C Panel SEIS, turbidity, suspended sediment and embeddedness data from stream monitoring sites that were paired to represent above- and below-mining locations were compared to determine if mining impacts were evident. The available data (which did not focus specifically on storm events) showed a slight increase in turbidity due to mining. This would potentially be the case for Panels F and G mining activities.

Roads in general, and roads on Forest lands specifically, are known sources of sediment loading to streams (USFS 2003b, Ketcheson and Megahan 1996). They can often increase sediment loads by one or two orders of magnitude above background rates for the disturbed areas (Furniss et al. 1991). The USFS, through its San Dimas Technology and Development Center, has developed an extensive series of publications on Water/Road Interactions (USFS 2004c) that describe the types of impacts Forest roads can have on water quantity and quality and the ways in which those impacts can be minimized. Simplot has committed to incorporating some of this information into its road design through a series of BMPs and design considerations, which are included in **Appendix 2C**. According to the RFP, "Road effects to watershed and riparian values can be prevented or minimized through proper planning reconnaissance, design, construction, and maintenance techniques." In addition, the RFP indicates that "Any new roads would be constructed with strict standards and guidelines, especially those that could influence the Aquatic Influence Zone (AIZ)." Therefore, a major component of the impact analysis for sediments is based upon the assumption that these practices, correctly implemented, can inherently reduce certain types of impacts to surface water. For example, many of these BMPs would reduce the likelihood that any given culvert would plug, overtop, and result in total road fill failure. If these BMPs were not effective and a culvert was plugged and submerged before it could be cleaned, the affected road fill would impound the water flooding the area immediately upstream. If the water overtopped the road fill, it could erode the fill and deposit this sediment downstream of the plugged culvert.

To compare the various Transportation Alternatives with regard to sediment impacts, several indices are used: number of stream channel crossings, proximity to a stream channel, and ground surface slope. The number of crossings, both total and in perennial stream reaches, is related to potential impacts because stream channel crossings present one of the greatest risks of a road to surface water and aquatic resources (Flanigan et al. 1998). The amount of road proposed within AIZs (or its equivalent on non-CNF lands) is used to indicate proximity to streams. The closer a road is to channel system, the more potential it has to disturb floodplain/riparian areas, restrict stream channel processes, contribute eroded sediments to the stream, and affect runoff patterns. Further, AIZs typically encompass riparian buffer strips; according to Belt et al. (1992), such strips "help to maintain the hydrologic, hydraulic, and ecological integrity of the stream channel…", so their use as an indicator provides a means to assess overall risk to surface water resources. Lastly, the percent of total road length located on slopes of varying degrees of steepness indicates potential impacts related to mass movements, erosion, and subsequent road drainage.

Quantifying the amount of sediment that would be contributed from a road to a given stream channel on a storm, annual, or long-term basis is not possible to do with any degree of certainty. The USFS estimates sediment production from roads with the WEPP:Road component of the USFS soil erosion model, Water Erosion Prediction Project (WEPP). This road module was run for all of the Proposed Action and Alternative roads. The road module and the WEPP program as a whole are discussed more thoroughly in **Appendix 4A**, but essentially, the module calculates erosion from the road surface and the fill slope and then uses the buffer slope characteristics to route the eroded material to the stream channel. In order to account for the fact that a number of BMPs that would be implemented on these roads could either reduce erosion or reduce the amount of eroded material that can potentially pass through the buffer, additional analysis was done, as described in **Appendix 4A**.

The sediment quantities calculated using WEPP:Road are estimates that include significant uncertainties and should not be taken as definitive values. However, some sedimentation to area streams from the Proposed Action and all Alternatives should be expected, and the WEPP results are useful to compare alternatives against each other and to baseline WEPP model results. Although the BMPs may minimize or reduce this potential, it is reasonable to expect that some sediment from mining operations and transportation routes may enter from streams over the life of the Project. The USFS has used the basic WEPP model to estimate that baseline soil erosion rates for vegetated areas in the CNF. Applying the WEPP model to 15 specific sites in the CNF predicted erosion rates of 0.03 to 0.08 tons per acre per year for 6 of the 15 sites and no measurable erosion on the other 9 sites (USFS 2003d). JBR conducted WEPP erosion analyses of existing conditions in the Project Area and the results indicated that there would be a 0 to 3 percent probability of erosion, with an average annual upland erosion rate of 0.04 tons per acre (**Appendix 4A**).

Using long culverts for roads crossing streams potentially adds to sediment loading from fills (as reflected by the WEPP:Road modeling) and also has the potential to alter channel morphology and habitat characteristics. With proper design, these effects may not extend any great distance downstream, but they would occur within the local confines of culvert placement. The Simplot commitment to design culverts for a 100-year flow means that, in general, any particular culvert would likely span the active channel width. This can minimize associated upstream aggradation and widening, and reduce downstream scour and undercutting. Further, such design features help to prevent culvert failure, which can result in road fill failure and mass loading to the stream. Overall, it can be assumed that, with the prescribed design and maintenance protocol, sediment contributions to stream channels and extensive channel changes should be held to levels that allow beneficial uses to continue over much of a stream's length. The various indicators presented above will be used in the relevant subsections to discuss the likelihood that specific Transportation Alternatives can meet this general statement.

Assessment Units that include the North and South Forks of Deer Creek, and the main stem of Deer Creek upstream of its confluence with the South Fork, are listed as impaired water bodies for sediment on the most recent EPA approved 303(d) list, based on IDEQ's 2002 303(d) recommendation. Various Transportation Alternatives described below predict increased sediment loading to these streams as a result of those activities. IDEQ has indicated that water quality and biological data from these assessment units, collected since IDEQ's last round of water body assessments (post 2002), strongly indicate these two streams are supporting the beneficial use of cold water aquatic life. IDEQ's Antidegradation Policy (IDAPA 58.01.02.051.01) requires the application of best management practices such that in-stream water uses and level of water quality necessary to protect the existing uses shall be maintained and protected. IDEQ has stated that the Transportation Alternatives and subsequent water quality impacts analysis as presented in the draft EIS meet the intent of the Antidegradation Policy (Lynn Vanevery, IDEQ, personal communication, September 5, 2006). In addition, IDEQ would require that Simplot implement a water quality monitoring and surveillance plan that is acceptable to the IDEQ to evaluate the effectiveness of those best management practices that are implemented as part of an approved mine plan.

Once reclamation has been successfully completed, these former road disturbance areas should revert back to natural erosion and sedimentation rates. Though there would be some areas that would remain unreclaimed, their extent and impact should be minimal. The sedimentation impacts for these roads are considered to be moderate, localized, and have short-term durations equal to the mine life. In the cases where roads would remain in use as Forest roads (though they would be narrowed to USFS standards and partially reclaimed), sedimentation potential would be long-term, should gradually reduce with time, but would not revert totally to background rates.

Water Quality in Runoff

Phosphate mining throughout Southeastern Idaho, including Simplot's existing operations, has impacted, and continues to impact, surface water quality by contributing various COPCs, primarily selenium. In recent years, focus on this issue has resulted in various environmental protection strategies and BMPs to reduce or eliminate such contributions. The Proposed Action and Alternatives incorporate several of these strategies. As such, past or current examples of mining-impacted surface water quality cannot necessarily be cited to predict similar impacts from the proposed mining. These strategies and BMPs have not yet been monitored over any extended period of time, so their effectiveness is assumed through general experience to be sufficient at this time.

Assuming that the environmental protection measures called for in Chapter 2 are effective in reducing overburden seeps and eliminating surface exposure of selenium-bearing materials that runoff can contact, related impacts from the proposed mining on surface water quality should be negligible. Further, Simplot's design and operation of sediment ponds minimizes the hydraulic connection between these ponds and surface water, as defined by IDEQ, and thereby minimizes the potential for dissolved constituents in mine-area storm water runoff to reach surface streams via this connection. However, there remains the mechanism whereby infiltrated precipitation percolates through overburden, picks up selenium and other COPCs, and is eventually discharged as groundwater contributing to area streams. Details on this mechanism are described in the previous groundwater discussion in **Section 4.3.1**. The implications of the contaminated groundwater to the water quality of area streams are further discussed here.

In simple terms, groundwater flowing at a given rate and with a given selenium concentration would enter a stream channel through either diffuse flow or a discrete spring discharge. (Because the other COPCs do not result in any surface water protection criterion exceedances due to the groundwater discharges, they are not discussed here, but the mechanism for dilution and mixing would be the same as described here for selenium.) The stream is also flowing at a given rate and with or without a measurable baseline selenium concentration. The two water sources would mix, and based upon relative flow rates and concentrations, a new selenium concentration would be present in the combined, downstream flow. Calculations using existing flow and water quality data for area streams and predicted groundwater flows and concentrations were made to predict the selenium concentration of these mixed flows. The predicted groundwater concentrations (shown in **Tables 4.3-12 and 4.3-16** above) and flow rates were mixed with other contributing flows to derive predicted flows and selenium concentration at the mouths of Deer Creek, South Fork Sage Creek, Sage Creek, and at locations along Crow Creek. For example, to derive a predicted selenium concentration at the mouth of Deer Creek, upstream surface flows were mixed with the predicted groundwater discharge to Deer Creek, and to derive a predicted selenium concentration at the mouth of South Fork Sage Creek, additional flow sources were mixed with the predicted discharge at South Fork Sage Creek Spring (SFSC-750). Base flows in late summer/early fall (when upstream Crow Creek flows are being diverted for irrigation) represent one examined scenario; a late fall/winter scenario was also analyzed wherein flows for irrigation are not being diverted but the streams are still in a base flow regime. Base flows provide the least amount of dilution to groundwater discharges from the proposed mining operations, so using the base flow seasons as a point of reference provide a measure of conservatism to the analysis. Stream flow data for these streams is limited to the data collected for the baseline studies, the CERCLA Site Investigation, and on-going monitoring since about 2004, and is insufficient to derive flow regimes such as the 7-day, 10-year low flow that is often used in similar types of analysis.

Much of the predicted effects of selenium to water quality would not occur in the near future, but instead would lag a number of decades due to slow groundwater flow rates (**Section 4.3.1**); with concentrations peaking at the times presented in **Section 4.3.1** and then decreasing over hundreds of years. Chemical attenuation of selenium is discussed in **Sections 3.1.6** and **4.3.1**, as is its potential to reduce concentrations in water via adsorption and biological accumulation. While chemical attenuation has been accounted for in the groundwater modeling, it has not been not been accounted for in the surface water analysis. Selenium attenuation has been observed in Idaho streams due to apparent sequestering of selenium from the water column into other components of the aquatic habitat (Stillings and Amacher 2004, NewFields 2005b, IDEQ 2004b). This reduces the selenium concentration in the water column due to the retention capacity of the hydrologic unit immediately downstream of the selenium source but potentially also results in bioaccumulation and internal recycling of the selenium within that hydrologic unit

(Lemly 2001). Impacts to surface streams from COPCs contributed by groundwater discharges are considered to be local and long-term. Where the resulting stream concentrations of the COPCs are within applicable regulatory criteria, the impacts would be minor to moderate. Where the concentrations are over regulatory criteria, the impacts would be major.

The overburden and runoff handling strategies described above -- in combination with the proper implementation of Simplot's SWPPP -- should prevent increases of COPCs in streambed sediments as a result of mining. This impact would be negligible to minor, site-specific, and short-term. As described in **Section 3.3**, baseline streambed samples in several of the Project Area streams showed concentrations of several COPCs that were greater than the IDEQ benchmark levels and/or removal action levels.

The haul or access roads associated with mining activity may have the opportunity to affect surface water quality and streambed substrate in regard to selenium and other COPCs. Where a road is built over the seleniferous Meade Peak Shale of the Phosphoria formation, seleniferous shale would become exposed in the cut slopes (Simplot has committed to not using this material for fill – thus reducing the exposure). This provides a potential mechanism for runoff waters to pick up dissolved amounts of selenium and perhaps other COPCs through oxidation and dissolution, and convey those contaminants to area stream channels. Any eroded cut slope materials that made their way to stream channels could contribute to streambed COPC levels. One indicator for the likelihood of impact from this source is the length of roadway that would cross the Meade Peak Shale outcrop. In addition, the closer the road is to a stream channel and the steeper the topography through which the road traverses, the more likely this type of contamination could occur.

Just as the attenuation of selenium, described briefly above, could result in a reduction of selenium concentrations in stream flow in a downstream direction, the attenuation could have the opposite effect over time on streambed sediments. As selenium is sequestered in particulates and organic detritus in the streambed, these sediments could accumulate greater amounts of selenium over time.

The proposed road BMPs would help to reduce this potential effect, and once reclamation has been successfully completed, the potential for selenium contribution from these former road areas should greatly diminish, except where roads would remain in place as Forest roads, though narrowed to USFS standards and partially reclaimed. The impacts from road construction across Meade Peak Shale are considered to be minor, site-specific, and short-term, because full, end-bench haul construction methods would ensure that all of this material would be removed from the road and handled as other Meade Peak Shale material.

<u>Other Pollutants</u>

Accidental releases of materials associated with mining such as oils and chemicals represent potential impacts to surface water quality during the life of the mining activity.

Potential hydrocarbon-related effects to water quality would be minimized through non-structural BMPs in the SWPPP and secondary containment and other procedures in Simplot's Spill Prevention Control Countermeasures (SPCC) Plan. Vehicle accidents, which would presumably be rare, could also release fuel, oil, or other substances to the road drainage network. In the event of any such releases, standard response and cleanup practices would occur, but there could be some short-term effects on water quality and biotic stream components if spilled materials reached nearby streams. The potential for such spills to occur would be low and the potential for stream impact even less so. These impacts are considered to be negligible to minor, site-specific, and short-term.

Water Rights and Water Uses

There are two ways in which water rights to streams could be affected: by reducing streamflow and thus restricting quantity of water delivered to a right holder; or by impacting water quality in a manner that would preclude the beneficial uses for which the right is granted. The water rights in the Project Area that would have the potential to be impacted are granted for stock watering, typically on a point-to-point basis in a given stream reach, and irrigation.

While certain rights may be affected, the RFP (page 3-14) states that "Loss of available surface water sources for uses such wildlife or grazing, as a consequence of mining operations shall be replaced or mitigated…". This statement implies that Simplot would have to replace all lost waters that have such uses, even if they are unattached to a water right. This would be feasible for the relatively small and isolated stock watering uses. Assuming this requirement of the RFP is followed, impacts to water rights would be minor, site-specific, and short-term.

For loss of surface water to wildlife (fisheries) due to selenium contamination, this loss could not be readily replaced or mitigated. Where this loss via contamination is predicted to occur, it could be contrary to the stated RFP standard. Such impacts are considered to be major, local, and long-term.

Baseflow impacts would be the relevant flows by which to assess water right impacts; general baseflow impacts were discussed above, and specifics are discussed (along with the related water right impact) for each Project component below.

There are no regulatory sediment or selenium water quality criteria for stock watering or irrigation. The IDEQ (2004b) used a selenium removal action level of 0.05 mg/L for domestic animal drinking water use in its Area Wide Risk Management Plan. Other sources use a selenium threshold of 0.02 mg/L for irrigation water, including the Food and Agriculture Organization (FAO) of the United Nations (FAO 1992). These values will be used herein to assess impact to water right holders as a result of selenium in Crow Creek and its tributaries.

4.3.2.1 Proposed Action

Panel F, Including Lease Modifications (Component of Agency Preferred Alternative)

As shown in **Table 4.3-17**, Panel F, including lease modifications, overburden storage areas, and topsoil piles would increase the amount of hydrologically disturbed land by less than 2 percent in each of the affected HUC 6 watersheds and by 0.5 percent in the HUC 5 Crow Creek watershed.

As described above, runoff/sediment ponds would be in place to retain sediment and runoff generated from mining disturbance (excluding roads) from all events up to and including the 100-year, 24-hour precipitation event. Under these circumstances, the mining disturbance would not likely increase sedimentation levels in the Project Area streams. Thus, this mining component would not impact streams listed under 303(d) for sediment.

TABLE 4.3-17 PERCENT OF WATERSHED AREA IN A HYDROLOGICALLY DISTURBED CONDITION

HUC NO.	WATERSHED DESCRIPTION	EXISTING DISTURBANCE	PROPOSED ACTION					
			POWER LINE	PANEL F	PANEL G	F ROAD	G ROAD	TOTAL P.A.
170402712	Diamond Creek	6.8	0	0	0	0	0.1	0.1
170402071203	Diamond Creek Below Timber Creek	7.9	0	0	0	0	0.1	0.1
1704010507	Crow Creek	7.3	<0.1	0.5	0.5	0.1	0.2	1.3
170401050705	Crow Creek Above Deer Creek	4.5	0	0	1.4	0	0	1.4
17040150707	Deer Creek	1.0	0.2	1.6	3.2	0	1.5	6.5
17040150703	Middle Crow Creek	1.7	<0.1	0.7	0	0	0	0.7
17040150708	SF Sage Creek	22.5	0.1	1.9	0	0.4	0.6	3.0

Table 4.3-18 shows the percentage by which contributing watershed areas would be reduced under the Proposed Action and the Mining Alternatives due to runoff and sediment control features (retention ponds). Disturbed areas associated with roads are not assumed to be withheld from contributing runoff, although in some cases, runoff from roads would also be directed to ponds. With the exception of the Deer Creek basin, these basins are smaller than the HUC 6 level watershed, so at the HUC 6 or HUC 5 levels, percentage reduction would be smaller because it would be calculated using a larger-size drainage area.

TABLE 4.3-18 REDUCTION IN CONTRIBUTING WATERSHED AREA DUE TO PITS AND OVERBURDEN STORAGE AREAS (%)

WATERSHED	PROPOSED ACTION			ALT. A		ALT. B	ALT. C	ALT. D	ALT. E	ALT. F
	PANEL F	PANEL G	TOTAL F+G	NO N. MOD.	NO S. MOD.					
SOUTH FORK SAGE CREEK	8	0	8	8	8	8	8	9	8	8
MANNING CREEK	6	0	6	6	6	6	6	9	6	6
DEER CREEK	2	3	5	2	0	5	5	6	5	5
WELLS CANYON	0	11	11	0	0	11	11	12	11	11

The contributing runoff area reductions from the Panel F, including lease modifications, due to open pits, overburden storage areas, and topsoil piles would be 296 acres in South Fork Sage Creek watershed, 93 acres in the Manning Creek watershed, and 126 acres in Deer Creek watershed. Potential reductions in surface flows due to these contributing area reductions are expected to generally follow the percent reductions in contributing watershed size given in **Table 4.3-18**. Panel F mining would be responsible for all of these reductions in the South Fork Sage Creek and Manning Creek watersheds, slightly more than one-third of the Deer Creek reductions, and none of the Wells Canyon reductions. Such levels would not be expected to be of any noticeable consequence to channel morphology or water supply of the streams during the time in which mining occurs.

Much of an unnamed tributary to South Fork Sage Creek would be removed by the Panel F. This tributary flows only ephemerally according to the baseline studies (Maxim 2004d). Further, baseline studies note that this channel becomes poorly defined just above its confluence with

South Fork Sage Creek, indicating that much of its flow may be subsurface by the time it reaches this location (Maxim 2004d). The Panel F pit would also remove the headwater channel of Manning Creek, which flows ephemerally.

Within the South Fork Sage Creek basin, two springs (SP-UTSFSC-200 and SP-UTSFSC-100) would likely be eliminated during Panel F mining, as discussed in **Section 4.3.1**. In late summer and early fall, when baseflow conditions dominate, these springs averaged a combined flow of about 0.01 cfs (Maxim 2004d). Baseline information indicates that these flows typically infiltrate into the otherwise dry channel bed of the unnamed tributary, and do not contribute surface flow to South Fork Sage Creek. These springs could provide subsurface flow to South Fork Sage Creek. The USFS has stock watering rights (No. 4054) to SP-UTSFSC-100. While this right would be affected by mining due to the loss of the spring, its minimal flow contribution means that rights to stream flows downstream should not be measurably affected.

According to **Section 4.3.1**, several discrete springs in the Deer Creek basin would be disrupted, or diminished (SP-UTNFDC-400, SP-UTNFDC-600, SP-UTNFDC-530, and SP-UTNFDC-540) during Panel F mining. Not including SP-UTNFDC-530 (for which no flow information was collected during baseline studies), these springs were supplying a combined flow of about 0.0007 to 0.0033 cfs during the baseflow monitoring events (Maxim 2004d). Comparing that amount with the total flow in Deer Creek (SW-DC-500) at that same time shows that those springs may supply between about ½ to 1 percent of the Deer Creek baseflow at that location. There are no water rights associated with these four springs, and given the small amount they supply to downstream surface water, rights to stream flows downstream of those springs should not be measurably affected.

A spring at the head of Manning Canyon (SP-MC-300) is located just west of the proposed highwall for Panel F and would likely be disrupted. Thus, it would no longer contribute to Manning Creek, but it does not appear to contribute very much under current conditions. The USFS holds a water right on SP-MC-300 (4053), which would be affected.

For the purposes of this analysis, it is presumed that all of the above-mentioned diminutions in baseflow would be permanent. The RFP (USFS 2003a) requires under the “drastically disturbed lands” category that “Loss of available surface water sources for uses such as wildlife or grazing, as a consequence of mining operations shall be replaced or mitigated by the mine operator. This includes the loss of water quality sufficient to maintain post-mining uses.”

Using the results of the groundwater modeling, given in **Section 4.3.1** above, and the surface water data (Maxim 2004d; TtEMI 2002a; TtEMI 2002b; IDEQ 2004b; Simplot operational monitoring including from NewFields 2005b, 2006b, 2007a; Tegtmeyer 2006; Maxim 2005a;), estimates of selenium increases during two baseline flow scenarios in area streams were made, as shown in **Table 4.3-19**. Under the Proposed Action, Panel F mining would result in the aquatic criterion for selenium (0.005 mg/L) being exceeded during summer/fall baseflow conditions in South Fork Sage Creek, Sage Creek, and Crow Creek downstream of Sage Creek, when irrigation withdrawals reduce flows in Crow Creek. The same would occur during the late fall/winter baseflow conditions (when flows are not reduced due to irrigation diversions). There are already exceedances of the aquatic criterion for selenium (0.005 mg/L) in the lower reaches of South Fork Sage Creek and Sage Creek (downstream of Hoopes Spring), due to the existing Smoky Canyon Mine (NewFields 2005b; NewFields 2007b and **Appendix 2A**). Selenium loading to South Fork Sage Creek would increase over baseline conditions under the Proposed Action and Mining Alternatives A through C. Using the average historic selenium loading in South Fork Sage Creek and lower Sage Creek, exceedances of the selenium criterion are estimated to occur but this assumes the average historic selenium loading to the stream stays the same until the peak selenium concentrations for the various alternatives occur in South Fork Sage Creek. The selenium concentrations from the Panel F and G impacts are expected to peak within a 50 to 100 year timeframe and then steadily decrease. This assumption is conservative because the regulatory Agencies and Simplot would be implementing programs over a much lesser period of time to remediate the current selenium loading to South Fork Sage Creek and lower Sage Creek.

At these analyzed stream locations, selenium concentrations would not affect water right holders' abilities to use this water for either stock watering or irrigation, based upon the action levels and thresholds discussed above.

TABLE 4.3-19 ESTIMATED SELENIUM CONCENTRATIONS IN AREA STREAMS, FOR PROPOSED ACTION AND ALTERNATIVES A, B, AND C (MG/L)

LOCATION	PROPOSED ACTION*	MINING ALT. A	MINING ALT. B	MINING ALT. C
SUMMER/FALL DURING IRRIGATION SEASON				
Mouth of Deer Creek	0.012	0.012	0.010	0.010
Crow Downstream of Deer Creek	0.004	0.004	0.004	0.004
Mouth of S.F. Sage Creek	0.010	0.009	0.009	0.010
Mouth of Sage Creek	0.009	0.009	0.009	0.009
Crow Downstream of Sage Creek	0.007	0.007	0.007	0.007
LATE FALL/WINTER BASEFOWS WITHOUT IRRIGATION DIVERSIONS				
Mouth of Deer Creek	0.012	0.012	0.010	0.010
Crow Downstream of Deer Creek	0.003	0.003	0.002	0.002
Mouth of S.F. Sage Creek	0.010	0.009	0.009	0.010
Mouth of Sage Creek	0.009	0.009	0.009	0.009
Crow Downstream of Sage Creek	0.006	0.006	0.006	0.006

*Alternatives E and F are the same as the Proposed Action for this table.

Note that the results shown in **Table 4.3-19** do not include the effect of selenium attenuation. This was done to allow a less complicated comparison between the alternatives than showing all the results for the complete range of selenium attenuation. The effects of selenium attenuation on the alternatives would be similar in nature and degree to that shown for the Proposed Action (**Tables 4.3-8 and 4.3-9**). For example the effect of 30 percent selenium attenuation on the Proposed Action concentration for the Mouth of South Fork Sage Creek (same as South Fork Sage Creek Spring) would be to reduce it from 0.010 mg/L to 0.008 mg/L. A similar effect on the selenium concentration at the same location and attenuation value for Mining Alternatives A and B would be to reduce those concentrations from 0.009 mg/L respectively to approximately 0.008 mg/L. The effect on selenium concentration for Alternative C would be the same as that for the Proposed Action, i.e., a reduction from 0.010 mg/L to 0.007 mg/L. After applying the maximum selenium attenuation to all the Mining Alternatives, the selenium concentration at the Mouth of South Fork Sage Creek is still greater than the surface water standard of 0.005 mg/L. This analysis indicates that the Proposed Action and the three mining Alternatives A, B, and C would all result in exceedances of the surface water quality standard for selenium.

Some of the overburden from Panel F would be hauled north to the existing Smoky Canyon Mine Pit E-0 for disposal. This pit area is already permitted, and existing runoff/sediment control ponds are meant to contain any surface runoff up to that occurring from the 100-year, 24-hour storm. Any excess would drain toward South Fork Sage Creek.

<u>Panel F Haul/Access Road (Component of Agency Preferred Alternative)</u>
The Panel F Haul/Access Road would increase the amount of hydrologically disturbed land by 0.4 percent in the Sage Creek HUC 6 watershed, which would equate to a 0.1 percent increase in the HUC 5 Crow Creek watershed.

The Panel F Haul/Access Road would disturb 66.5 acres within the Sage Creek basin. There would be one drainage channel crossing associated with this road, which would be in a non-perennial reach of South Fork Sage Creek. This culvert would be approximately 230 feet long. It would be designed, constructed, and maintained using the criteria discussed in **Appendix 2C**, in order to reduce the sedimentation and stability impacts inherent in culverted road crossings.

Less than one acre of this road, or 1 percent of its total area, would be within AIZs. About half the road would be crossing ground slopes of 30 percent or less and about half would be crossing ground slopes between 31 and 65 percent. None of this road would cross Meade Peak Shale outcrops.

According to the WEPP:Road analysis, adjusted for BMP reductions, sediment loading to Sage Creek is calculated be about 0.5 tons annually; most of this amount would be contributed directly to South Fork Sage Creek. This is about 0.3 percent of the calculated baseline sediment load for this stream.

There would be no impact to water rights due to this road.

<u>Panel G (Component of Agency Preferred Alternative)</u>
As shown in **Table 4.3-17**, Panel G, include pits, overburden storage areas, and topsoil piles, would increase the amount of hydrologically disturbed land by 3.2 percent in the Deer Creek HUC 6 watershed and by 1.4 percent in the Crow Creek above Deer Creek HUC 6 watershed. This results in an overall increase of 0.5 percent in the HUC 5 Crow Creek watershed.

As described above, runoff/sediment ponds would be in place to retain sediment and runoff generated from mining disturbance (excluding roads) from all events up to and including the 100-year, 24-hour precipitation event. Under these circumstances, the mining disturbance would not likely increase sedimentation levels in the Project Area streams. Thus, this mining component would not impact streams listed under 303(d) for sediment.

Mining of Panel G, including the pits, overburden storage areas, and topsoil piles would result in a reduction in contributing watershed area of about 245 acres in the Deer Creek drainage and about 220 acres in Wells Canyon. Potential reductions in surface flows due to these contributing area reductions are expected to generally follow the percent reductions in contributing watershed size given in **Table 4.3-18**. Panel G mining would be responsible for all of these reductions in Wells Canyon, slightly less than two-thirds of the Deer Creek reductions, and none of the South Fork Sage and Manning watershed reductions. Such levels would not be expected to be of any noticeable consequence to channel morphology or water supply during the time in which mining occurs.

According to **Section 4.3.1**, two discrete springs in the Deer Creek basin would be removed or diminished during Panel G mining: SP-UTDC-700 and SP-UTDC-800. These springs were supplying a combined flow of about 0.0001 to 0.003 cfs during the baseflow monitoring events (Maxim 2004c). Comparing that amount with the total flow in Deer Creek (SW-DC-500) at that same time shows that those springs may supply up to about 2 percent of the Deer Creek baseflow at that location. Another spring (UTSFDC-500) would be covered by the overburden dump, but it may still continue to flow and contribute to the unnamed tributary to the South Fork of Deer Creek. According to Maxim (2004d), this spring flows in May but dries up later in the season. There are no water rights associated with those springs, nor would their minimal flow contribution be expected to impact downstream water rights to streamflow.

One spring (SP-UTWC-300) that contributes flow to Wells Canyon is expected to be eliminated during Panel G mining, as described in **Section 4.3.1**, but all three late summer/early fall observations of that spring reported dry conditions, so it likely does not materially contribute to any surface flow in the Wells Canyon channel during the baseflow season. There is no water right associated with this spring.

For the purposes of this analysis, it is presumed that all of the above-mentioned diminutions in baseflow would be permanent.

Using the results of the groundwater modeling, given in **Section 4.3.1**, and the baseline surface water data described above, predictions of selenium increases in area streams were made, as shown in **Table 4.3-19** above. Panel G mining would result in the aquatic criterion for selenium (0.005 mg/L) being exceeded during baseflow conditions (summer, fall, and winter) in lower Deer Creek, but once Deer Creek flows are mixed with Crow Creek flows, Crow Creek would meet the criterion. At these analyzed stream locations, selenium concentrations would not affect water right holders' abilities to use this water for either stock watering or irrigation, based upon the action levels and thresholds discussed above.

<u>Panel G West Haul/Access Road (Component of Agency Preferred Alternative)</u>
The Panel G West Haul/Access Road would increase the amount of hydrologically disturbed land by 1.5 percent and 0.6 percent in the HUC 6 Deer Creek and Sage Creek watersheds, respectively. This results in an overall increase of 0.2 percent in the HUC 5 Crow Creek watershed. The road would also increase the hydrologically disturbed land in the HUC 6 Diamond Creek watershed below Timber Creek and the HUC 5 Diamond Creek watershed by 0.1 percent. This road is the only aspect of the Proposed Action that would affect the Diamond Creek watershed, which is in the Blackfoot Basin, unlike the rest of the watersheds, which are in the Salt River Basin.

The Panel G West Haul/Access Road would disturb about 88 acres within the Sage Creek basin, 17 acres in Diamond Creek watershed, and 112 acres in the Deer Creek basin. There would be 5 drainage channel crossings associated with this road, 2 of which would be in perennial stream reaches. Crossing Upper Deer Creek would require an approximate 280-foot long culvert and crossing South Fork Deer Creek would require an approximate 260-foot long culvert. The culverts would cross approximately perpendicular to the stream channels. These culverts would be designed, constructed, and maintained using the criteria discussed in

Appendix 2C, in order to reduce the sedimentation and stability impacts related to culverted crossings.

Two springs (SP-DC-100 and SP-DC-120) would be located under the current design footprint of this road.

There would be no effects to water rights due to this road.

About 15 acres of this road, or 7 percent of its total area, would be within AIZs (a small amount of this would be for the road-associated topsoil stockpiles). About 44 percent of the road would cross slopes of 30 percent or less and 56 percent would cross slopes between 31 and 65 percent. Additionally, about 10 acres, or 5 percent of this road, would cross Meade Peak Shale.

According to the WEPP:Road analysis, adjusted for BMP reductions, sediment loading to Deer Creek is calculated to be about 8.3 tons annually, and about 0.15 tons annually to South Fork Sage Creek. These sediment loadings are about 2.7 percent and 0.1 percent, respectively, of the calculated baseline sediment loads for these streams.

IDEQ's Antidegradation Policy (IDAPA 58.01.02.051.01) requires the application of BMPs such that in-stream water uses and level of water quality necessary to protect the existing uses shall be maintained and protected. IDEQ has stated that the Transportation Alternatives and subsequent water quality impacts analysis presented in the EIS meet the intent of the Antidegradation Policy (Lynn Van Avery, IDEQ, personal communication, September 5, 2006).

Because this road would remain in place after mining as a Forest road (though narrowed to USFS standards and partially reclaimed), the potential for the types of impacts described above would continue once mining was completed, although at a lesser scale.

<u>Power Line Between Panels F and G</u>
As shown in **Table 4.3-17** above, the power line would have a negligible effect on the amount of hydrologically disturbed land in any of the affected watersheds.

4.3.2.2 Mining Alternatives

Mining Alternative A – No South and/or North Panel F Lease Modifications
Table 4.3-20, below, shows the percent of watershed area that would be hydrologically disturbed due to each aspect of Mining Alternative A. This table only reflects the changes to the Panel F mine plan as compared to the Proposed Action and does not include any roads or the disturbances associated with the Panel G mining, which would remain as stated for the Proposed Action. If this alternative were to replace the Panel G portion of the Proposed Action, it would not cause the total amount of land in a hydrologically disturbed condition to rise above 30 percent in any of the affected HUC 5 or HUC 6 watersheds. Like the Proposed Action, this mining component would not impact streams listed under 303(d) for sediment.

The predictions of selenium increases in South Fork Sage Creek, Sage Creek, and Crow Creek downstream of Sage Creek are the same as, or slightly less than, those predicted for the Proposed Action Mining of Panel F, as shown in **Table 4.3-19**.

TABLE 4.3-20 PERCENT OF WATERSHED AREA IN A HYDROLOGICALLY DISTURBED CONDITION – ALTERNATIVE A

HUC NO.	WATERSHED	EXISTING DISTURBANCE	PANEL F WITHOUT NORTH MODIFICATION	PANEL F WITHOUT SOUTH MODIFICATION
170402712	Diamond Creek	6.8	0	0
170402071203	Diamond Creek Below Timber Creek	7.9	0	0
1704010507	Crow Creek	7.3	0.5	0.3
170401050705	Crow Creek Above Deer Creek	4.5	0	0
17040150707	Deer Creek	1.0	1.6	<0.1
17040150703	Middle Crow Creek	1.7	0.7	0.6
17040150708	Sage Creek	22.5	1.9	1.9

No Panel F North Lease Modification

As shown in **Table 4.3-20**, Panel F, without the North Lease Modification, would result in less than 2 percent of the land being hydrologically disturbed in any of the affected HUC 6 watersheds and by 0.5 percent in the HUC 5 Crow Creek watershed. This is essentially the same as the Proposed Action for Panel F. Further, the percent reduction in contributing watershed area, should this alternative replace the Panel F portion of the Proposed Action, would not be measurably different than the Proposed Action, as shown in **Table 4.3-18**. Like the Proposed Action, this mining alternative would not impact streams listed under 303(d) for sediment.

Impacts to South Fork Sage Creek and Deer Creek base flows and water rights due to spring diminishment would be the same under this alternative as under the Proposed Action Panel F.

If the Panel F North Lease Modification were not approved, impacts to surface water quantities in the Deer Creek and Manning Creek drainages would be the same as under the Proposed Action for Panel F. Impacts to surface water quantities in South Fork Sage Creek would essentially be the same as under the Proposed Action Panel F including the lease modifications.

No Panel F South Lease Modification

As shown in **Table 4.3-20**, Panel F, without the South Lease Modification, would result in 1.9 percent in the Sage Creek HUC 6 watershed and 0.6 percent in the Middle Crow Creek HUC 6 being hydrologically disturbed. Combined, this would represent 0.3 percent of the HUC 5 Crow Creek watershed. These numbers are slightly less than, or equal to, the Proposed Action numbers for Panel F under the Proposed Action. This alternative would not increase disturbances in the Deer Creek HUC 6 watershed.

In regard to the percent reduction in contributing watershed area, if this sub-alternative replaced the Panel F portion of the Proposed Action, **Table 4.3-18** shows that there would be no measurable difference between the two proposals for the South Fork Sage Creek and Wells Canyon watersheds. However, there would be somewhat less reduction for both the Manning and Deer Creek watersheds under this alternative than under the Proposed Action. Like the Proposed Action, this mining alternative would not impact streams listed under 303(d) for sediment.

Impacts to South Fork Sage Creek base flows and downstream water rights due to spring diminishment would be the same under this alternative as under the Proposed Action Panel F. Unlike the Proposed Action mining for Panel F, Deer Creek base flows would not be affected because no contributing springs would be lost.

If the Panel F South Lease Modification were not approved, there would be no impacts to surface water quantities in the Deer Creek drainage from mining Panel F. The impacts to surface water quantities in South Fork Sage Creek and Manning Creek would essentially be the same as under the Proposed Action for Panel F, except that the disturbed acreage in Manning Creek drainage would be reduced.

Mining Alternative B – No External Seleniferous Overburden Fills
Under this alternative, both the amount of land that would become hydrologically disturbed, and the amount of runoff reduction due to reduced contributing watershed areas would be the same as for the Proposed Action. Baseflow reductions to Deer and South Fork Sage Creek would be the same as under the Proposed Action. Like the Proposed Action, this mining alternative would not impact streams listed under 303(d) for sediment.

The estimates of selenium increases in area streams would be similar to the Proposed Action, depending upon the location, as shown in **Table 4.3-19**.

Mining Alternative C – No External Overburden Fills at All
Under this alternative, both the amount of land that would become hydrologically disturbed and the amount of runoff reduction due to reduced contributing watershed areas would be the same as for the Proposed Action. Baseflow reductions to Deer Creek and South Fork Sage Creek would be the same as under the Proposed Action. Like the Proposed Action, this mining alternative would not impact streams listed under 303(d) for sediment.

The estimates of selenium increases in area streams are the same as those predicted for Alternative B, as shown in **Table 4.3-19**.

Mining Alternative D – Store and Release Cover on Overburden Fills (Component of Agency Preferred Alternative)
Under this alternative, the amount of land in a hydrologically disturbed condition would increase over the amount for the Proposed Action, due to the need for the Dinwoody borrow pits and stockpiles. **Table 4.3-21** provides the percent disturbance that would result from this alternative, which includes the Proposed Action disturbances. This Alternative would not cause the total amount of land in a hydrologically disturbed condition to rise above 30 percent in any of the affected HUC 5 or HUC 6 watersheds. Like the Proposed Action, this mining alternative would not impact streams listed under 303(d) for sediment.

In regard to the percent reduction in contributing watershed area, the proposed Dinwoody borrow pits are presumed to be impounding structures, and the stockpiles are presumed to be either internally draining or within the confines of disturbance directed to retention ponds. If all of the borrow pit disturbances under this alternative were added to the Proposed Action disturbances (which is a conservative analysis), **Table 4.3-18** shows that there would be a percent or two greater runoff reduction than the Proposed Action.

TABLE 4.3-21 PERCENT OF WATERSHED AREA IN A HYDROLOGICALLY DISTURBED CONDITION – ALTERNATIVE D

HUC NO.	WATERSHED	EXISTING DISTURBANCE	ALTERNATIVE D
170402712	Diamond Creek	6.8	0.1
170402071203	Diamond Creek Below Timber Creek	7.9	0.1
1704010507	Crow Creek	7.3	1.3
170401050705	Crow Creek Above Deer Creek	4.5	1.5
17040150707	Deer Creek	1.0	6.8
17040150703	Middle Crow Creek	1.7	0.9
17040150708	Sage Creek	22.5	3.5

Baseflow reductions to Deer Creek and South Fork Sage Creek would be the same as under the Proposed Action.

Using the results of the groundwater modeling and the available surface water data, estimates of selenium increases in area streams were made for various attenuation scenarios, as shown in **Table 4.3-22**. Under all of the examined scenarios, predicted selenium concentrations would be about half of the aquatic criterion at the mouth of Deer Creek. Under all of the examined scenarios, predicted selenium loading would contribute to already occurring exceedances in the lower reaches of Sage Creek and in South Fork Sage Creek. Under the no-attenuation scenario, there would be an exceedance in Crow Creek downstream of Sage Creek during the irrigation season but not during the winter season. The existing Smoky Canyon Mine causes these exceedances. The Sage Creek exceedances and South Fork Sage Creek exceedances are being investigated through a CERCLA process to determine how best to correct the situations. Reclamation, and removal and remedial actions taken under the AOC to reduce selenium loading to these surface waters would reduce the potential for exceedances of surface water standards in the lower reaches of Sage Creek due to Panels F and G activities. These actions are currently underway at Pole Canyon and are proposed for Panel E reclamation (see **Appendix 2A**). At these analyzed stream locations, selenium concentrations would not affect water right holders' abilities to use this water for either stock watering or irrigation, based upon the action levels and thresholds discussed above.

TABLE 4.3-22 ESTIMATED SELENIUM CONCENTRATIONS (MG/L) IN AREA STREAMS FOR ALTERNATIVE D STORE AND RELEASE COVER (0.6 IN/YR)

LOCATION	NO ATTEN.	15% ATTEN.	25% ATTEN.	30% ATTEN.	2" + 30% ATTEN.
SUMMER/FALL DURING IRRIGATION SEASON					
Mouth of Deer Creek	0.0032	0.0028	0.0025	0.0023	0.0014
Crow Downstream of Deer Creek	0.0017	0.0015	0.0014	0.0013	0.0008
Mouth of S.F. Sage Creek	0.0051	0.0048	0.0046	0.0045	0.0039
Mouth of Sage Creek	0.0072	0.0070	0.0069	0.0069	0.0066
Crow Downstream of Sage Creek	0.0051	0.0049	0.0048	0.0048	0.0044
LATE FALL/WINTER BASEFLOWS WITHOUT IRRIGATION DIVERSIONS					
Mouth of Deer Creek	0.0032	0.0028	0.0025	0.0023	0.0014
Crow Downstream of Deer Creek	0.0013	0.0012	0.0011	0.0011	0.0008
Mouth of S.F. Sage Creek	0.0051	0.0048	0.0046	0.0045	0.0039
Mouth of Sage Creek	0.0072	0.0070	0.0069	0.0069	0.0066
Crow Downstream of Sage Creek	0.0041	0.0040	0.0039	0.0039	0.0036

For all of the Alternative D scenarios, as shown in **Table 4.3-22**, as expected, selenium loading would be greatest under the no-attenuation scenario, and progressively decrease as selenium attenuation increases.

As discussed in **Appendix 2A**, the available data for South Fork Sage Creek Spring and fluctuating concentrations at Hoopes Spring could be explained by a combination of site-specific factors related to the existing mining operations at the Smoky Canyon Mine located immediately north of South Fork Sage Creek (NewFields 2007b). The Bureau of Land Management, U.S. Forest Service, and Idaho Department of Environmental Quality have reviewed the recent work by NewFields and agreed that it represents one possible interpretation of the available data. As shown in **Table 4.3-23,** according to the NewFields report, once the planned Pole Canyon overburden fill removal action is complete and successful, and the reclamation and remediation in the Panel E area is complete, selenium concentrations at the mouths of South Fork Sage Creek and Sage Creek and in Crow Creek downstream of Sage Creek for all of the Alternative D scenarios would be below the water quality standard of 0.005 mg/L.

TABLE 4.3-23 ESTIMATED SELENIUM CONCENTRATIONS (MG/L) IN SAGE CREEK AND CROW CREEK FOR ALTERNATIVE D STORE AND RELEASE COVER (0.6 IN/YR), ASSUMING SUCCESSFUL RECLAMATION AT E PANEL AND WITH HOOPES SPRINGS SELENIUM REMOVAL ACTION

LOCATION	NO ATTEN.	15% ATTEN.	25% ATTEN.	30% ATTEN.	2” + 30% ATTEN.
SUMMER/FALL DURING IRRIGATION SEASON					
Mouth of South Fork Sage Creek	0.0037	0.0034	0.0032	0.0031	0.0025
Mouth of Sage Creek	0.0036	0.0034	0.0034	0.0033	0.0030
Crow Downstream of Sage Creek	0.0029	0.0027	0.0026	0.0025	0.0022
LATE FALL/WINTER BASEFLOWS WITHOUT IRRIGATION DIVERSIONS					
Mouth of South Fork Sage Creek	0.0037	0.0034	0.0032	0.0031	0.0025
Mouth of Sage Creek	0.0036	0.0034	0.0034	0.0033	0.0030
Crow Downstream of Sage Creek	0.0024	0.0023	0.0022	0.0022	0.0019

The most recent EPA-approved 303(d) list includes Sage Creek and its tributaries, one of which is South Fork of Sage Creek, as impaired by selenium. The predicted selenium concentrations for Alternative D in South Fork Sage Creek would be allowed by IDEQ. IDEQ (personal communication, Mary Kauffman, IDEQ, July 10, 2006) states that:

> “The addition of selenium to an already impaired water body is not necessarily a violation of the Water Quality Standards. An increase in selenium only violates the antidegradation policy when the increase results in water quality that further impairs the use. IDAPA 58.01.02.051.01. In addition, the TMDL provisions in the Water Quality Standards do not prohibit any increase in the load of pollutants for water bodies that are medium or low priority for TMDL development. Instead, IDAPA 58.01.02.054.05 provides that best management practices must be used to prohibit further impairment of the designated or existing uses. In addition, DEQ’s water quality criteria for selenium do not speak to increasing loadings into a water body that already exceeds the criteria. The criteria for selenium is based on a concentration. The addition of selenium that does not increase the concentration above the water quality criteria is not a violation of the Water Quality Standards. DEQ is committed to working with Simplot, BLM and the USFS to further evaluate additional mining alternatives that will not violate water quality criteria for selenium. In addition, DEQ will require that Simplot implement a water quality monitoring and surveillance plan to evaluate the effectiveness of those best management practices that are implemented as part of an approved mine plan.”

Because IDEQ has determined that there is not a conflict between the 303(d) listing for selenium and the Agency Preferred Alternative, the USFS has determined that their RFP Standard regarding this issue would also be met (USFS 2006b).

Mining Alternative E - Power Line Connection from Panel F to Panel G Along Haul/Access Road (Component of Agency Preferred Alternative)
The fewer acres of disturbance for this alternative, which would be distributed across several HUC 6 watersheds, would not measurably change the percent of hydrologically disturbed land or the percent of runoff reduction from those values for the Proposed Action. Further, baseflow reductions to Deer Creek and South Fork Sage Creek would be the same as under the Proposed Action. This alternative would have no discernable affect on water quality in addition to that for the haul/access road along which the power line would be constructed. There would be no additional effect from the power line on the impacts of the haul/access roads on streams listed under 303(d) for sediment.

Mining Alternative F - Electrical Generators at Panel G
This alternative would have the same disturbance areas as the Proposed Action. Therefore, the percent of hydrologically disturbed land and the percent of runoff reduction would be equal to the Proposed Action. Baseflow reductions to Deer Creek and South Fork Sage Creek would be the same as under the Proposed Action. This alternative would have no direct effect on water quality in addition to the Proposed Action. There would be a slightly higher risk of a fuel oil spill for this alternative over the Proposed Action because of the greater requirement for vendor delivery of fuel for the generators.

4.3.2.3 Transportation Alternatives

In addition to pit and overburden fill disturbances, roads would also contribute to the amount of land that would become hydrologically disturbed. For the Proposed Action roads and all eight Transportation Alternatives, the percent of additional hydrologically disturbed land is shown in **Table 4.3-24**. Under any of these alternatives, the resulting percentage would not cause the total amount of land in a hydrologically disturbed condition to rise above 30 percent in any of the affected HUC 5 or HUC 6 watersheds.

All culvert crossings of stream channels would be designed, constructed, and maintained using the criteria discussed in **Appendix 2C** in order to reduce the sedimentation and stability impacts inherent in culverted crossings. These criteria would also minimize the chance that any given culvert could plug and result in culvert failure, overtopping, road fill failure, and mass loading of road fill material into the stream.

Table 4.3-25 provides a comparison of the road indicators discussed in the general impacts section above for the Proposed Action and the Transportations Alternatives. Sediment loading from roads is outlined in **Table 4.3-26**, with details of this assessment found in **Appendix 4A**. Lastly, **Table 4.3-27** provides information on the amount of road crossing Meade Peak Shale outcrops.

Alternative 1 – Alternate Panel F Haul/Access Road
The Alternate Panel F Haul/Access Road would disturb 46 acres within the Sage Creek watershed. As shown in **Table 4.3-24**, this road alternative would result in 0.3 percent of hydrologically disturbed land in the Sage Creek HUC 6 watershed, which would equate to less than 0.1 percent in the HUC 5 Crow Creek watershed.

As shown in **Table 4.3-25**, there would be one drainage channel crossing associated with this road, which would be in a non-perennial reach of South Fork Sage Creek, and the same length and alignment as for the Proposed Action Panel F Haul/Access Road.

About 2 acres of this road, or 4 percent of its total area, would be within AIZs (**Table 4.3-25**). About 63 percent of the road would be crossing ground slopes of 30 percent or less, and 37 percent would be crossing ground slopes between 31 and 65 percent. None of this road would cross Meade Peak Shale outcrops (**Table 4.3-27**).

According to the sediment loading analysis, sediment loading to Sage Creek is calculated at about 0.7 tons annually; with about half of this amount contributed directly to South Fork Sage Creek (**Table 4.3-26**). The added sediment to South Fork Sage Creek would be about 0.2 percent of its calculated baseline sediment load. This alternative would not impact streams listed under 303(d) for sediment.

There would be no effects to water rights due to this road.

Some of these indicators are greater and some lesser than for the Proposed Action Panel F Haul/Access Road. However, the general effects to surface water resources would be in the same range for both of these roads.

Alternative 2 – East Haul/Access Road

The East Haul/Access Road would disturb 35 acres within the Sage Creek HUC 6 basin, 77 acres in the Middle Crow Creek HUC 6 basin, 23 acres in the Deer Creek HUC 6 basin, and 81 acres in the Crow Creek above Deer Creek HUC 6 basin. As shown in **Table 4.3-24**, these disturbances result in 0.2, 0.5, 0.3, and 0.4 percentages, respectively, of hydrologically disturbed land within these HUC 6 basins. Total disturbance from this alternative within the Crow Creek HUC 5 basin would be 0.2 percent.

There would be ten drainage channel crossings associated with this road, one of which would be perennial (**Table 4.3-25**). The perennial crossing would be in Lower Deer Creek, and would require a culvert about 300 feet long. The road would cross the channel at a near right angle.

About 5 acres of this road, or 2 percent of its total area, would be within AIZs, as shown in **Table 4.3-25** (a small amount of this would be for the road-associated topsoil stockpiles). This table also shows that 73 percent of the road would be crossing ground slopes of 30 percent or less, and 27 percent would be crossing ground slopes between 31 and 65 percent. Additionally, about 3 acres, or 1 percent of this road, would cross Meade Peak Shale outcrops (**Table 4.3-27**).

Sediment loading to various streams within the Crow Creek basin is calculated to be about 4.5 tons annually, which is 0.4 percent of the calculated baseline sediment load in **Table 4.3-26** that underestimates the actual sediment load in the basin from all upstream tributaries. This alternative would not impact streams listed under 303(d) for sediment.

The road fill for this alternative would be very close to, and possibly cover, one spring (SP-MC-600) where the road crosses the Manning Creek drainage.

There would be no effects to water rights due to this road.

TABLE 4.3-24 ADDITIONAL PERCENT OF WATERSHED IN A HYDROLOGICALLY DISTURBED CONDITION-DUE TO TRANSPORTATION ALTERNATIVES

HUC NO.	WATERSHED	EXISTING	P.A. F ROAD	P.A. G ROAD	ALT. 1	ALT. 2	ALT. 3	ALT. 4	ALT. 5	ALT. 6	ALT. 7	ALT. 8
170402712	Diamond Creek	6.8	0	0.1	0	0	0	0	0.1	0	0	0
170402071203	Diamond Crk. Below Timber Creek	7.9	0	0.1	0	0	0	0	0.1	0	0	0
1704010507	Crow Creek	7.3	0.1	0.2	<0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1
170401050705	Crow Crk. Above Deer Crk.	4.5	0	0	0	0.4	0.4	0	0	0	0.2	0
17040150707	Deer Creek	1.0	0	1.5	0	0.3	1.1	2.1	2.0	0.4	<0.1	1.0
17040150703	Middle Crow Crk.	1.7	0	0	0	0.5	0.5	0.1	0.1	0.1	0.2	0.1
17040150708	Sage Creek	22.5	0.4	0.6	0.3	0.2	0.2	0.1	0.2	0.2	<0.1	0.1
17040150702	Crow Crk. Above Spring Crk.	7.8	0	0.1	0	0	0	0	0	0	0.2	0
17040150701	Lower Crow	23.5	0	0.1	0	0	0	0	0	0	0.1	0

TABLE 4.3-25 COMPARISON OF ROAD CHARACTERISTICS

CHARACTERISTIC	P.A. F ROAD	P.A. G ROAD	ALT. 1	ALT. 2	ALT. 3	ALT. 4	ALT. 5	ALT. 6	ALT. 7	ALT. 8
# Drainage Culverts*	1	5	3	10	10	14	9	2	21	14
# Perennial Drainage Culverts	0	2	0	1	1	0	2	0	4	0
Area in AIZs (Acres)	<1	15	2	5	10	9	15	6	11	10
Area in AIZs (%)	1	7	4	2	4	5	7	10	10	10
Area on 0 - 30% Slopes (acres)	33	86	29	127	122	46	82	39	88	35
Area on 0 - 30% Slopes (%)	50	44	63	73	53	24	40	63	77	35
Area on 31 - 65% Slopes (acres)	33	107	17	46	104	142	120	22	26	64
Area on 31 – 65% Slopes (%)	50	56	37	27	45	74	60	37	23	65
Area on 66+% Slopes (acres)	0	0	0	0	6	3	0	0	0	0
Area on 66+% Slopes (%)	0	0	0	0	2	2	0	0	0	0

*Note that drainage crossing culverts counted above do not include smaller ditch relief culverts or minor crossing culverts that may be proposed during final road design.

TABLE 4.3-26 SEDIMENT LOADING TO STREAMS FROM TRANSPORTATION ALTERNATIVES ROAD EROSION (TONS/YEAR AVERAGE)

STREAM	EXISTING STATUS	P.A. F HAUL	P.A. G HAUL	ALT. 1	ALT. 2	ALT. 3	ALT. 4	ALT. 5	ALT. 6	ALT. 7	ALT. 8
SF SAGE	154.8	0.45	0.15	0.35	0	0	1.05	1.05	0	0	0.20
L SAGE*	NA	0.05	0	0.35	0.50	0.50	0	0	0	0	0
MANNING	58.7	0	0	0	1.20	1.10	0.25	0.25	0	0	0
DIAMOND	482.4	0	0	0	0	0	0	0	0	0	0
DEER	307.8	0	8.30	0	0.60	1.50	6.45	9.35	0.40	0	1.9
NATE	22.0	0	0	0	1.20	1.20	0	0	0	0	0
WELLS	83.5	0	0	0	0	0	0	0	0	0.65	0
CROW**	NA	0	0	0	1.00	0.75	0	0	0	0.30	0
TOTAL***	1,109.2	0.50	8.45	0.70	4.5	5.05	7.75	10.65	0.40	0.95	2.1

*Contributed to Sage Creek downstream of South Fork Sage; does not include quantities listed for South Fork Sage.
**Includes quantities contributed directly to Crow Creek or to one of the small, unnamed tributaries to it; does not include quantities listed for the other named tributaries listed in the table.
*** This total only includes the listed tributaries and does not include sediment load from all other tributaries in the Crow Creek basin.

TABLE 4.3-27 AREA OF ROAD ALTERNATIVES CROSSING MEADE PEAK SHALE OUTCROP

INDICATOR	P.A. F HAUL	P.A. G HAUL	ALT. 1	ALT. 2	ALT. 3	ALT. 4	ALT. 5	ALT. 6	ALT. 7	ALT. 8
AMOUNT OF ROAD (ACRES) TRAVERSING OUTCROP	0	10	0	3	3	10	10	2	1	9
% OF ROAD TRAVERSING OUTCROP	0	5	0	1	1	5	5	4	<1	10

As compared with the Proposed Action Panel G West Haul/Access Road, this alignment generally presents less impact to surface water resources. While it has an overall greater number of stream crossings, only one is perennial, compared to two for the Proposed Action Panel G Haul/Access Road. Otherwise, this alternative avoids more AIZs, steep slopes, and Meade Peak Shale than the Proposed Action Panel G West Haul/Access Road. The WEPP analysis rated this alternative as much lower impact, in regard to sedimentation, than the Proposed Action Panel G West Haul/Access Road.

Alternative 3 – Modified East Haul/Access Road

The Modified East Haul/Access Road would disturb 34 acres within the Sage Creek HUC 6 basin, 77 acres in the Middle Crow Creek HUC 6 basin, 83 acres in the Deer Creek HUC 6 basin, and 82 acres in the Crow Creek above Deer Creek HUC 6 basin. As shown in **Table 4.3-24**, these disturbances amount to 0.2, 0.5, 1.1, and 0.4 percentages, respectively, of hydrologically disturbed land within those HUC 6 basins. Total disturbance from this alternative within the Crow Creek HUC 5 basin would be 0.2 percent. While much of this disturbance would be the same as for the Alternative 2 East Haul/Access Road, the disturbance in Deer Creek drainage would be greater under Alternative 3 than Alternative 2.

There would be ten drainage channel crossings associated with this road, one of which would be perennial (**Table 4.3-25**). Many of the culverts would be the same as for the Alternative 2 East Haul/Access Road, except the culvert in Deer Creek, which would be located further upstream and would be longer at about 390 feet. These culverts would be designed, constructed and maintained using the criteria discussed in **Appendix 2C**, in order to reduce the sedimentation and stability impacts inherent in culverted crossings.

About 10 acres of this road, or 4 percent of its total area, would be within AIZs (a small amount of this would be for the road-associated topsoil stockpiles), compared with 15 acres for the Proposed Action Panel G West Haul/Access road, and 5 acres for Alternative 2 (**Table 4.3-25)**. This table also shows that 45 percent of the road would be crossing ground slopes of 30 percent or less, 45 percent would be crossing ground slopes between 31 and 65 percent, and 2 percent would be crossing ground slopes greater than 65 percent. Overall, this alternative would be on flatter ground than the Proposed Action West Haul/Access Road, but would have some steep sections; it would be on generally steeper ground than Alternative 2. Additionally, about 3 acres, or 1 percent of this road, would cross Meade Peak Shale outcrops, which is less than for the Proposed Action West Haul Road, but more than for Alternative 2 (**Table 4.3-27)**.

According to the sediment loading analysis, sediment loading to various streams within the Crow Creek basin from this road is calculated at about 5 tons annually, which is 0.45 percent or less of the calculated baseline sediment load for this stream. This is less than predicted for the Proposed Action Panel G West Haul/Access Road, and similar to Alternative 2. This alternative would not impact streams listed under 303(d) for sediment.

The road fill for this alternative would be very close to, and possibly cover, one spring (SP-MC-600) where the road crosses the Manning Creek drainage.

There would be no effects to water rights due to this road.

This alternative is closer in impact level to Alternative 2 East Haul/Access Road than it is to the Proposed Action Panel G West Haul/Access Road.

Alternative 4 – Middle Haul/Access Road

The Middle Haul/Access Road would disturb 14 acres within the Sage Creek HUC 6 basin, 16 acres in the Middle Crow Creek HUC 6 basin, and 162 acres in the Deer Creek HUC 6 basin. As shown in **Table 4.3-24**, these disturbances amount to 0.1, 0.1, and 2.1 percentages, respectively, of hydrologically disturbed land within those HUC 6 basins. Total disturbances from this alternative within the Crow Creek HUC 5 basin would be 0.2 percent. The Deer Creek disturbance would occur further downstream in the watershed than would occur under the Proposed Action Panel G West Haul/Access Road or the Alternate Panel G West Haul/Access Road, and further upstream than would occur under the Modified East or East Haul/Access Roads.

There would be 14 drainage channel crossings associated with this road, none of which would be in perennial stream reaches (**Table 4.3-25**). This is more total crossings than the Proposed Action Panel G West Haul/Access Road, but fewer perennial ones. About 9 acres of this road, or 5 percent of its total area, would be within AIZs, which is less than estimated for the Proposed Action Panel G West Haul/Access Road (**Table 4.3-25**). This table also shows that 24 percent of the road would be crossing ground slopes of 30 percent or less, 74 percent would be crossing ground slopes between 31 and 65 percent, and 2 percent would be on ground sloping greater than 2 percent. Slightly more of this road would be on steeper slopes than would the Proposed Action Panel G West Haul/Access Road. Additionally, about 10 acres, or 5 percent of this road, would cross Meade Peak Shale outcrops, the same as for the Proposed Action Panel G West Haul/Access Road (**Table 4.3-27**).

According to the sediment loading analysis, sediment loading to Deer Creek from this road is calculated to be about 6.4 tons annually, slightly less than for the Proposed Action Panel G West Haul/Access Road; with smaller amounts being contributed to South Fork Sage and Lower Sage Creek directly (**Table 4.3-26**). The sediment load to Deer Creek is about 2 percent of the calculated baseline sediment load of this stream. This alternative would impact stream segments listed under 303(d) for sediment.

IDEQ's Antidegradation Policy (IDAPA 58.01.02.051.01) requires the application of BMPs such that in-stream water uses and level of water quality necessary to protect the existing uses shall be maintained and protected. IDEQ has stated that the Transportation Alternatives and subsequent water quality impacts analysis presented in the EIS meet the intent of the Antidegradation Policy (Lynn Van Avery, IDEQ, personal communication, September 5, 2006).

One spring (SP-NFDC-50) would be located under the current design footprint of this road, and could be covered by road fill.

There would be no effects to water rights due to this road.

Alternative 5 – Alternate Panel G West Haul/Access Road

The Alternate Panel G West Haul/Access Road would disturb 38 acres within the Sage Creek HUC 6 basin, 16 acres in the Middle Crow Creek HUC 6 basin, 155 acres in the Deer Creek HUC 6 basin, and 17 acres in the Diamond Creek below Timber Creek HUC 6 basin. As shown in **Table 4.3-24**, these disturbances amount to 0.2, 0.1, 2.0, and 0.1 percentages, respectively, of hydrologically disturbed land within those HUC 6 basins. This results in a total disturbance of 0.2 percent in the HUC 5 Crow Creek watershed and 0.1 percent in the HUC 5 Diamond Creek watershed.

There would be nine drainage channel crossings associated with this road, two of which would be in perennial stream reaches (**Table 4.3-25**). The two perennial crossings, as well as several of the other culvert crossings would be the same as for the Proposed Action West Haul/Access Road.

About 15 acres of this road, or 7 percent of its total area, would be within AIZs, as shown in **Table 4.3-25** (a small amount of this would be for the road-associated topsoil stockpiles). This table also shows that 40 percent of the road would be crossing ground slopes of 30 percent or less, and 60 percent would be crossing ground slopes between 31 and 65 percent. Additionally, about 10 acres, or 5 percent of this road, would cross Meade Peak Shale outcrops (**Table 4.3-27)**. These values are quite similar to the Proposed Action Panel G West Haul/Access Road.

According to the sediment loading analysis, sediment loading to Deer Creek from this road is calculated to be about 9.4 tons annually; with a total of 10.7 tons to various streams within the Crow Creek basin, or slightly more than estimated for the Proposed Action West Haul/Access Road. These sediment loads to Deer Creek and Crow Creek are about 3 percent and 1 percent increases, respectively, compared to the calculated baseline sediment loads in these streams in **Table 4.3-26**. Because the table does not include sediment loads from all upstream tributaries of Crow Creek, the actual percentage increase in sediment to Crow Creek would be less. This alternative would impact stream segments listed under 303(d) for sediment.

IDEQ's Antidegradation Policy (IDAPA 58.01.02.051.01) requires the application of BMPs such that in-stream water uses and level of water quality necessary to protect the existing uses shall be maintained and protected. IDEQ has stated that the Transportation Alternatives and subsequent water quality impacts analysis presented in the EIS meet the intent of the Antidegradation Policy (Lynn Van Avery, IDEQ, personal communication, September 5, 2006).

As with the Proposed Action version of this road alignment, two springs (SP-DC-100 and SP-DC-120) would be located under the current design footprint of this road and could be covered by road fill.

There would be no effects to water rights due to this road.

Alternative 6 – Conveyor from Panel G to Mill

The conveyor and its associated maintenance road would disturb 24 acres within the Sage Creek HUC 6 basin, 8 acres in the Middle Crow Creek HUC 6 basin, and 29 acres in the Deer Creek HUC 6 basin. As shown in **Table 4.3-24**, these disturbances amount to 0.2, 0.1, and 0.4 percentages, respectively, of hydrologically disturbed land within those HUC 6 basins. Total disturbances from this alternative within the Crow Creek HUC 5 basin would be 0.1 percent. The Deer Creek disturbance would occur further downstream in the watershed than would occur under the Proposed Action Panel G Haul/Access Road or the Alternate Panel G West Haul/Access Road.

As shown in **Table 4.3-25**, there would be two drainage channel crossings associated with this road, neither of which would be in perennial streams reaches (the road would stop short of both South Fork Sage Creek and Deer Creek to avoid crossing those streams). About 6 acres of this conveyor corridor, or 10 percent of its total area, would be within AIZs, as shown in **Table 4.3-25** (a small amount of this would be for the road-associated topsoil stockpiles). This table also shows that 63 percent of the road would be crossing ground slopes of 30 percent or less, and 37 percent would be crossing ground slopes between 31 and 65 percent. About 2 acres, or 4 percent of this road, would cross Meade Peak Shale outcrops (**Table 4.3-27)**.

According to the sediment loading analysis, sediment loading to Deer Creek from this corridor is calculated at about 0.40 tons annually, much less than for the Proposed Action Panel G West Haul/Access Road (**Table 4.3-26**). This alternative would impact stream segments listed under 303(d) for sediment.

IDEQ's Antidegradation Policy (IDAPA 58.01.02.051.01) requires the application of BMPs such that in-stream water uses and level of water quality necessary to protect the existing uses shall be maintained and protected. IDEQ has stated that the Transportation Alternatives and subsequent water quality impacts analysis presented in the EIS meet the intent of the Antidegradation Policy (Lynn Van Avery, IDEQ, personal communication, September 5, 2006).

There would be no effects to water rights due to this Alternative.

When compared with the Proposed Action and other haul road alternatives to the Proposed Action Panel G West Haul/Access Road, there would be less impact to surface water resources under this alternative. Alternative 7 or 8 would also need to be considered along with the conveyor alternative for a full comparison.

Alternative 7 – Crow Creek/Wells Canyon Access Road

Alternative 7 would disturb 5 acres within the Lower Crow Creek HUC 6 basin, 40 acres within the Crow Creek above Spring Creek HUC 6 basin, 5 acres within the Sage Creek HUC 6 basin, 25 acres in the Middle Crow Creek HUC 6 basin, 1 acre in the Deer Creek HUC 6 basin, and 38 acres in the Crow Creek above Deer Creek HUC 6 basin. As shown in **Table 4.3-24**, these disturbances amount to 0.1, 0.2, <0.1, 0.2, <0.1, and 0.2 percentages, respectively, of hydrologically disturbed land within those HUC 6 basins. The total increase from this alternative within the Crow Creek HUC 5 basin would be 0.1 percent.

There would be 21 drainage channel crossings associated with this road, 4 of which would be in perennial stream reaches, but most of these crossings are already present along the existing road (**Table 4.3-25**). The four perennial crossings would be located near the mouths of: Deer Creek, Sage Creek, Hardmans Hollow, and an unnamed stream. Culvert lengths would be 185, 105, 75, and 70 feet, respectively.

About 11 acres of new construction on this road, or 10 percent of its total area, would be within AIZs, which is less than for the Proposed Action Panel G West Haul/Access Road (**Table 4.3-26**). This table also shows that 77 percent of the road would be crossing ground slopes of 30 percent or less, and 23 percent would be crossing ground slopes between 31 and 65 percent. This would be on flatter ground than the Proposed Action Panel G West/Access Haul Road. Additionally, about 1 acre, or less than 1 percent of this road, would cross Meade Peak Shale outcrops, which is much less than for the Proposed Action Panel G West/Access Haul Road (**Table 4.3-27**).

According to the sediment loading analysis, annual sediment loading to Crow Creek and Wells Canyon from this road is calculated to be about 0.30 and 0.7 tons, respectively, much less than the Proposed Action Panel G West Haul/Access Road, even when combined with Alternative 6 (**Table 4.3-26**). This alternative would not impact streams listed under 303(d) for sediment.

One spring (SP-Books) is located adjacent to the footprint of this road. It is presumed that the existing road footprint for this road allows the spring to function adequately and that the upgraded road would also allow this. There is a water right (4069) associated with the spring.

The Wells Canyon portion of this road would remain in use as the permanent access up Wells Canyon after mining is completed, so the potential impacts from it that are described above would continue. However, the existing Wells Canyon Road, which is located in the canyon bottom, would be decommissioned and reclaimed, eliminating the existing impacts that it causes to the Wells Canyon stream channel.

Alternative 8 – Middle Access Road

The Middle Access Road would follow the same alignment as much of the Middle Haul/Access Road (Alternative 4), thus disturbing the same watersheds. However, because it would be a narrower road, it would disturb less acreage than Alternative 4. Alternative 8 would disturb 11 acres within the Sage Creek HUC 6 basin, 9 acres in the Middle Crow Creek HUC 6 basin, and 79 acres in the Deer Creek HUC 6 basin. As shown in **Table 4.3-24**, these disturbances amount to 0.1, 0.1, and 1.0 percent, respectively, of hydrologically disturbed land within those HUC 6 basins. Total disturbance from this alternative within the Crow Creek HUC 5 basin would be 0.1 percent.

There would be 14 drainage channel crossings associated with this road, none of which would be in perennial stream reaches (**Table 4.3-25**). About 10 acres of this road, or 10 percent of its total area, would be within AIZs (**Table 4.3-25**). This table also shows that 35 percent of the road would be crossing ground slopes of 30 percent or less, and 64 percent would be crossing ground slopes between 31 and 65 percent. Additionally, about 9 acres, or 10 percent of this road, would cross Meade Peak Shale outcrops (**Table 4.3-27**). This would be less acreage than for the Proposed Action Panel G West Haul/Access Road that would cross AIZs, steep slopes, and shale outcrops.

According to the results of the sediment loading analysis, sediment loading to Deer Creek from this road is calculated at about 1.9 tons annually and about 0.20 tons annually to South Fork Sage Creek, much less than for the Proposed Action Panel G West Haul/Access Road. These sediment loads are about 0.6 percent and 0.1 percent, respectively, of the calculated baseline sediment loads in these streams. This alternative would impact stream segments listed under 303(d) for sediment.

IDEQ's Antidegradation Policy (IDAPA 58.01.02.051.01) requires the application of BMPs such that in-stream water uses and level of water quality necessary to protect the existing uses shall be maintained and protected. IDEQ has stated that the Transportation Alternatives and subsequent water quality impacts analysis presented in the EIS meet the intent of the Antidegradation Policy (Lynn Van Avery, IDEQ, personal communication, September 5, 2006).

Two springs (SP-NFDC-50 and SP-DC-350) would be covered by the currently designed road fill of this road.

There would be no effects to water rights due to this road.

4.3.2.4 No Action Alternative

Under the No Action alternative, effects to surface water in the affected drainages would not change beyond those currently caused by mining in the Sage Creek drainage, previous exploration activities in the nearby drainages including Deer Creek, and existing Forest roads. The percent hydrologic disturbance would remain at current levels, which is well below the allowed 30 percent, leaving room for other types of development on Forest land.

4.3.3 Mitigation Measures

Where haul/access roads are currently designed close to or over springs, the finally selected road would be rerouted around them, or if that is not feasible, Simplot would install culverts, drains, or other mechanisms in the base of the road fills to ensure the natural spring flows would continue to flow.

Springs currently in use that are disrupted by mining or covered by road building would be replaced with alternate, permanent, and generally equivalent water sources by Simplot, in accordance with the RFP requirements.

This replacement would be done for springs that are affected either during (short-term) or after (long-term) mining operations. Disrupted springs that are within the footprint of the mine disturbance area would not be replaced in their original location; instead, alternative water replacement sources would be located all around the mine disturbance footprint. The specific type of water source replacement would be determined on a case-by-case basis in concert with the appropriate FEIS resource specialists (hydrology, range, wildlife). Depending upon the location and the existing use of a water source, its replacement plans may need to consider wildlife other than just the large mammals (i.e., insects, amphibians, birds). The projects would be designed by Simplot, reviewed and approved by the USFS, constructed (and operated) by Simplot, and monitored for effectiveness by Simplot. Monitoring results would be submitted to the CNF on a regular basis. In some cases, supplemental NEPA analysis and water rights changes may also be required. These spring mitigation measures would not necessarily restore the original functions and values of any wetlands at the native springs that are being replaced; these would be determined on a case-by-case basis.

Replacement options that would be considered include:

1. Supplying new water tanks with water hauled and/or piped by Simplot;

2. Improving water flow or retention (ponding) at springs near the disturbed area to compensate for springs disrupted within the disturbed area, and/or fencing them (while considering the ramifications of fencing on specific species such as bats);

3. Building new livestock/wildlife watering ponds;

4. Building guzzlers, some of which could accommodate various species by using alternate guzzler designs such as ramps, etc. (i.e., gallinaceous guzzlers);

5. Designing some mine runoff and sediment retention ponds to be available to livestock and wildlife, while monitoring water quality to ensure it is suitable for their consumption;

6. Drilling small water wells into Rex Chert or Dinwoody local aquifers with windmills to supply water tanks;

7. Creating wetland areas, flowing water areas, diverse shoreline areas, and enhancing vegetation to provide shade, cover, and habitat diversity; and

8. Enhancing nearby existing stock ponds that typically dry up early in the summer with bentonite sealing of the bottom, thereby extending their season of usefulness.

Further, if long-term monitoring of springs whose water quality can potentially be affected shows that unacceptable chemistry impacts are, in fact, occurring, Simplot would be required to either clean up this water chemistry or safely dispose of the contaminated water and replace the lost water with clean water.

Water resources monitoring sites pertaining to this Project would be added to the current water monitoring program at Smoky Canyon Mine (see **Section 2.10**).

Regular inspections would be conducted along the outer toes and slopes of all overburden fills to look for indications of seeps or springs discharging from the overburden.

Simplot would conduct infiltration testing within the footprint of the seleniferous overburden disposal sites prior to placing overburden. This testing would be conducted according to a plan that would be reviewed and approved by the Agencies before implementation. The testing would be intended to demonstrate that the vertical percolation rate in the seleniferous interior of the external overburden fills is sufficient to prevent development of seleniferous external overburden seeps.

Record keeping and use of a third party quality control inspector satisfactory to the Agencies would be employed by Simplot to ensure that the external overburden disposal facilities are built as proposed.

Roads would be designed, constructed, and operated to prevent a fuel or oil spill from entering a nearby stream by implementing suitable BMPs to contain such an event.

Monitoring would take place for COPC content analysis of overburden proposed for use as construction material according to an agency-approved geochemical sampling program.

Monitoring of the construction and functioning of Alternative D would be conducted in accordance with the Record of Decision and an agency-approved cover construction and operation monitoring plan. This plan would include monitoring of construction to provide data showing the cover was built in accordance to agency-approved plans and specifications. It would also include monitoring of the performance of the cover to provide data showing the cap is functioning as designed and modeled.

4.3.4 Unavoidable (Residual) Adverse Impacts

Groundwater

Unavoidable adverse effects to groundwater conditions at the site after mining ceases, and after any mitigation and/or final reclamation has occurred, would be mainly from a water quality impact. Since it has been determined that infiltration of precipitation through seleniferous overburden has the potential to affect groundwater quality by releasing selenium and other COPCs into the groundwater regime, residual effects would still be likely to remain and be ongoing after proposed reclamation actions have been completed. Over hundreds of years, the concentration of contaminants in the infiltrating water are expected to decrease.

Surface Water

The water quality impacts caused by groundwater contributions of selenium to surface waters would result in increased levels of this parameter beyond the mining timeframe. Similarly, the contributions of baseflow to surface water (although small) from the springs that would be eliminated would be lost beyond the mining timeframe.

Road corridors remain a potential source of sedimentation to streams, even with high design standards, BMP implementation, and maintenance commitments, for some years after their reclamation.

4.3.5 Relationship of Short-Term Uses and Long-Term Productivity

The local, short-term use of the mineral resources and groundwater supply for phosphate mining would result in ongoing employment and other economic benefits to the local and regional economies affected by the Smoky Canyon Mine and the Don Plant in Pocatello. It would also provide fertilizer for the agricultural areas supplied by the Don Plant.

<u>Groundwater</u>
Seepage of infiltration through seleniferous overburden and contribution of COPCs to groundwater downgradient of the overburden disposal areas would result in long-term water quality impacts of this groundwater. No exceedences of groundwater quality protection standards are expected. Where the contaminated groundwater discharges to the surface environment, the contaminants would be transferred from the subsurface to the surface environment for long periods of time. No exceedences of surface water quality standards are expected. Over many centuries, these concentrations are expected to decrease.

<u>Surface Water</u>
The short-term use of the affected watershed areas for phosphate mining would benefit the local and regional economy. The long-term productivity of the streams affected by COPCs contributed through groundwater discharges would be diminished to varying degrees based on the concentrations of the COPCs.

4.3.6 Irreversible and Irretrievable Commitments of Resources

<u>Groundwater</u>
The loss of groundwater quantity that is used for mining at Panel G during the proposed mining operations would practically all be recovered through natural precipitation and infiltration. Based on the aquifer characteristics of the formations in the area, impacts to groundwater quantity would not be irreversible or irretrievable.

Irretrievable changes in groundwater quality under and downgradient of the overburden disposal areas would occur. This would occur because of the long-term infiltration of water through the seleniferous overburden material disposed of on-site. An area of the Wells formation aquifer extending east from Panel F has been modeled to have water quality impacts from overburden seepage. An area of the Wells formation aquifer extending northeast from Panel G has also been modeled to have water quality impacts from overburden seepage. Peak concentrations of COPCs within the affected areas of the aquifer are expected to comply with applicable groundwater protection standards.

Springs/seeps that would be disrupted by mine panels would be permanently eliminated. Some springs and seeps downgradient of mine panels would have various degrees of permanent decreases in flows due to reductions in upgradient recharge. Certain springs/seeps would be permanently covered with mine overburden.

<u>Surface Water</u>
For practical purposes, streams that are negatively impacted by COPCs in groundwater discharges would be irreversible commitments of these resources. The same is true for springs that are permanently disrupted by mining or covered by road fills.

4.4 Soils

Issue:
The mining operations and related transportation activities may have the potential to affect soil resources in the Project Area.

Indicator:
Estimated acres of soil disturbance created during mining, and quantity of acres not reclaimed at the conclusion of mining.

4.4.1 Direct and Indirect Impacts

The Proposed Action and Alternatives would have direct and indirect impacts to the soil resources within the Project Area. Soil resources outside the Proposed Action and Alternatives would not be directly affected. Direct impacts to soil resources include loss of soil during salvage, sediment loss due to erosion, exposure and potential mobilization of selenium, and reduced productivity. Indirect impacts related to soil resources include water quality degradation related to erosion or selenium in sediment, potential elevated selenium content of vegetation on reclaimed areas, and reduced viability of vegetation related to soil fertility factors.

Indirect impacts related to the selenium content of plant growth medium within the Project Area are possible but would be greatly reduced by covers with low selenium concentrations that would be placed over seleniferous overburden fills.

Potential impacts to soil resources would be similar for the Proposed Action and all Alternatives except the No Action Alternative. The described activities would be similar for the different alternatives presented, although the acres affected and reclaimed may vary depending on the alternative. With implementation of growth medium salvage and reuse practices, soil conservation measures, BMPs, and other proposed operating procedures, the impacts to this resource under the Proposed Action and Alternatives would be site-specific, long-term, and moderate (see page 4-1 for definition).

Physical Changes to Soil Resources
Surface disturbance and removal of soil resources for replacement during reclamation activities would result in direct impacts to soils within the Project Area. Physical and chemical changes to the soil are expected to be moderate and would occur by mixing during initial salvage operations and when the soil is placed in stockpiles for future reclamation use.

Microorganisms such as bacteria and fungi are important in the decomposition of biological materials and the formation and improvement of soil itself (USDA 1979). Natural processes, such as dust blowing on the site from other areas, would reinoculate the site with these microorganisms. Root penetration and the development of a rhizosphere environment are also thought to perpetuate the growth of microorganisms (USDA 1979). Microbiotic soil crusts are recognized as an important aspect of soil quality (USDA 2003a), and damage to these crusts would occur during disturbance, reducing soil quality by increasing erosion potential and changing the properties of the associated soil.

Direct physical impacts to soil resources include compaction and crushing of the soil and soil crust by equipment during recovery, stockpiling, and subsequent replacement during reclamation. Physical effects of soil compaction would be moderate and include reduced permeability and porosity, damage to microbiotic crusts, increased bulk density, decreased available water holding capacity, increased erosion potential, reduced gaseous exchange, and loss of soil structure. Soils in the area of the Proposed Action or Alternatives characteristically have a high percentage of coarse fragments, which would provide support for heavy equipment without compressing the underlying soils.

Productivity

Productivity is defined as the rate of vegetation production per unit area, usually expressed in terms of weight or energy. Primary factors that influence natural soil productivity include length of growing season, climate and soil depth, and production/fertility. As identified in the RFP (USFS 2003a), soil productivity and soil quality on the Forest are generally stable, but some areas, associated with management actions, show declines.

Production and fertility of the stockpiled growth medium would be directly affected by mixing of the soils during salvage operations. Incorporation of slash and vegetative materials into the growth medium during stripping would increase the organic matter content of the material and elevate the production potential. Mixing of soils with low coarse fragment content together with soils of high coarse fragment content would serve to dilute the coarse fragment content and is likely to increase the production potential of the growth medium.

Soil compaction can contribute to soil erosion and reduced soil productivity. Productivity loss due to compaction influences would be negligible with implementation of the Proposed Action or Alternatives.

Soil Salvage

Soil salvage, planting methods, and seed mix selection are important for establishment of permanent vegetation on reclaimed areas. Topsoil/growth medium would be salvaged for reclamation purposes and stockpiles placed on stable landforms would be protected from erosional forces. Temporary cover crops established on the stockpiles serve to enhance productivity potential and reduce soil loss over the life of the stockpile.

Soil salvage would be based on suitability criteria as described in this document, including site slope and configuration. Direct haul and placement of growth medium to sites ready for immediate reclamation would minimize the need for stockpiling the material and would be done whenever possible. Based on suitable soil depths shown in **Tables 3.4-1 and 3.4-4**, the average potential topsoil stripping depth for soils within the area of the Proposed Action is estimated to be about 22 inches. A summary of in-situ topsoil/growth medium volumes for mapped soil units in the area of the Proposed Action and Alternatives is presented in **Table 3.4-4**. These mapped units occur within a specific study area and do not represent the entire area encompassed by the transportation alternatives or haul/access roads. The total volume of suitable, in-situ growth medium to be salvaged with implementation of the Proposed Action is estimated at 3,962,700 cubic yards. The amount of growth medium to be salvaged was calculated using the estimated 1,340 acres of disturbance and the average topsoil stripping depth of 22 inches (1.833 feet). Although the topsoil within the topsoil stockpile footprints would not be salvaged, once the stockpiled topsoil is removed from these areas and used for reclamation, the existing topsoil underneath the stockpiled locations would be ripped and scarified to aid in reclamation. Thus, this proposed disturbance acreage was included in calculating the available topsoil to be salvaged.

Considering the effects of inaccuracies in the estimation of average thickness of suitable soils within the disturbance footprint, potential swell of soil volumes during excavation, and potential compaction of soil during reapplication, the resulting re-applied soil would yield a layer of growth medium of about 18 inches (ranging from one to two feet) available for placement over the 1,269 acres of disturbance to be reclaimed. Growth medium placed to this depth would enhance the long-term productivity of the reclaimed areas. The actual total volume of available growth medium resources may be slightly different than estimated, due to variable site conditions.

Soil Loss

Localized declines in soil quantity are directly associated with increasing loss of soil from erosion and displacement, loss of fine litter and coarse woody debris, changes in vegetation composition, and increases in bulk density from compaction (USDA 2003a). A portion of the soils within the Project Area would be physically lost during salvage and replacement operations through mechanical and erosion effects. Soil mixing and loss of some soil would also occur during final growth medium distribution and completion of reclamation.

Erosion would occur in areas of new or increased surface disturbance. Soil characteristics identified in **Table 3.4-5** suggest that disturbed areas would experience moderate erosion potential, either by wind or water. Measures would be implemented for sediment and erosion control to reduce soil loss and sedimentation that could be caused by sheet and gully erosion from drainage and surface runoff. Reducing the duration of time that the soil is exposed would limit the degree of erosion by wind or water. Growth medium stockpiles would be graded and seeded to reduce the loss of soil resources by erosion. Concurrent and timely revegetation of disturbed areas would reduce the potential for soil erosion in the Project Area by improving ground cover.

Soil erosion potential is determined based on physical soil characteristics and slope. Areas located on steep slopes are inherently more susceptible to erosion. The majority of reclaimed areas identified in the Mine and Reclamation Plan incorporate a 3:1 (Horizontal:Vertical) slope surface during regrading and reclamation activities, yielding an average slope value of approximately 33 percent.

Localized factors such as type and amount of vegetative ground cover, percentage, and type of rock fragments on the ground surface, and/or implementation of soil conservation BMPs may prevent soil erosion, even in areas with inherently high soil erosion potential.

Water Erosion

Potential for water erosion would be increased after soil salvage operations due to the removal of the vegetative cover and the loss of soil structure. Erosion of topsoil/growth medium after redistribution on regraded sites during the final stages of reclamation would also have a greater potential until the soil is stabilized by successful revegetation.

Surface runoff management ditches, culverts, settling ponds, and sediment traps would be constructed following approved BMPs and practices described in the Smoky Canyon Storm Water Pollution Prevention Plan (SWPPP) (Simplot AgriBusiness 2004). The SWPPP was developed in accordance with U.S. EPA General Storm Water and National Pollution Discharge Elimination System (NPDES) permit requirements, in addition to other regulatory input. Sediment entrained in runoff would be routed to settlement basins to collect, settle, infiltrate, and evaporate runoff water. These structures would be sized to contain the expected volume of sediment and runoff associated with the 100-year, 24-hour precipitation event. The settlement basins would be properly maintained to ensure adequate containment volume is available throughout the life of the mine. Silt fences, straw bale filters, and rock check dams would also be used to control sediment during construction activities.

Wind Erosion

Wind erosion hazard is expected to be low to moderate due to the characteristic soil features, such as the high percentage of coarse fragments throughout the soil profile. The wind erodibility hazard for the majority of soils within the Proposed Action and Alternatives area has been rated as moderate (Maxim 2004f). Concurrent and timely revegetation of disturbed areas would reduce the potential for soil erosion by improving ground cover.

Soil Quality Maintenance

Soil salvage and site reclamation for all alternatives would meet management objectives to maintain soil productivity by following RFP guidance, BMPs, and proven reclamation practices. Mine excavations, overburden fills, and specified transportation facilities are excluded from R-4 Soil Quality Standards and Guidelines (FSH 2509.18 Supplement r4_2509.18-2002-1). Detrimental soil disturbance may apply to disturbances such as ponds, ditches, topsoil stockpiles, and temporary roads that are outside the mine footprints. All disturbed soils would be ameliorated to meet soil quality standards and guidelines. Topsoil/growth medium would be salvaged prior to disturbance for use during reclamation. An estimated 12 total acres of soil resources in the area of the Proposed Action would not be recovered as growth medium for reclamation due to limiting factors such as rock outcrop, excessive coarse fragments or slope. These areas of unrecovered soil would be scattered throughout the Project Area depending upon the site conditions, and would not occur on areas of 10 acres or greater, per the standards identified in the RFP (USFS 2003a).

Soil Erosion Estimate

The Disturbed WEPP (USDA 2000) model was utilized to represent erosion predictions for reclaimed areas during both interim vegetation establishment and at the completion of successful revegetation. A detailed description of the methodology and operating parameters characteristic of the WEPP modeling program is found in **Appendix 4A**. WEPP predictions for interim vegetation establishment indicate that there would be a 47 to 67 percent chance of erosion during the first three years of reclamation for the Proposed Action and Alternatives. The average annual erosion rate for all WEPP model runs for interim vegetation establishment on the reclaimed areas is 0.78 tons/acre. WEPP predictions for successful vegetation establishment indicate that the chance of erosion after successful reclamation for the Proposed Action and Alternatives would be 17 to 40 percent. The average annual erosion rate for all WEPP model runs for successful vegetation establishment on the reclaimed areas is 0.17 ton/acre.

It should be noted that the WEPP model does not have provisions to allow for the implementation of BMPs, the degree of other coarse fragments in the soil, or other mitigative variables that influence erosion and sedimentation.

Selenium Mobilization

Mackowiak et al. (2004) determined that selenium levels in vegetation growing in undisturbed soils overlying and derived from Phosphoria formation rocks tended to be higher than vegetation in undisturbed soils derived from Wells Limestone or Rex Chert. The total concentration of selenium in soils does not directly determine the concentration of selenium in the plants growing on those soils (Lakin 1972; Bauer 1997; Fisher 1991). Palmer and Olson (1991) indicate that the soluble soil selenium should be a reasonable predictor of plant selenium content. Absorption by plants depends on the chemical form and solubility of the selenium, as well as the pH and moisture content of the soil. The actual amount of selenium in a given plant tissue reflects the amount of selenium available to the plant as well as the accumulating proclivity of that plant (Prodgers and Munshower 1991). The reclamation seed mix would not include vegetation species considered to be selenium accumulator plants.

Section 3.4.5 identifies the processes that influence the mobilization and availability of the four-oxidation states of selenium that may be present in the soil. Soluble selenium in surficial growth medium is mobile and subject to being accumulated in plants and leached out of the material in surface runoff or infiltration. The BMPs proposed for Panels F and G are designed to reduce potential impacts from selenium mobilization to negligible levels.

Studies were conducted in the vicinity of the Proposed Action and Alternatives area (JBR 2001a) and at other phosphate mining operations in Southeastern Idaho (IMA 2000) to determine the effect of different reclamation treatments on the selenium concentration of growth medium and vegetation. Geochemical analysis conducted by JBR at the Smoky Canyon Mine (2001a) included testing for pH, CEC, total selenium, extractable selenium, and trace metals cadmium, copper, manganese, molybdenum, nickel, zinc, and vanadium. Analysis indicated that there is little correlation between the total selenium and extractable selenium concentrations of the same soil/growth medium material. Additionally, the total concentration of selenium in soils was poorly correlated with the concentration of selenium in the plants growing on those soils. The correlation with extractable selenium was much better. Absorption by plants depends on the chemical form and solubility of the selenium, the tendency for selenium accumulation in certain plant species, as well as soil conditions including pH and moisture content.

The current technique to reduce the exposure of seleniferous overburden to the surface environment is the placement of low selenium chert as a thick cover. Deep and coarse textured chert would deter deep root penetration into underlying seleniferous overburden, thereby reducing bioaccumulation in reclamation vegetation. Studies defining an optimal covering depth that prevents root penetration into the waste rock have not been conducted (Mackowiak et al. 2004). Rooting depths for the grass and forbs in the reclamation seed mix would typically be less than 4 feet with deeper rooting for shrubs and trees, and the total depth of the Proposed Action 4-foot chert cover plus the growth medium layer would be approximately 5 to 6 feet.

Soils with slightly elevated selenium concentrations would be mixed with growth medium containing lower concentration to dilute the total concentration in salvaged soils. Current recommendations for soil materials and growth medium used in reclamation indicate materials with less than 13 mg/Kg total selenium dry weight and less than 0.10 mg/L extractable selenium are considered suitable for use as a planting medium when used in combination with other preventative BMPs (USFS 2003a).

4.4.1.1 Proposed Action

Panel F, Including Lease Modifications (Component of Agency Preferred Alternative)

Construction of pits and external overburden storage facilities would result in 515 acres of disturbance to soil resources. Growth medium from soil stockpile area footprints would not be salvaged and placed in stockpile storage areas but would remain in place. Panel F would be largely backfilled, and the pit areas would be recontoured to resemble natural contours and reclaimed. A 38-acre portion of Panel F would not be backfilled, which would leave part of the pit footwall and two remaining hanging walls exposed and unreclaimed.

Panel F Haul/Access Road (Component of Agency Preferred Alternative)

Construction of the haul and access roads located outside the pit in Panel F would result in 67 acres of disturbance to soil resources. The salvageable growth medium on the road disturbance areas would not be removed for placement in stockpiles, but would be stockpiled in windrows along the margins of the disturbance area or in discrete growth medium stockpiles and would be readily available for future road reclamation. Approximately half of the road would be constructed on slopes steeper than 33 percent (3h:1v), which increases the hazard of erosion in those areas. Approximately 4 acres of roads constructed in areas of steep slopes would not be fully recontoured or reclaimed.

Panel G (Component of Agency Preferred Alternative)
The open pit and external overburden fills for Panel G would result in the disturbance of 513 acres of soil resources. Growth medium salvaged on these areas would be placed in stockpiles. Growth medium from soil stockpile area footprints would not be salvaged and placed in stockpile storage areas, but would remain in place. In the final configuration of this pit, an 8-acre portion of the Panel G hanging wall would be left exposed and unreclaimed.

Panel G West Haul/Access Road (Component of Agency Preferred Alternative)
Construction of the Panel G West Haul/Access road would result in an estimated 217 acres of disturbance to soil resources. The salvageable growth medium on the road disturbance areas would not be removed for placement in stockpiles, but would be stockpiled in windrows or in discrete growth medium stockpiles along the margins of the disturbance area and would be readily available for future road reclamation. Portions of the haul/access road built across slopes steeper than 33 percent (3h:1v) would not be reclaimed due to equipment limitations and safety concerns. Approximately 21 acres of road disturbance would not be reclaimed. Roads constructed on steep slopes increase the hazard of erosion in those areas.

Power Line Between Panels F and G
The disturbance corridor footprint, outside of the mine pit disturbances, of the power line comprises approximately 28 acres. Soil disturbance would be temporary and would occur within the 25-foot disturbance radius surrounding each of the 74 power poles to be placed in areas of new disturbance. Poles located within the Panel F and G mine disturbance area would not create new disturbance. Cutting of large trees would occur, but downed vegetation and undisturbed low vegetation would be left in place within this disturbance corridor to serve as soil protection and erosion control along the power line route.

4.4.1.2 Mining Alternatives

For comparison of soil impacts, initial mine disturbance areas for Alternatives are assumed to be the same as the Proposed Action (1,056 acres), with the exception of Alternative A, which has fewer acres of disturbance and Alternative D which involves the construction of a store and release cover and encompasses a larger disturbance area. Comparisons of the disturbance characteristics for these alternatives are listed in **Table 4.4-1**.

TABLE 4.4-1 SUMMARY OF DISTURBANCE AND RECLAMATION AREAS FOR THE MINING ALTERNATIVES (ACRES)

ALTERNATIVE	A*	B	C	D	E	F
Disturbed Area	1,054 / 918	1,056	1,056	1,193	1,028	1,028
Reclaimed Area	1,008 / 901	1,018	1,056	1,146	982	982
Unreclaimed Area	46 / 17	38	0	46	46	46

* Values are for No North Lease Modification / No South Lease Modification

Mining Alternative A – No South and/or North Panel F Lease Modifications
Boundaries of the Panel F Pit would be decreased on the north and south ends, although disturbance to soil resources related to construction of haul roads, growth medium stockpiles, power line, and other facilities would still occur. Final reclamation contours would be different than the Proposed Action and would result in reduced impacts to soil resources.

No Panel F North Lease Modification

If this alternative were adopted the soil disturbance area for the Panel F Pit would be reduced by 2 acres.

No Panel F South Lease Modification

If this alternative were adopted, the soil disturbance area for the Panel F Pit would be reduced by 138 acres and would not cross over the topographic divide into the Deer Creek drainage, reducing potential soil impacts to this watershed from Panel F. The 38-acre open pit left in Panel F for the Proposed Action would be partially backfilled under this alternative, leaving 17 acres unreclaimed.

Mining Alternative B – No External Seleniferous Overburden Fills

The initial soil disturbance footprint for this alternative would be the same as the Proposed Action. The 8-acre highwall remaining in Panel G under the Proposed Action would be reclaimed under this alternative. The 38-acre, unreclaimed open pit area in Panel F would remain under this alternative.

Mining Alternative C – No External Overburden Fills at All

The mine footprint and the area of soil resource that would be disturbed would be the same as the Proposed Action with implementation of this alternative. Under this alternative, the 38-acre, open pit in Panel F would be backfilled and reclaimed. The 8-acre Panel G highwall would also be reclaimed.

Mining Alternative D – Store and Release Covers on Overburden Fills (Component of Agency Preferred Alternative)

With this alternative, development of shale borrow pits and stockpile areas could increase the disturbance to soil resources by approximately 137 more acres than the Proposed Action.

Mining Alternative E – Power Line Connection from Panel F to Panel G Along Haul/Access Road (Component of Agency Preferred Alternative)

Implementation of this alternative would result in no new disturbance to soil resources and would yield a reduction of about three acres of soil disturbance from the Proposed Action because there would be no need for a separate power line corridor between Panels F and G. Trees would not be removed along the power line corridor as described in the Proposed Action. Impacts to soil resources in mining areas and along road alignments would be the same as the Proposed Action.

Mining Alternative F – Electrical Generators at Panel G

Implementation of this alternative would eliminate the three acres of soil disturbance within the proposed power line corridor, and no new disturbance would occur with installation of the electrical generators. Disturbance to soil resources would be limited to proposed mining activities, growth medium stockpiles, roads, and other facilities including settling ponds and ditches. Impacts to soil resources would be the same as the Proposed Action.

4.4.1.3 Transportation Alternatives

Road construction activities would be designed to fit the terrain by avoiding unstable slopes and highly erodible soils to the extent practicable; roadway placement would follow the ground contours as much as possible, and roads would not be constructed with deeper fills and cuts than the geometric road standard requires. If roads were constructed in areas that have been classified as having a high cut and fill erosion hazard (**Table 3.4-6**), special protective measures would be necessary to protect soils and prevent excessive sedimentation (USDA 1990). These protective measures include, but are not limited to, mulch, matting, or slope length shortening. At the completion of mining activities road surfaces would be reclaimed, except in areas where the natural slope is more than 33 percent.

Table 4.4-2 shows the soil map units present along each of the following transportation alternative routes and identifies the range of limitations and suitability ratings for roads and development within each of these units. The majority soil column lists the soil(s) that comprise the majority percentage within the proposed disturbance area for each transportation alternative and the Proposed Action.

Alternative 1 – Alternate Panel F Haul/Access Road
This alternative is 0.5 mile shorter and would have 21 acres less disturbance to soil resources than the Proposed Action. Approximately 5 acres of the total 46 acres involved with implementation of this alternative would remain unreclaimed. As shown in **Table 4.4-2**, approximately 38 acres of the soil resources in this alternative have been identified as having slight to severe revegetation limitation. These areas have also been identified as having fair to good trafficability and a low to moderate erosion hazard for roads and development.

Alternative 2 – East Haul/Access Road
Approximately 7 acres of the total 216 acres of soil disturbance involved in this alternative would remain unreclaimed. **Table 4.4-2** shows that approximately 61 acres of the soil resources in this alternative have been identified as having poor trafficability, slight to moderate revegetation limitation, and a low to moderate erosion hazard for roads and development.

Alternative 3 – Modified East Haul/Access Road
More than a quarter of the route for this alternative would involve construction of road cuts and fills in areas having slopes between 31 percent and 65 percent in order to create switchbacks to reduce the overall road slope. Alternative 3 would involve 276 acres of soil disturbance and 21 acres of this transportation route would remain unreclaimed. Soil limitations on 62 acres would be similar to Alternative 2, with the addition of 89 acres having moderate to high cut and fill erosion hazard and moderate to severe cut and fill revegetation limitation.

Alternative 4 – Middle Haul/Access Road
Steep sandstone slopes would necessitate large road cuts and fills that would be more difficult to reclaim than the Proposed Action or Alternative 2, and portions of this alignment would be located on rocky side slopes with slopes of 60 percent or more. Alternative 4 involves disturbance of a total of 192 acres of soil resources with 34 acres unreclaimed. This alternative would impact the North Fork Deer Creek watershed more than either of the other haul/access roads due to erosion hazard of soil resources. As shown in **Table 4.4-2**, approximately 147 acres of the soil resources in this alternative have been identified as having severe revegetation limitation, poor trafficability, and a high erosion hazard for roads and development.

Alternative 5 – Alternate Panel G West Haul/Access Road
This alternative is similar to the Proposed Action except for a route change that would disturb less of the South Fork Sage Creek watershed and eliminate the long, north aspect road section in this area. Approximately 28 acres of the total 226 acres of soil disturbance involved in this alternative would remain unreclaimed. As shown in **Table 4.4-2**, an estimated 137 acres of this road corridor have been identified as having severe revegetation limitation, 58 acres have moderate to high erosion hazard and poor trafficability, and 136 acres have low to moderate erosion hazard.

Alternative 6 – Conveyor from Panel G to Mill
This alternative would eliminate the need for a haul road connecting Panels F and G, and a conveyor would be built along a 50-foot corridor to transport ore. The conveyor alternative would have less soil disturbance than any of the haul/access road alternatives, involving 61 total acres with no acres of unreclaimed soil resources. Either Alternative 7 or Alternative 8 access roads would need to be implemented in conjunction with this alternative. Soils in this alternative have slight to severe revegetation limitation, low to moderate erosion hazard, fair to good trafficability, and low cut slope stability hazard.

Alternative 7 – Crow Creek/Wells Canyon Access Road
This alternative involves the improvement and upgrading of an existing road in order to support the conveyor alternative (Alternative 6). Both the Wells Canyon and Crow Creek roads would remain open-to-the-public under this alternative. Implementation of this alternative would involve 114 acres of disturbance to soil resources of which 55 acres would remain disturbed after mining. Soil limitations include moderate to severe revegetation and moderate to high erosion hazard on 22 acres.

Alternative 8 – Middle Access Road
Selection of Alternative 6 necessitates the construction of either this alternative or Alternative 7. Implementation of this alternative would involve 99 acres of disturbance to soil resources, all of which would be reclaimed at the end of mining. As shown in **Table 4.4-2**, approximately 78 acres of the soil resources in this alternative have been identified as having severe revegetation limitation, poor trafficability and a high erosion hazard for roads and development.

The summary of disturbance and reclamation statistics for the transportation alternatives is shown in **Table 4.4-3**.

4.4.1.4 No Action Alternative

Under the No Action Alternative, Simplot's proposed detailed mining and reclamation/mitigation plans for the development of mine Panels F and G would not be approved. Simplot would not be able to proceed with mining of the ore in these panels until such time as a mining and reclamation plan is found to be acceptable by the BLM and USFS. Local effects to soil resources from the mining of Panels F and G would be eliminated since none of the mining or transportation alternatives would be implemented. An area of about 29 acres in the existing Pit E-0 of Panel E would not be reclaimed since overburden generated from the Proposed Action would not be available for backfill material. Mining and reclamation would continue on the existing, approved mine panels. The No Action Alternative temporarily would result in no additional impacts to soil resources in the Project Area. With implementation of the No Action Alternative, mining activities could shift to other Simplot leases in Southeastern Idaho earlier than planned, which would defer environmental impacts to other locations.

TABLE 4.4-2 ROAD SUITABILITY RATINGS FOR SOILS PRESENT ALONG TRANSPORTATION ALTERNATIVE ROUTES

ALTERNATIVE	SOIL MAP UNITS (AND ACRES) PRESENT ALONG ROUTE[1]	TOTAL ACRES OF ROAD DISTURBANCE	MAJORITY[2] SOIL MAP UNIT AND LIMITATION(S)/ SUITABILITY	RANGE OF LIMITATIONS FOR ROADS AND DEVELOPMENT			
				UNSURFACED ROAD TRAFFICABILITY	CUT & FILL EROSION HAZARD	CUT & FILL REVEGETATION LIMITATION	CUT SLOPE STABILITY HAZARD
Proposed Action Panel G West Haul/Access Road	656 (91) 755 (45) 301 (26) 381 (12) 653 (12) 201 (7)	217	656 – Severe Revegetation Limitation/ Low to Moderate Erosion Hazard	Poor to Good	Low to High	Moderate to Severe	Low to Moderate
Proposed Action Panel F Haul/Access Road	380 (36) 755 (31)	67	380 – Slight to Severe Revegetation Limitation/ Low to Moderate Erosion Hazard, Fair to Good Trafficability	Poor to Good	Low to High	Slight to Severe	Low to Moderate
Alt. 1 Alternate Panel F Haul/Access Road	380 (38) 755 (8)	46	380 – Slight to Severe Revegetation Limitation/ Low to Moderate Erosion Hazard, Fair to Good Trafficability	Poor to Good	Low to High	Slight to Severe	Low to Moderate
Alt. 2 East Haul/Access Road	300 (61) 653 (9) 912 (7) 451 (15) 473 (27) 380 (24)	216	300 – Poor Trafficability/ Low to Moderate Erosion Hazard, Slight to Moderate Revegetation Limitation	Poor to Good	Low to High	Slight to Severe	Low to High
Alt. 3 Modified East Haul/Access Road	300 (62) 473 (46) 451 (37) 404 (15) 405 (32) 380 (24)	276	300 – Poor Trafficability/ Low to Moderate Erosion Hazard, Slight to Moderate Revegetation Limitation 473, 404 and 405 -- Moderate to Severe Revegetation Limitation, Moderate to High Erosion Hazard	Poor to Good	Low to High	Slight to Severe	Low to High
Alt. 4 Middle Haul/Access Road	653 (91) 553 (56) 201 (15) 381 (15) 301 (13)	192	653 and 553 – Poor Trafficability, High Erosion Hazard, and Severe Revegetation Limitation	Poor to Good	Low to High	Moderate to Severe	Low to Moderate

ALTERNATIVE	SOIL MAP UNITS (AND ACRES) PRESENT ALONG ROUTE[1]	TOTAL ACRES OF ROAD DISTURBANCE	MAJORITY[2] SOIL MAP UNIT AND LIMITATION(S)/ SUITABILITY	RANGE OF LIMITATIONS FOR ROADS AND DEVELOPMENT			
				UNSURFACED ROAD TRAFFICABILITY	CUT & FILL EROSION HAZARD	CUT & FILL REVEGETATION LIMITATION	CUT SLOPE STABILITY HAZARD
Alt. 5 Alternate West Haul/Access Road	656 (91) 553 (46) 381 (27) 301 (18) 653 (12)	226	656 – Severe Revegetation Limitation/ Low to Moderate Erosion Hazard 553 – Poor Trafficability, Moderate to High Erosion Hazard, and Severe Revegetation Limitation	Poor to Good	Moderate to High	Moderate to Severe	Low to Moderate
Alt. 6 Conveyor	381 (21) 404 (11) 301 (10) 380 (13)	61	381 – Slight to Severe Revegetation Limitation/ Low to Moderate Erosion Hazard, Fair to Good Trafficability, Low Cut Slope Stability Hazard	Poor to Good	Low to High	Slight to Severe	Low to Moderate
Alt. 7 Wells Canyon and Crow Creek Access Roads	755 (22) 653 (2)	114	755 – Moderate to Severe Revegetation Limitation, Moderate to High Erosion Hazard Majority of soils along this route are located on Private land or outside of the Study Area	Poor to Good	Low to High	Slight to Severe	Low to Moderate
Alt. 8 Middle Access Road	653 (41) 553 (37) 381 (11) 301 (11)	99	653 and 553 – Poor Trafficability, High Erosion Hazard, and Severe Revegetation Limitation	Poor to Good	Low to High	Moderate to Severe	Low to Moderate

1 3rd Order Soil Map Units as identified on **Figure 3.4-3** (Source: USDA 1990). Acreage numbers have been rounded and map units with less than 8 acres may not be included in this list.
2 Majority soil is defined as the soil(s) that comprise the majority percentage of the proposed disturbance area. Limitations and suitability ratings of majority soils would likely have more consideration and applicability for evaluating soils than those map units that compose only a minor portion of the area.

TABLE 4.4-3 SUMMARY COMPARISON OF TRANSPORTATION DISTURBANCE AREAS (ACRES)

#	ALTERNATIVE	LENGTH (MILES)	TOTAL ACRES	UNRECLAIMED ACRES
1	Alternate Panel F Haul/Access Road	2.1	46	5
2	East Haul/Access Road	7.4	216	7
3	Modified East Haul/Access Road	8.4	276	21
4	Middle Haul/Access Road	6.4	192	34
5	Alternate West Haul/Access Road	8.0	226	28
6	Conveyor	6.1	61	0
7	Crow Creek/Wells Canyon Access Road[1]	15.1	114	55
8	Middle Access Road	5.9	99	0

[1] New disturbance only

4.4.2 Mitigation Measures

Simplot would reduce the loss of soil fertility within the Project Area by incorporating slash into the salvaged growth medium to increase the organic matter content, mixing soil types containing few coarse fragments together with soils containing high coarse fragment content in order to dilute the total coarse fragment percentage, and timing salvage operations to optimize revegetation.

Prior to seeding, all compacted areas and applied topsoil would be loosened by disking or ripping to a depth of 12 inches to allow unrestricted root growth in the reclamation vegetation.
Monitoring the effectiveness of erosion and sedimentation control measures and other soil resource BMPs would be conducted according to the conditions of the Record of Decision and an agency-approved soil resource monitoring plan.

In addition to monitoring effectiveness of proposed Environmental Protection Measures and BMPs, the soil resource monitoring plan would include:

- Monitoring of vegetation germination and growth for assessment of erosion potential based on percentage of ground cover and seedling establishment effectiveness (see monitoring requirement under Vegetation below).

- Soil sampling and analysis for initial nutrient amendment assessment for reclamation activities and to evaluate areas of low production after reclamation activities have concluded.

4.4.3 Unavoidable (Residual) Adverse Impacts

Native soil conditions would be lost on the disturbed areas due to the breakdown of soil structure, adverse effects to microorganisms, and discontinuation of natural soil development as a result of salvage operations. Soils salvaged and utilized in reclamation would initially demonstrate a decrease in infiltration and percolation rates, decrease in available water holding capacity, and loss of organic matter. These effects would be reversed by natural soil development over time. Successful reclamation of disturbed areas would expedite these natural processes and create an environment suitable for long-term vegetation establishment.

Approximately 46 acres of disturbance under the Proposed Action and Alternatives D, E, and F would consist of unreclaimed pit bottoms and highwall areas. An estimated 12 acres of soil resources in the area of the Proposed Action would not be recovered as growth medium for reclamation due to limiting factors such as rock outcrop, excessive coarse fragments or slope. These areas of unrecovered soil would be scattered throughout the Project Area and would not occur on areas larger than 10 acres, per the standards identified in the RFP (USFS 2003a).

4.4.4 Relationship of Short-Term Uses and Long-Term Productivity

The use of this area for recovery of phosphate resources would provide economic support for the local economy of Southeastern Idaho. Reclamation of disturbed areas would return the disturbed soil to long-term productivity by being utilized as growth medium in reseeded areas, while the unreclaimed pit bottoms highwall areas, and road cuts would permanently eliminate 71 acres from potential production.

Short-term uses and long-term productivity potential for soil resources would be similar with implementation of the Proposed Action or Alternatives. Implementation of the No Action Alternative would not change the short-term uses or the long-term productivity of soil resources in the Project Area.

4.4.5 Irreversible and Irretrievable Commitment of Resources

Unreclaimed areas of soil disturbance for open pits, highwalls, and road disturbances would produce an irreversible commitment of soil resources disturbed by these features.

Implementation of the No Action Alternative would constitute an irreversible commitment of soil resources over an area of about 29 acres in the existing Pit E-0 of Panel E, which would not be reclaimed since overburden generated from the Proposed Action would not be available for backfill material.

Irretrievable commitment of resources includes the disturbance of soil resources with implementation of any alternative except the No Action Alternative. Approximately 1,340 acres of soil resources would be disturbed with implementation of the Proposed Action or Alternatives B, C, E, or F; 1,200 acres for Alternative A, and 1,477 acres with Alternative D.

4.5 Vegetation

Issue:
The mining operations and related transportation activities may affect vegetation patterns and productivity in the Project Area, including Threatened, Endangered, Proposed, Candidate, and Sensitive (TEPCS) plant species habitat.

Indicators:
Acres of vegetation communities and suitable TEPCS plant species habitats that would be disturbed and also potentially subjected to an increase in weed invasion;

Acres of disturbed area that are planned for reclamation and the types of vegetation that would be restored;