17.24.304 Baseline Information: Environmental Resources

(1) Each application must contain:

(g) Description of Overburden and Mineral Materials

(A) The SCM permit area is located within the Fort Union Geological Formation. This Formation consists mainly of interbedded sandstones, siltstones, and claystones that are weakly to moderately consolidated. The Fort Union Formation dominates the Eastern Sedimentary Plains of the coal mining region of southeastern Montana. The Formation extends into northeastern Wyoming, western North Dakota, and northwestern South Dakota.

Pyrometamorphic rock, commonly referred to as clinker or scoria, surround the permit area, and can also be found within the permit boundary. This oxidized, reddish colored rock material resulted from coal seam burns over geologic time. Within the mine permit area, variable-grain-size sandstone dominates high cover areas. This material tends to be highly-weathered and weakly consolidated. Deeper buried stratigraphic units within the permit area consist of less weathered, and finer-grained siltstones and claystones. Geologic cross-sections are presented in detail in Volumes 3 and 4. These cross-sections show relative positions of overburden units as commonly found within the permit area. Geologic cross sections exhibiting the structural and stratigraphic relationships within Pit 4 are presented in Appendix I.

(B) The physical and chemical assessment of overburden in the vicinity of Pits 1, 2 and 3 is contained within Volume 6, EBS. All overburden drill hole geochemical analyses are found within this volume and reports by the Colorado School of Mines Research Institute (CSMRI) assessing overburden suitability as plant rooting media. This assessment addresses both micronutrient and macronutrient requirements of reclamation species, and potential toxicities of elements identified through the overburden assessment program. Impacts of overburden to surface and groundwater sources within the permit can be found in the Probable Hydrologic Consequences section Appendix L of this permit in response to Section 17.24.314. The Probable Hydrologic Consequences section has been updated to consider impacts of mining within the Pearson Creek area.

Overburden suitability within Pit 4 area is discussed in Appendix A-1. Laboratory analysis of core holes used for this analysis are presented in Addendum 7 of Appendix A-1. The Pearson Creek overburden suitability analysis is located in Appendix A-2

(C) Lithologic (stratigraphic) and geophysical logs, where available for selected drill holes completed in the original permit area prior to permit approval, are located in Volumes 5 and 7, EBS. Lithologic and geophysical logs, where available, for all drill holes completed within the Pit 4 area through 1998 have been provided to the MDEQ in Annual Prospecting Progress Reports and have been compiled and submitted to MDEQ for reference. In addition, Volume 4 of the EBS shows

overburden cross-sections with geophysical logs overlaid on overburden units. Lithologic and geophysical logs for drill holes completed within Pit 4 are available in Annual Mining Reports. All lithologic logs for monitoring wells completed within Pit 4 are presented in Appendix I. Logs from supplemental drilling in 1998 and geologic cross sections specific to the Pit 4 area are provided in Appendix I. Lithology logs for core holes used for the overburden suitability analysis are presented in Addendum 6 of Appendix A-1. Lithology logs for core holes drilled in the Pearson Creek area are located in Appendix A-2.

(D) Overburden suitability for reclamation has been the topic of background and ongoing review. Earlier documents completed by CSMRI indicated that overburden was generally suitable for reclamation purposes, except for a few instances of elevated sodium levels in relation to calcium and magnesium concentrations (sodium adsorption ratio or SAR) and isolated occurrences of saline material or high molybdenum levels. Potential molybdenum-related toxicity has been addressed in more detail in Appendix H and MDEQ concluded in the late 1990s that reclamation forage will not cause a nutritional problem in livestock. Monitoring of Cu:Mo in plants has been discontinued with MDEQ approval. Earlier assessments identified sodium as the most limiting aspect of overburden at SCM due to high SARs in overburden. In response, SCM addressed material suitability and quantified the volume of nonsodic material in the event that "alternate" material was required to achieve reclamation goals.

The most recent research completed to date show that reclamation objectives could be met at SCM using material within the permit area, and 4 feet of nonsodic cover material (review submitted to the MDEQ in 1988). A variance, was approved by the MDEQ on October 7, 1988, that stipulated that a study plot be established to evaluate whether 4' of suitable cover could meet performance standards. Consistent with the design submitted to MDEQ on December 8, 1988 (as revised through March 24, 1998), SCM constructed the cover depth plots on the east end of the west half of Pit 1 spoils, just south of Stockpiles B38 and A27 in 1995. Vegetation development was reported in the 1998, 2000, and 2003 Annual Mining Reports (vegetation sections). Future monitoring for this 10-year study will also be reported in Annual Mining Reports, with a comprehensive report submitted at the end of the study.

A quantitative assessment of suitable overburden was also undertaken to demonstrate that an adequate volume of suitable overburden was present within the permit area to accomplish reclamation objectives. "Demonstration of Presence of Adequate Suitable Materials to Meet Eight Foot Burial Requirements at Spring Creek Mine", evaluated the amount and availability of nonsodic overburden at the mine site. The review used an SAR cutoff of 12 and was submitted to the MDEQ on December 26, 1979. This report verified that enough nonsodic overburden was available to provide eight feet of suitable material for reclamation, given the proposed disturbance limits at that time.

SCM completed a quantitative assessment of overburden for the South Fork application area using the current SAR cutoff. The volume of suitable material is defined as SAR values less than 20. As a constraint on the volume of suitable material, only prestrip volume above the dragline digging depth of 105 feet was included in the calculations. The suitable volume of prestrip material was determined to be approximately 72.5 million bcy for the prestrip material ahead of the southern advance of Pits 1 and 2 (this analysis did not include the additional suitable material in the South Fork Extension area ahead of Pit 2).

Quantitative assessment of the suitability of overburden materials that will be disturbed within Pit 4 was conducted. Results are contained in Appendix A-1. The results in Appendix A-1 indicate that in the Pit 4 prestrip operations, there will be approximately 16 million bcy of suitable overburden material.

SCM also completed a quantitative assessment of overburden for the Pearson Creek amendment application area using the SAR cutoff of 20. Again, suitable material was taken from the prestrip above the dragline bench (160' above coal). The suitable volume of prestrip material was determined to be approximately 29.6 million bcy within the Pearson Creek Amendment area. This prestrip material is ahead of the advance of Pit 2. The results of this analysis are located in Appendix A-2.

The combined volume of suitable overburden material is approximately 118.1 million bcy. This volume is sufficient to provide approximately 11.9 feet of suitable material for the life-of-mine disturbed area of 7,065 acres. The mine is committed to provide 4 feet of suitable covering material. Topsoil (suitable plant growth material) will comprise approximately 1.5 feet of the 4 feet of suitable material. Suitable overburden will comprise approximately 2.5 feet of the 4-foot suitable zone. This would require approximately 28 million bcy of suitable overburden material over the life-of-mine disturbance area of 7,065 acres. This analysis indicates that sufficient quantities of suitable material are available from pre-stripping operations to meet the suitable cover requirements.

Chemical and physical properties of the overburden that will be moved to mine and reclaim the Pit 4 area were examined to evaluate their suitability for use as a plant growth medium in reclamation. The physicochemical characteristics of the overburden in the SCM permit area and the Pearson Creek Amendment Area are presented in Table 304-1.

Weighted averages of the suitable material, unsuitable material and the entire core column were calculated for all overburden coreholes in Pit 4. The results are shown in Appendix A-1. The composite of all parameters in the suitable intervals is well within the suitability criteria for overburden and regraded spoil established in the Soil, Overburden and Regraded Spoil Guidelines – December 1994. Coreholes 93026OB and 93027OB show concentrations exceeding 1.0 ppm of molybdenum at depths greater than 60 feet. Composites for both entire columns exceed acceptable limits for molybdenum. However, this unsuitable material will

Table 304-1. Comparison of Physiochemical Data from Overburden Coreholes in the SCM Permit Area and the Pearson Creek Amendment Area.

Parameter	MDEQ Soil, Overburden and Regraded Spoil Guidelines December 1994 – Appendix B Unsuitability Criteria	SCM Permit Area	Pearson Creek Amendment Area
pH	<5.5 & > 8.5	8.3	7.9
Conductivity (mmhos/cm)	> 4.0 - 8.0	3.1	3.3
Saturation Percentage	< 25% & > 90%	62.1	69.4
SAR	> 20	8.2	17.7
Nitrate-Nitrogen	> 130 ppm	1.76	7.67
Boron	> 5 ppm	0.21	0.56
Boron (hot water method)	> 5 ppm	0.03	NA
Molybdenum	> 1.0 ppm	0.79	0.50
Selenium	> 0.1 ppm	0.047	0.088
Texture		Clay Loam/Silty Clay Loam	Clay Loam/Silty Clay Loam
Sand %		19.0	17.4
Silt %		50.7	50.9
Clay %		29.5	31.7

Note: Values have been weighted for interval length. Values have not been weighted for area of influence or volume.

not be disturbed under the main permit mine plan (see Plate A-1-2 CAA Suitable Overburden Isopach). In the event that borrow material is taken within 1000 feet of core holes 930260B and 930270B, material salvaged below 60' will be placed at least 8 feet below the surface, due to the material's unsuitability. In addition, in corehole CB980150BC the composite pH of the entire column (9.0) exceeds the acceptable limit for pH, but the composite pH for the top 78 feet of the columns (8.3) meets the pH limit.

Moderately high salinity and selenium concentrations are present in Pit 4 within 30 feet of the overburden surface in the bluffs on both sides of Spring Creek.

In nearly all areas of Pit 4, this material when blended with the overburden immediately above or below it will produce spoils suitable for reclamation. CB81002OBC is the only corehole location where blending will not produce spoils suitable for reclamation. In this area unacceptable levels of selenium are not present,

but the surface material, when blended with the surrounding strata would not produce suitable spoils, based on salinity (electrical conductivity or EC). In most areas of the mine, saline spoils are not anticipated. Where this is not the case, spoil will be covered with four foot of suitable soil and overburden.

High sodium adsorption ratio (SAR) values exist at depth in many areas of the mine. Corehole data show that spoils generated by dragline operations in high-cover areas on the southwest and northeast flanks of the mine area are generally sodic. Overburden in low cover areas of the Spring Creek valley floor are generally nonsodic (SAR < 20) or marginally sodic (SAR > 20, < 25). Spoils in these areas mixed by dragline operations are anticipated to have SAR values well below 20. In Pit 4, where sodic materials are present on the surface of backfill, SCM remains committed to covering the material with four foot of suitable material.

Corehole data summarized for all depths indicates that clay content won't result in textural noncompliance. Again, SCM is aware that blending of various materials may not alleviate all unsuitabilities. When unsuitable materials due to clay content are present on the backfill surface, SCM remains committed to covering the material with four foot of suitable material.

When a weighted average is computed, physicochemical characteristics of overburden differ little from area to area. Sufficient quantities of suitable overburden can be removed, transported using a truck-shovel combination, and used as plant growth media. Suitable overburden can be found throughout the area of disturbance. The suitable overburden which caps the bluffs on the southwest and northeast flanks of the mine area will be some of the last truck shovel material removed as mining advances. These are the borrow areas for final reclamation and contain the greatest depths of truck-shovel overburden material identified as suitable according to the current mine plan. Sufficient quantities of suitable material will be available throughout the mine life to meet reclamation goals.

Current reclamation practices at SCM appear to be well suited to the area. The similarity of geological formations, the similarity of overburden physicochemical characteristics, and use of the same reclamation techniques currently approved and employed successfully at SCM insure that reclamation goals will be met. There are no compelling reasons to change reclamation practices, including special handling where required.

(E) Requires no response.