APPENDIX D-5

TOPOGRAPHY, GEOLOGY AND OVERBURDEN

Topography

The pre-mining topography of the amendment area is illustrated on Map No. D5-1, Pre-Mining Topography and Overburden Samples Location Map, included in this section of the amendment application. The project area is located in the foothill scrubland and low mountains of the southeastern Big Horn Basin in north-central Wyoming. Dry mountain ranges and foothill slopes dominate across the project area. The Nowood River is the nearest permanent water source and is located 3 miles east of the project area. Big Cottonwood Creek meanders within one mile west of the project area with several of its unnamed ephemeral drainages bisecting the project area. Elevations range from 4,537 feet above sea level along the floodplain of an unnamed ephemeral drainage that trends to the northwest along the eastern edge of the project area to 4,700 feet above sea level on top of the northwest trending ridge tops within the project area

One hundred-two (102) photographs were taken of the area in July 2008. These photos are provided to document pre-mining conditions (topography and vegetation) on the amendment area. These photos can be found in Addendum D5A. The locations and general direction (views) of the photography are illustrated on the Pre-Mining Photograph Location Map, Map No. D5 - 2, included in this section of the amendment application.

Geology

Geologically, the area contains extensive outcrops of the upper portion of the Lower

Cretaceous Mowry shale and lower section of the Lower Upper Cretaceous Frontier formation. The Frontier formation occurs directly above the Mowry formation, and the lower Frontier is identified by a thirty foot thick caprock sandstone over the softer Mowry shales. The Frontier formation consists of alternating layers of sandstones and shales with many non-commercial bentonite seams. The Mowry formation consists of alternating layers of soft and hard shales. In the Ten Sleep area the Mowry formation contains three commercial bentonite zones which occur sixty to one hundred and fifty feet below the Mowry-Frontier contact. In addition to the commercial beds, which are two to five feet thick, there are numerous bentonite layers which are too thin to be of value.

The bentonite bed to be mined on this project area is the "Mowry Bed" which occurs approximately 60 feet below the contact between the upper Mowry shale and the lowermost Frontier sandstone.

Overburden Assessment

The bentonite to be mined on the amendment area consists of bentonite found within the upper Mowry formation. Overburden within this formation is generally characterized as marine shales ranging in depth from 0 to 35 feet. The upper 25 feet of overburden consists of gray micaceous shale with bentonite zones absent. Shales of this zone are hard and brittle but not massive. From the top of the overburden zone to 10 feet above the seam, there is a zone of massive siltstone interbedded with bentonite. At the top of the bentonite seam is a six inch zone of bentonite which contains many impurities, primarily grit in the form of sand and silt. This impure zone has no commercial value. The layer of the Mowry bentonite which will be mined is generally two to five

feet thick, and is underlain by hard micaceous basal shales which form the pit floor.

Overburden Sampling

Approximately 8.1 acres are proposed to be mined on the 155.0 acre amendment area. Previous overburden sampling of material lying above this bentonite bed indicate that high SAR values limit the suitability of the deeper overburden material as root zone material. From a depth of approximately 20 feet to the top of the bentonite, SAR values range from 10.50 to 59.00. These SAR levels render this material unsuitable as root zone material.

Black Hills Bentonite's proposed mining practices, as discussed in the Mine Plan section of this permit application will ensure that the overburden material placed directly below the topsoil and subsoil will be suitable root zone material.