SECTION 17

GEOLOGIC INFORMATION

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LIST OF REVISIONS DURING PERMIT TERM

REV. NUMBER	REVISION DESCRIPTION	DATE APPROVED

17 GEOLOGIC INFORMATION

17.1 General Description

The permit area is located on the west flank of the San Juan Basin. This basin is an asymmetric, structural basin with a northwest trending axis parallel to the Hogback monocline in northwest New Mexico. The basin is bounded on the northwest by the Hogback monocline and on the north by the San Juan Uplift. The eastern rim is formed by the Brazos Uplift and the Nacimiento Uplift. The Zuni Uplift and the Chaco Slope form the southern margin of the basin while the Defiance Uplift and Four Corners Platform complete the northwestern basin rim (Fasset and Hinds, 1971) (Figure 17-1).

The rock strata in the southern part of the permit area strike north-south while the strata in the northern part strike northeast-southwest. The average dip in the area is 2° to the east. No major faults cut the permit area, although minor low angle compaction faults and slumps up to eight feet in displacement are common. Seismically, the area is very stable with no historically recorded earthquakes of sufficient magnitude to damage structures (U.S.D.I Bureau of Reclamation, 1975).

The stratigraphic section in the permit area reflects the Late Cretaceous transition of shallow marine depositional environment to a terrestrial fluvial depositional environment. The four formations encompassing this depositional environment change are (in ascending order): the Lewis Shale, the Pictured Cliffs Sandstone, the Fruitland Formation, and the Kirtland Shale.

A generalized stratigraphic section and geologic map of the permit area are presented in Figure 17-2 and Figure 17-3.

The Lewis Shale contains the last purely marine shales deposited in the Upper Cretaceous epeiric seaway. It consists of gray to black shale with some interbeds of sandy limestone, brown sandstone, and bentonite.

The Pictured Cliffs Sandstone conformably overlies and intertongues with the Lewis Shale. This formation consists of both delta-front and barrier-beach sediments and marks the change to a littoral (near-shore) depositional environment (Flores and Erpenbeck, 1981). The upper two-thirds of the Pictured Cliffs sandstone consists of a generally coarsening upward sequence of light gray, fine to medium grained sandstone while the lower one-third of the formation consists of interbedded shale and sandstone. The upper 20 meters of this sandstone is consistently massive, light gray to light brown, fine to medium grained with predominately rounded quartz grains, and has a salt-and-pepper texture. The total thickness of the Pictured Cliffs Sandstone is approximately 110 feet in the permit area.

The Fruitland Formation, which conformably overlies the Pictured Cliffs Sandstone, contains sediments deposited in fluvially influenced delta plain and adjoining back beach-bar depositional environments

(Flores and Erpenbeck, 1981). The lithologies of the rock units encountered in the Fruitland Formation include fine to medium grained sandstones, siltstones, sandy and silty claystones, carbonaceous claystones, bentonitic claystones, and coal.

The Kirtland Shale conformably overlies the Fruitland Formation. This formation is divided into two units, the upper shale member which includes Farmington Sandstone Member, and the lower shale member. Sediments in the Kirtland Shale were deposited in an upland flood-plain environment where aggrading stream channels were separated by narrow, parallel flood plains. The lower shale member is composed of gray claystone shales that contain a few thin interbeds of siltstone and sandstone. The upper shale member is composed of a series of interbedded sandstone lenses and claystone shales. The shale beds in the upper shale member of the Kirtland Shale are much more colorful than those in the lower shale member and are purple, green, white, and gray. No coal beds exist in the Kirtland Shale (Fasset and Hinds, 1971).

Several deposits of Quaternary alluvial and eolian sands occur within the permit area. These are important sources of topdressing material for reclamation.

The economically important stratigraphic interval in the permit area is the lower 250 feet of the Fruitland Formation where 11 different minable Coal Seams occur. Up to seven different minable seams occur in any one location in the permit area. A minable Coal Seam is defined as a seam with a minimum thickness of two feet, a minimum heating value of 6,000 Btu/lb. and an aerial extent and stratigraphic position that makes the seam economically viable to mine. Fruitland Coal Seams are very lenticular in nature and most are minable in very localized areas only.

Geologic information on the minable Coal Seams are presented in:

1. Exhibit 17-1, Exhibit 17-2, Exhibit 17-3, and Exhibit 17-4 showing drill hole locations and Coal Seam data,
2. Exhibits 17-5 (Sheet 1, Sheet2, and Sheet 3), Exhibit 17-6, Exhibit 17-7 (Sheet 1, Sheet 2, Sheet 3, Sheet 4, and Sheet 5), Exhibit 17-8 (Sheet 1, Sheet 2, Sheet 3, and Sheet 4), Exhibit 17-9, Exhibit 17-10, Exhibit 17-11, and Exhibit 17-12 showing cross-sectional views of the local seams and overburden in both east-west and north-south directions,
3. Exhibit 17-13 (Sheet 1 and Sheet 2), Exhibit 17-14 (Sheet 1, Sheet 2, and Sheet 3), Exhibit 17-15 (Sheet 1 and Sheet 2), Exhibit 17-16 (Sheet 1, Sheet 2, and Sheet 3), Exhibit 17-17 (Sheet 1 and Sheet 2), Exhibit 17-18 (Sheet 1, Sheet 2, and Sheet 3), Exhibit17-19 (Sheet 1 and Sheet 2), Exhibit 17-20 (Sheet 1, Sheet 2, and Sheet 3), Exhibit 17-21 (Sheet 1, Sheet 2, and Sheet 3), Exhibit 17-22 (Sheet 1 and Sheet 2), Exhibit 17-23 (Sheet 1 and Sheet 2), Exhibit 17-24 (Sheet 1 and Sheet 2), Exhibit 17-25 (Sheet 1 and Sheet 2), Exhibit 17-26 (Sheet 1, Sheet 2, and Sheet 3), Exhibit 17-27 (Sheet 1 and Sheet

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4. The following written section dealing with Coal Seam characteristics.

Supplemental explanation is provided below for map details of Exhibits 17-1 through 17-37.

- Two different lines showing the extent of mining exist on the maps for Section 17. The drill hole locations and seam data maps (Exhibit 17-1, Exhibit 17-2, Exhibit 17-3, and Exhibit 17-4) have a line showing where mining had progressed to as of April 1985. This line shows the current mine pit limits. All other Section 17 maps have a line showing where the mine pit boundaries were in December 1977 when Indian lands became subject to Surface Mining Control Reclamation Act (SMCRA) regulations. Section 17 maps do not show Coal Seam geology for these areas mined before December 1977. The areas mined between December 1977 and April 1985 can be defined by overlaying any of the Section 17 maps with the appropriate drill hole location and seam data map. See Section 34, Exhibits 34-1 through 34-2 for current permit term disturbance limits.
- Several different kinds of lines showing the minable boundaries of the Coal Seams are used on Section 17 maps. This was done to show the different reasons for limiting the minable area of each seam. The factors that limit the minable area of a seam include the coal crop line, a seam thickness of less than two feet, a heating value of less than 6,000 Btu/lb, and burned areas. Each of these factors responsible for limiting the minable area of each seam have a distinctive line type on Section 17 maps.
- The overburden isopach lines on the seam structure and overburden maps [Exhibit 17-13 (Sheet 1 and Sheet 2), Exhibit 17-14 (Sheet 1, Sheet 2, and Sheet 3), Exhibit 17-15 (Sheet 1 and Sheet 2), Exhibit 17-16 (Sheet 1, Sheet 2, and Sheet 3), Exhibit 17-17 (Sheet 1 and Sheet 2), Exhibit 17-18 (Sheet 1, Sheet 2, and Sheet 3), Exhibit17-19 (Sheet 1 and Sheet 2), Exhibit 17-20 (Sheet 1, Sheet 2, and Sheet 3), Exhibit 17-21 (Sheet 1, Sheet 2, and Sheet 3), Exhibit 17-22 (Sheet 1 and Sheet 2), Exhibit 17-23 (Sheet 1 and Sheet 2), Exhibit 17-24 (Sheet 1 and Sheet 2), Exhibit 17-25 (Sheet 1 and Sheet 2), Exhibit 17-26 (Sheet 1, Sheet 2, and Sheet 3), Exhibit 17-27 (Sheet 1 and Sheet 2)] include the thickness of all existing material above that seam, including the thickness of the upper Coal Seams.
- No Coal Seam geology is shown for portions of the Navajo lease that are designated as surface land use areas because NTEC does not yet have the right to mine the coal underlying these areas.

17.2 Overburden Characteristics

The overburden material at Navajo Mine has been sampled and characterized in the North Area and Areas 2, 3 and 4 North. A total of 33 drill holes were drilled and sampled in the years 1973, 1979, 1982, 1984,

1987, and 1989. In the special condition response (2F) of November 22, 1989, Navajo Mine had planned to report the overburden data from each of the drill holes for this permit application. However, In accordance with the conversations of March 23, 1990, between Navajo Mine Environmental Quality Department personnel and Office of Surface Mining Reclamation and Enforcement (OSMRE) personnel, it was agreed to report sampling for only 1987 and 1989. Figure 17-4 shows the locations of the drill holes. Table 17-1 identifies the location, elevation and depth of each drill hole used in this report. Appendix 17.A contains the lithologic drill logs for 1987 and 1989. The overburden chemical and physical analyses are presented in Appendix 17.B.

Overburden is defined here as consolidated geologic strata from the Fruitland Formation that lies above, between, and immediately below the lowest minable Coal Seam. Overburden samples are represented by undisturbed cores which are crushed and subsampled for chemical and physical analysis. The methods of analysis are included in Appendix 17.C and Appendix 17.D.

17.2.1 Summary

The general nature of the overburden is a geologic formation composed of sandstone, siltstone, claystone, mudstone and shale. The variation in the lithology of the overburden is a result of the environment in which the Fruitland Formation was deposited. The cretaceous aged land forms were comparable to modern deltas and shorelines receiving successive deposits of sand, silts and clays. The ancient swamps (coal deposits) were buried by meandering stream deposits that contained high amounts of salts.

The strata are mostly tan or gray and gray shale dominates. pH values are highly alkaline (pH > 8.0) with few examples of strongly acid material. It is most frequently nonsaline (EC < 4 mmhos/cm) but the dominant soluble cation is sodium (SAR values frequently above 18). The fine earth textures of crushed samples are most frequently clay loams and silty clay loams. The clays are commonly highly expansive and believed to be smectites because the saturation percentages are high, frequently exceeding 85%. The potential to form acidic material from the oxidation of sulfur exists but is not common. It is expected that these acid-forming materials will not be a concern but will help reduce the dominantly high pH of the material.

Two trace elements of interest are boron and selenium. Elevated levels of the soluble forms are not common and when averaged throughout the mined spoil are expected to present only a minor problem. Total selenium frequently exists at levels higher than the established suitability criteria. In light of the limited information about selenium, total selenium may require additional information before it can be used as a criterion for rooting zone material.

Geostatistical models to predict the overburden characteristics have not been used and are not expected to be successful for two reasons. First, the strata are not continuous or uniform over large areas. Modeling would require an extremely large number of closely spaced samples. Second, there does not appear to be a unique property or characteristic of the strata that can be used to predict the suitability of the overburden. Strata meeting the suitability criteria seems to result from being near the surface rather than having identifiable characteristics (e.g. rock type, color or hardness).

There is an uncertainty of extrapolating the overburden characteristics and subsequently extrapolating its suitability for revegetation success. The present emphasis is to develop spoil management programs and reduce the emphasis on extensive drilling and sampling of the overburden.

The Coal Seams are more uniform and continuous than the overburden strata and therefore are more easily modeled by geostatistics than the overburden. The Coal Seams have been successfully modeled for general planning (location and thickness) by using drill holes located on approximately 1000 foot centers.

17.3 Seam Characteristics

The analytic information for the coal seams is contained in Appendix 17.A while that for the overburden is in Appendix 17.B.

17.3.1 Coal Seam No. 2A

[(Exhibit 17-13 (Sheet 1 and Sheet 2) and Exhibit 17-14 (Sheet 1, Sheet 2, and Sheet 3)]

Stratigraphic Position – directly overlies the Pictured Cliffs Sandstone Formation.

Seam Characteristics – This seam is a split of Seam 2B. The seam becomes thin and completely pinches out in a northeasterly direction. The seam is located in the southern one-eighth portion of the permit area.

Average Minable Coal thickness – 3.2 feet.

Average Minable Coal Grade – 9545 Btu/lb.

Average total sulfur content – 1.10%

Parting Characteristics – No significant rock partings occur in this seam.

Cropline and Burn Areas – The seam crops out off the permit area to the west. No Burn Area exists in this seam within the permit area.

17.3.2 Coal Seam No. 2B

[Exhibit 17-15 (Sheet 1 and Sheet 2) and Exhibit 17-16 (Sheet 1, Sheet 2, and Sheet 3)]

Stratigraphic Position – Except where 2A splits from this seam, the seam overlies the Pictured Cliffs Sandstone. This seam is known as the bottom most minable Coal Seam.

Seam Characteristics – The seam is located in mine property Areas 3 and 4 North. Minable thickness varies from 2.0 feet up to 11.0 feet. The seam becomes thicker to the southwest. The Coal Seam pinches out at the north end of Area 3 and along the east property boundary of Area 4 North.

Average Minable Coal Thickness – 6.4 feet.

Average Minable Coal Grade – 9531 Btu/lb.

Average Total Sulfur – 1.10% Area 3.
0.79% Area 4 North

Parting Characteristics – No significant rock partings occur in this seam. Thin bone coal and thin tonstein lenses occur throughout the seam.

Cropline and Burn Areas – The only significant burn area is located in the extreme southwest corner of Area 4 North. The cropline is located on the west side of the mine property outside of the coal lease.

17.3.3 Coal Seam No. 3

[Exhibit 17-17 (Sheet 1 and Sheet 2) and Exhibit 17-18 (Sheet 1, Sheet 2, and Sheet 3)]

Stratigraphic Position – Varies from 8 feet to 27 feet above the No. 2 Coal Seam.

Seam Characteristics – This seam is one of the dirtier seams in the Navajo Mine area. The coal bed lies within mine Areas 3 and 4 North. In the southwest section of Area 4 North the seam merges with the upper Seam No. 4 forming a single seam.

Average Minable Coal Thickness – 4.5 feet.

Average Minable Coal Grade – 8988 Btu/lb.

Average Total Sulfur – 1.06%

Parting Characteristics – No significant rock partings occur in the seam. Thin bone coals, carbonaceous shales, and tonsteins are fairly abundant within the seam.

Cropline and Burn Areas – The only significant burn area is located in the extreme southwest corner of the permit area. The cropline is located well beyond the coal lease on the west side of the property.

17.3.4 Coal Seam No. 4

[Exhibit17-19 (Sheet 1 and Sheet 2) and Exhibit 17-20 (Sheet 1, Sheet 2, and Sheet 3)]

Stratigraphic Position – Varies from 0 feet to 19 feet above the No. 3 Coal Seam.

Seam Characteristics – The seam is located in Areas 4 North, 3 and 2. The seam pinches out abruptly at the north end of Area 2. The seam becomes thicker than average towards the northern section of Area 3 and into Area 2. The seam pinches out in the southwest section of Area 3 and merges with Seam No. 3 along the western edge of Area 4 North within the permit boundary.

The seam has a name change at the Area 2 and 3 mining boundaries, where Seam No. 4 becomes Seam No 6B. The reason for this name change is that seam numbers were assigned to each coal bed before it was known that they were actually the same seam. Recent extensive exploration drilling programs brought this error to light. To avoid confusion in this permit application, all the accompanying maps and reserve figures for Seam No. 4 include only that part of the seam located in Areas 3 and 4 North.

Average Minable Coal Thickness – 6.0 feet.

Average Minable Coal Grade – 9409 Btu/lb.

Average Total Sulfur – 0.73%

Parting Characteristics - The seam has no significant rock partings. Partings are rare except for very minor tonsteins, bone coal, and carbonaceous shale lenses which occur throughout the seam.

Cropline and Burn Areas – The seam cropline is beyond the permit boundary west of the mine property. The only significant burn area known in this seam is in the extreme southwest corner of Area 4 North.

17.3.5 Coal Seam No. 5

[Exhibit 17-21 (Sheet 1, Sheet 2, and Sheet 3)]

Stratigraphic Position – Varies from 13 feet to 23 feet above the No. 4 seam.

Seam Characteristics – The seam exists in only a small area in the western half of Area 4 North.

Average Minable Coal Thickness – 2.7 feet.

Average Minable Coal Grade – 8527 Btu/lb.

Average Total Sulfur – 0.73%

Parting Characteristics – This seam has no rock partings except for thin tonsteins, bone coals, and carbonaceous shale lenses within the seam.

Cropline and Burn Areas – A small burn area exists in the southwest corner of Area 4 North. The seam crops out in one small area on the northwest edge of the minable area.

17.3.6 Coal Seam No. 6A

[Exhibit 17-22 (Sheet 1 and Sheet 2) and Exhibit 17-23 (Sheet 1 and Sheet 2)]

Stratigraphic Position – Seam No. 6A occurs in two separate areas in the permit area. In the southern section of Area 3 the seam varies 9 feet to 54 feet above Coal Seam No. 4, and in the southern section of Area 2 the seam varies from 30 feet to 40 feet above the Pictured Cliffs Sandstone.

Seam Characteristics – In the southern section of Area 3, the seam splits from Coal Seam No. 6B. In Area 2, the seam is limited to a very small area. The seam thins to the northwest.

Average Minable Coal Thickness	Area 3 – 2.3 feet
	Area 2 – 3.9 feet
Average Minable Coal Grade	Area 3 – 9316 Btu/lb.
	Area 2 – 8876 Btu/lb.

Average Total Sulfur – 0.72%.

Parting Characteristics – No significant rock partings occur in the seam. Thin tonsteins, bone coals and carbonaceous shale lenses occur in Area 3. The Area 2 seam has nodules of bone coal occurring throughout the seam.

Cropline and Burn Areas – No croplines or burn areas exist in Area 3. The seam extends in a fanlike fashion over a small area. In Area 2 the seam has no burn areas within the permit boundary. The seam crops out well beyond the permit boundary to the west.

17.3.7 Coal Seam No. 6B

[Exhibit 17-24 (Sheet 1 and Sheet 2), Exhibit 17-25 (Sheet 1 and Sheet 2), and Exhibit 17-26 (Sheet 1, Sheet 2, and Sheet 3)]

Stratigraphic Position – In Area 3 and Area 4 North, Seam No. 6B varies from 5 feet to 37 feet above Seam No. 4 and 6 feet above Seam No. 5, where No. 5 exists. In Area 2, the seam varies from 15 feet to 45 feet above the Pictured Cliffs Sandstone.

Seam Characteristics – This seam is considered to be one of the better quality Coal Seams in terms of thickness and coal grade in existence in Area 4 North and the southern part of Area 3. In most of Area 2, Seam No. 6B is the lowest minable Coal Seam. The seam is consistent in thickness and quality in this area, also. As explained in the section discussing Seam No. 4, Seam No. 6B in Area 2 correlates to Seam No. 4 in Area 3. The maps and coal reserve figures for Seam No. 6B given in this permit application include those parts of Seam No. 6B in Area 2 that are actually Seam No. 4. Any confusion generated by this miscorrelation can be relieved by studying the enclosed maps and cross sections. With the addition of Block B to the permit area, Seam 6B varies from 2 feet to 45 feet above the Pictured Cliffs Sandstone.

Average Minable Coal thickness	Area 4 North,
	Area 3 – 4.5 feet.
	Area 2 – 8.2 feet.
Average Minable Coal Grade	Area 4 North,
	Area 3 – 9704 Btu/lb.
	Area 2 – 9522 Btu/lb.

Average Total Sulfur – 0.72%.

Parting Characteristics – There are no significant rock partings within the seam. Very thin tonsteins and bone coal lenses are abundant throughout this seam.

Cropline and Burn Areas – In mine Area 4 North the seam cropline is visible in the bluff line along the coal permit area. In the southern portion of Area 3 the cropline is outside of the permit area.

The seam cropline no longer exists in Area 2 and has been mined through prior to December 16, 1977. The cropline not affected by the mining activity extends well beyond the permit area in the southern portion, and a fairly extensive burn exists in the central portion of Area 2.

17.3.8 Coal Seam No. 7

[Exhibit 17-27 (Sheet 1 and Sheet 2), Exhibit 17-28 (Sheet 1 and Sheet 2), and Exhibit 17-29 (Sheet 1, Sheet 2, and Sheet 3)]

Stratigraphic Position –- Varies from 4 feet to 128 feet above Seam No. 6.

Seam Characteristics – This seam is one of the most consistent seams in the permit area. The seam extends from Area 4 North, through Area 3, and up to the north end of Area 2. One pinchout occurs along the northeast coal lease line, and a second pinchout occurs at the Area 2 and 3 mine area boundary. The seam splits to 7A and 7B throughout much of the permit area.

Average Minable Coal Thickness – 4.9 feet.

Average Minable Coal Grade – 9900 Btu/lb.

Average Total Sulfur – 1.37%.

Parting Characteristics – No significant rock partings occur in the seam.

Cropline and Burn Areas – The cropline extends along the bluffs and into the valley floor in Area 4 North, then trends northward crossing the Cottonwood Arroyo and extending to the west of Area 3. In the southwest portion of Area 2 the cropline runs outside of the permit area. The cropline for the rest of Area 3 has been disturbed by mining operations. The only significant burn areas known to exist in this seam are located in the central section and a very small portion of the northwest section of Area 2.

17.3.9 Coal Seam No. 8A

[Exhibit 17-30 (Sheet 1 and Sheet 2), Exhibit 17-31 (Sheet 1 and Sheet 2), and Exhibit 17-32 (Sheet 1, Sheet 2, and Sheet 3)]

Stratigraphic Position – Varies from 4 feet to 25 feet above Seam No. 7.

Seam Characteristics – the seam is fairly extensive and widespread. The seam is located within the permit boundary of Area 4 North, Area 3, and the Southern section of Area 2. Due to the numerous irregular erosional patterns, the Coal Seam pinches out before the coal actually crops. A pinchout also occurs along the eastern boundary of Area 4 North. This seam splits from Seam No. 8B in the south part of Area 2 and along the northeastern portion of Area 3.

Average Minable Coal Thickness – 6.0 feet.

Average Minable Coal Grade – 9310 Btu/lb.

Average Total Sulfur – 0.74%.

Parting Characteristics – No significant rock partings occur in the seam.

Cropline and Burn Areas – Where irregular erosional patterns occur near the seam cropline, coal quality and minable thickness cutoff lines have been established. The seam has no known burn areas.

17.3.10 Coal Seam No. 8B

[Exhibit 17-33 (Sheet 1 and Sheet 2), Exhibit 17-34 (Sheet 1 and Sheet 2), Exhibit 17-35 (Sheet 1 and Sheet 2), and Exhibit 17-36 (Sheet 1, Sheet 2, and Sheet 3)]

Stratigraphic Position – Varies from 16 feet above Seam No. 8A in Area 4 North, Area 3, and the southern section of Area 2, and varies from 2 feet to 23 feet above Seam No. 7 in Area 2. In Area 1 the seam overlies the Pictured Cliff Sandstone.

Seam Characteristics – This seam consists of a fairly clean coal that exists the entire length of the permit area along the eastern boundary. A major portion of the coal has been mined out in the northern half of the permit area. Seam No. 8A splits from this seam in the south section of Area 2.

Average Minable Coal Thickness –- 11.5 feet.

Average Minable Coal Grade – 9143 Btu/lb.

Average Total Sulfur – 0.72%.

Parting Characteristics – No major rock partings exist in the seam. However, minor partings of bone coal and carbonaceous shale are common.

Cropline and Burn Areas – Due to irregular erosional patterns around the cropline, average minable thickness and average minable coal grade cutoff lines have been established for Area 3 and Area 4 North. A large portion of the seam has been mined out in the northern half of the permit area. Some scattered burn areas exist along the cropline in Area 4 North.

17.3.11 Coal Rider Seam Above Seam No. 8B

[Exhibit 17-37 (Sheet 1 and Sheet 2)]

Stratigraphic Position – Varies from 2 feet to 60 feet above Seam No. 8B.

Seam Characteristics – The seam occurs in a small area in the northern section of Area I where extensive mining has taken place. This seam is not consistent and several "window" pinchout areas exist in the Coal Seam.

Average Minable Coal Thickness – 3.4 feet.

Average Minable Coal Grade – 10,202 Btu/lb.

Average Total Sulfur – 0.72%.

Parting Characteristics – No significant rock partings exist in the seam.

Cropline and Burn Areas - No burn area is known to exist in the seam. The cropline has been disturbed and mined through prior to December 16, 1977.

17.3.12 Other Coal Seams

Several other thin, shaley, bone Coal Seams exist in the Fruitland formation. At present, there are no plans to mine theses seams.

17.3.13 Aquifers

Some of the Fruitland Formation Coal Seams in the permit area are water-bearing. However, Section 18.2 – Groundwater concludes that classifying these strata as aquifers is questionable because their low permeability and production rates, and the naturally poor quality of their water preclude their use as a water source in the region. See Section 18.2 for a detailed description of the Groundwater hydrology.

17.4 Geologic Hazards

The permit area is located in a stable seismic area. Historical records indicate no earthquakes of sufficient magnitude to damage structures within hundreds of miles of the permit area. The area is classified Zone 1 (minimum risk) by ESSA/Coast and Geodetic Survey (U.S.D.I. Bureau of Reclamation, 1975).

Previous mining in the permit area was limited to a small underground operation at the north edge of Area 1 and a small surface pit in the northern part of Area 2. These small mines were later mined through by NTEC (formerly BHP Minerals), which has mined the permit area continuously since 1963.

The only geologic hazards existing in the permit are those hazards associated with exposed highwalls and spoil piles. Possible hazards include rock falls and mass failures. To date, only one mass highwall failure has been documented in the permit area. Spoil failures, although relatively common, occur in a slow, controlled manner which minimizes any risk of injury or property damage. Rock falls are a fairly common occurrence in active pits but are rare in older pits. All geologic hazards associated with mining are minimized in the permit area by strict enforcement of the Mine Safety Health Administration (MSHA) regulations requiring restricted access to mining areas.

Occasionally, small faults in the highwall will fail. These areas are known, and are watched for telltale cracks. The dragline bucket is used to scale small areas of loose rock that are hung up on the highwall.

17.5 Geologic Information Collection and Analysis

17.5.1 Overburden Sampling

Five drill holes were sampled in 1987, all in Area 4 North (Holes 487-01 through 487-05).

Locations for each drill hole at Navajo Mine are shown in Figure 17-4 and Table 17-1. The distance between drill holes averages 6500 feet (1 hole/1000 acres) and ranges from 5100 to 8600 feet.

Nine drill holes were sampled in 1989: five in Area 2 (289-01 through 289-05) and four in Area 3 (389-48 through 389-51). Locations of the drill holes are shown in Figure 17-4 and Table 17-1. The average distance between drill holes in Area 2 is 5450 ft. The distance between drill hole 389-48 and 389-49 located in the Lowe Pit mining area is approximately 5400 feet (1 hole/670 acres). The distance between drill hole 389-50 and 389-51 located in the Dixon Pit mining area is approximately 3400 feet (1 hole/265 acre). The core logs are reproduced in Appendix 17.A.

Drill holes were cored from ground surface to 10 feet below the bottom minable Coal Seam and continuous core samples were collected. The undisturbed cores were logged by a geologist, sealed, boxed, and stored

for analysis. Each geologic stratum was sampled for analysis per OSM – Western Field Office (WFO) instructions, i.e. major strata were sampled in five foot increments. Strata less than one foot thick were combined with adjacent layers. A four foot stratum of shale containing several two to three inch sandstone lenses will be represented by a single sample with documentation identifying lithologic change. Once the samples were selected the cores were crushed to pass a two mm sieve.

The 1987 cores were analyzed by ACZ Inc., Laboratory Division of Steamboat Springs, Colorado for the parameters below:

pH	(1:2 soil to water extract)
Electrical Conductivity (EC)	(1:2 soil to water extract)
ESP (Exchangeable Sodium Percentage)	
Sodium Adsorption Ratio (SAR)	(1:2 soil to water extract)
Ca, Mg, Na (water soluble)	(1:2 soil to water extract)
Boron (hot water soluble)	
Selenium (water soluble)	
Organic Carbon	
Calcium Carbonate	
Organic, Pyritic, Sulfate, and Total Sulfur	
Acid-Base Potential	
Texture	
Saturation	(1:2 soil to water extract)

The 1989 cores were analyzed by Inter-Mountain Laboratories (IML) of Farmington, NM for the following parameters.

pH	(saturated paste)
Electrical Conductivity (EC)	(saturated paste)
Sodium Adsorption Ratio (SAR)	(saturated paste)
Ca, Mg, Na (water soluble)	(saturated paste)
Boron (hot water soluble)	
Selenium (water soluble)	
Organic Carbon	(loss on ignition)
Neutralization Potential	
Organic, Pyritic, Sulfate, and Total Sulfur	
Acid-Base Potential	

Texture	(hydrometer)
Saturation	(saturated paste)

The overburden chemical and physical analytical results are contained in Appendix 17.B.

The methods of analysis for the physical and chemical properties of the samples are identified in Appendix 17.C and Appendix 17.D. pH, EC, Ca, Mg, Na, and percent saturation were all determined using 1:2 (soil:water) extracts for the 1987 samples in contrast to saturated paste extracts for the 1989 samples. A common result of using a 1:2 extract rather than using a saturated paste extract in a system high in sodium is to increase the pH value and reduce the SAR and EC values. The OSMRE Root Zone Suitability Criteria for Navajo Mine are based on saturated paste extracts.

Total Selenium was determined by one sample that best represented the middle of a lithologic layer (geologic stratum) per OSM-WFO instruction. Since total selenium values are not available for all samples analyzed it has not been used as a parameter to determine root zone suitability. The purpose of determining total selenium was to identify a direct relationship between soluble selenium and total selenium. Data from this study does not support a correlation between these two parameters.

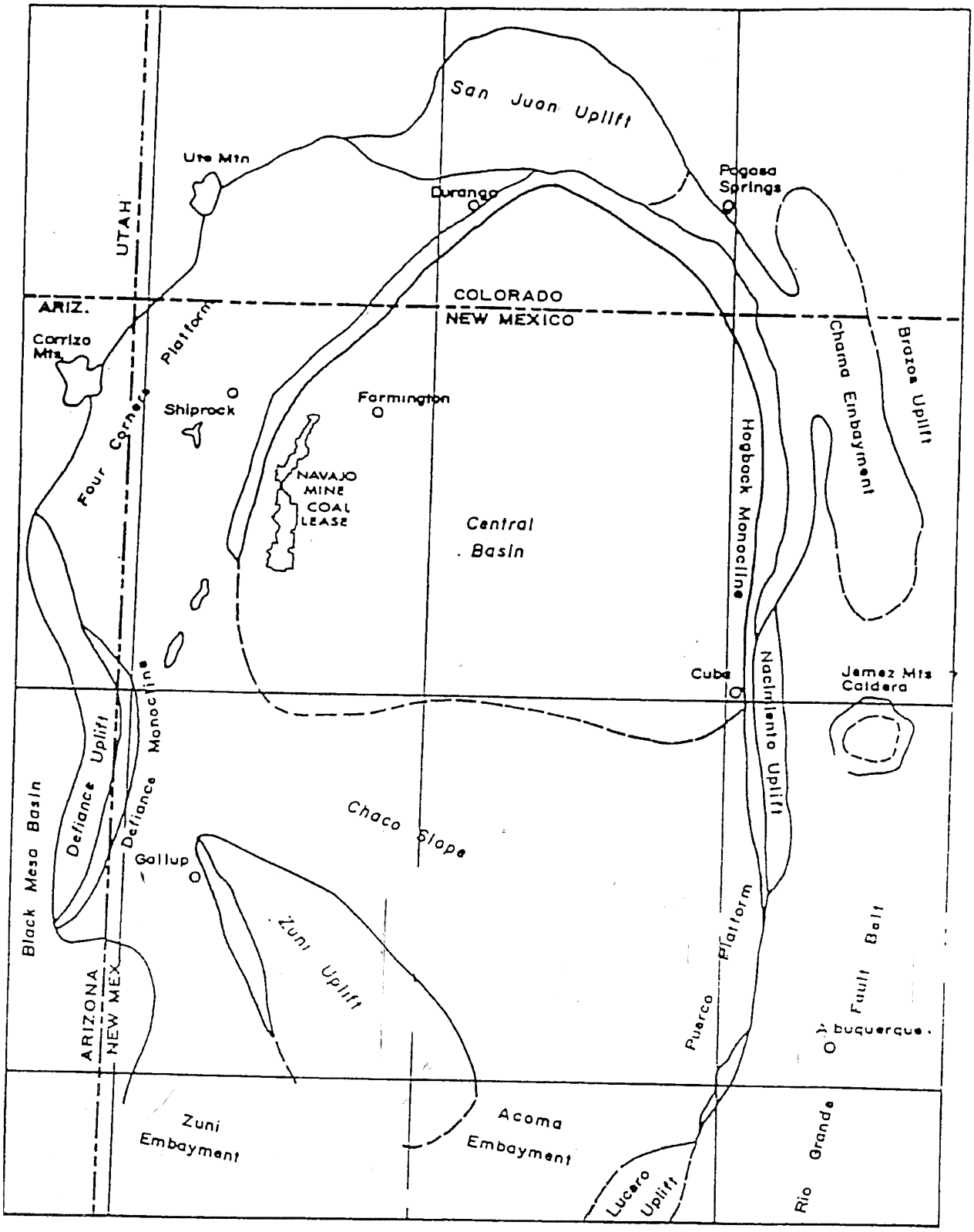
Fourteen samples sites (Table 17-1) were cored to provide the information for this survey. A total of 2370 feet of core were sampled (Appendix 17.B). The average depth of the holes was 209 feet and the average thickness of mined overburden was 169 feet per hole. A total of 680 samples were analyzed as overburden and the data are presented in Appendix 17.B. Average values for the analyses are presented in Table 17-2. These averages are weighted by the lengths of the individual samples.

References

Fasset, J.E., and J.S. Hinds. 1971. Geology and fuel resources of the Fruitland Formation and Kirtland Shale of the San Juan Basin, New Mexico and Colorado. U.S. Geological SurveyProfessional Paper 676.

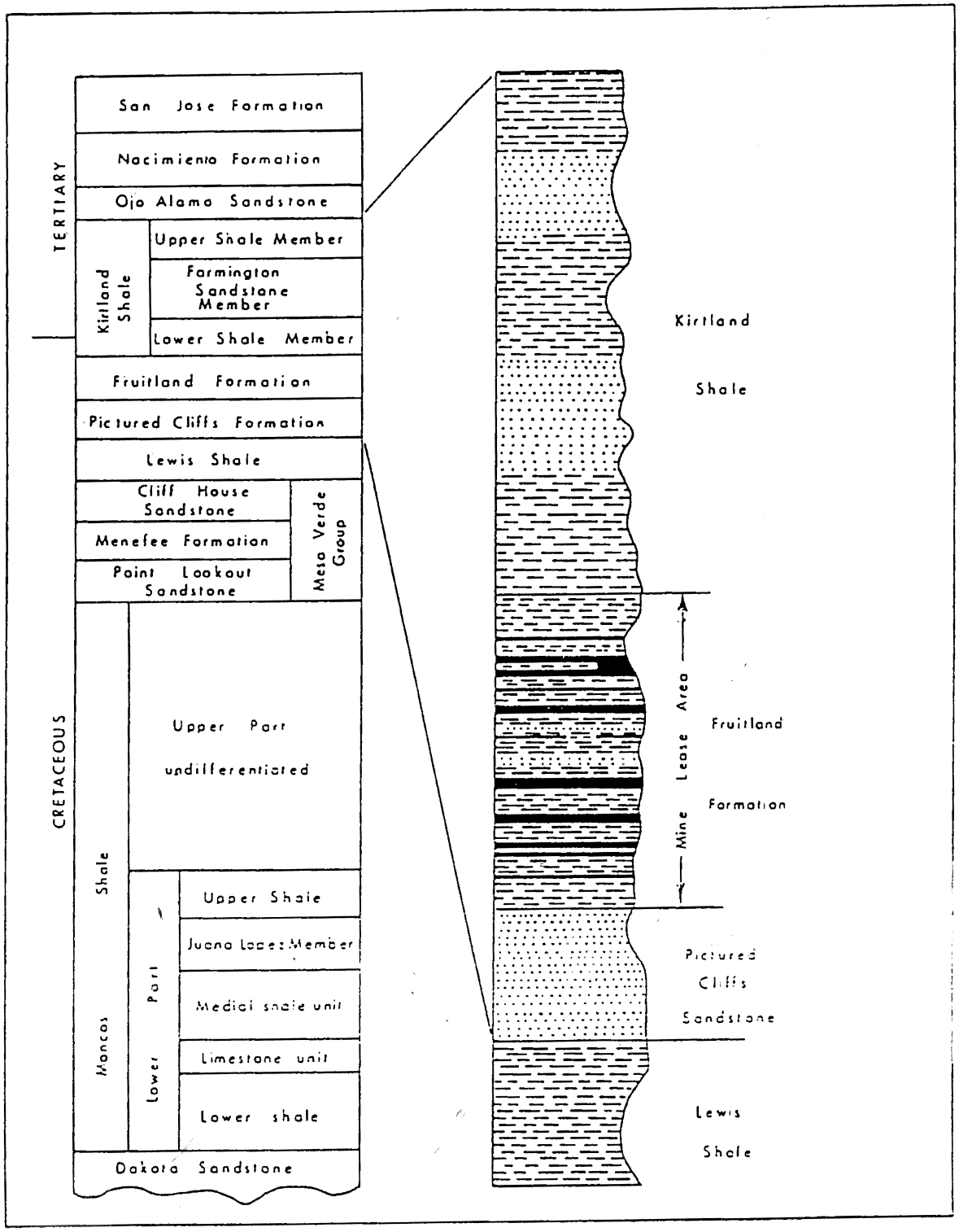
Flores, R.M., and M.F. Erpenbeck. 1981. Differentiation of delta front and barrier lithofacies of the Upper Cretaceous Pictured Cliffs Sandstone, southwestern San Juan Basin, New Mexico. The Mountain Geologist, v. 18, no. 2, p. 23-34.

U.S.D.I., Bureau of Reclamation. 1975,



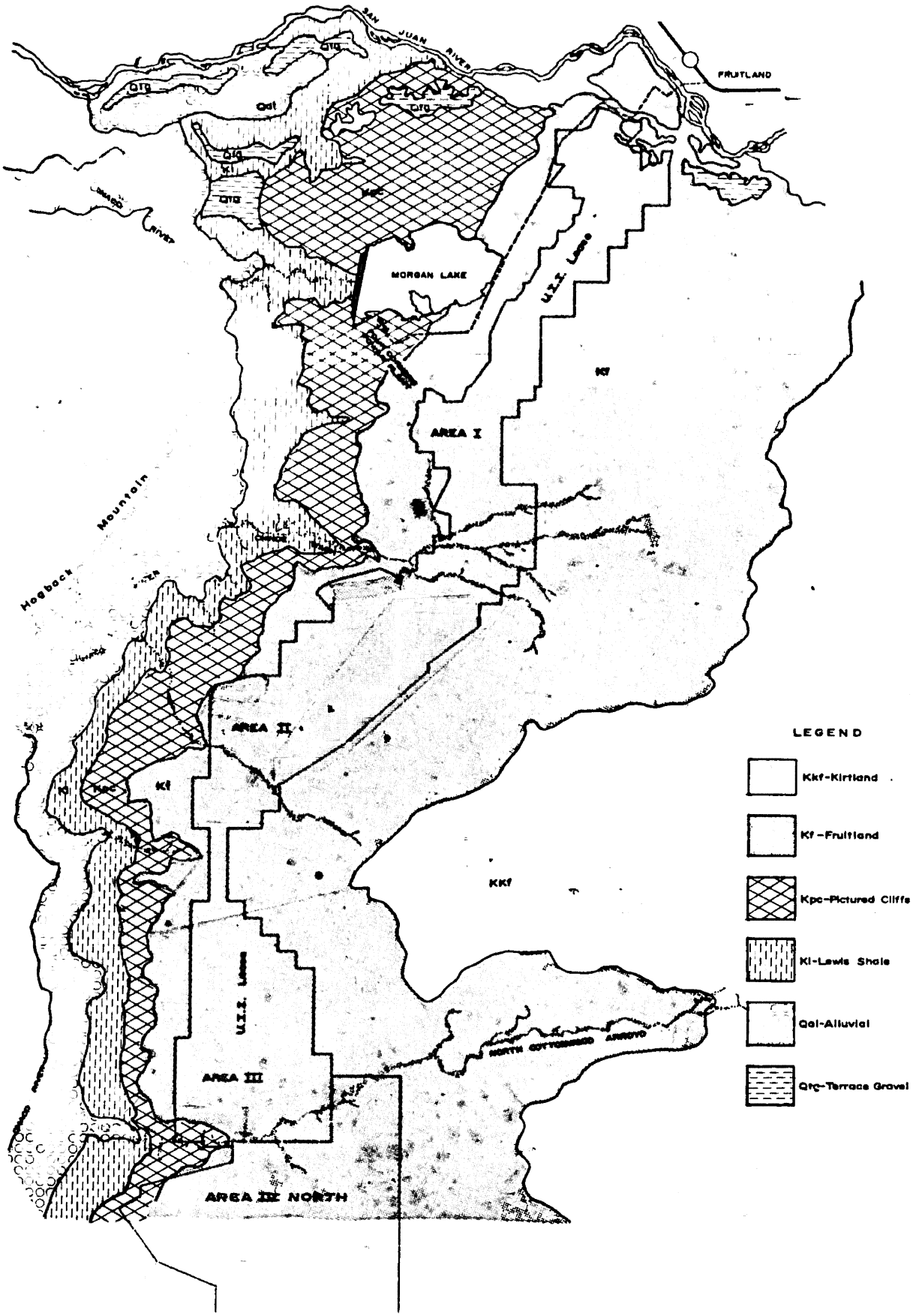
General structural features of the San Juan Basin of northwestern New Mexico

Figure 17-1



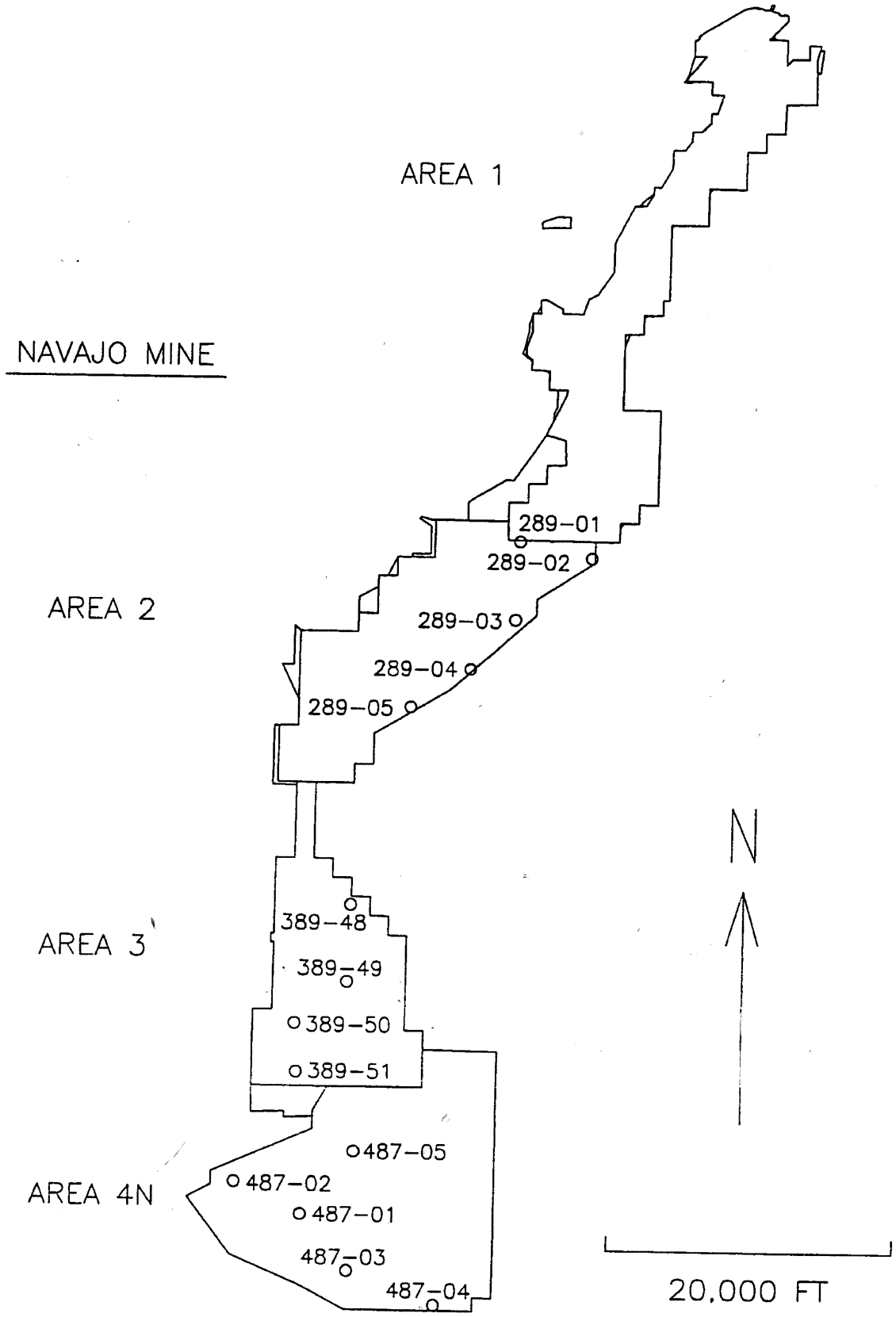
Stratigraphic nomenclature and generalized stratigraphy of the Upper Cretaceous and Tertiary sediments found on the Navajo Mine coal lease

Figure 17-2



Surface expression of Geologic Units on and surrounding the BHP Minerals Internation Inc., Navajo Mine coal lease

Figure 17-3



Overburden Drill Hole Locations

Figure 17-4

Table 17-1 Overburden Drill Site Locations

Year	Site No.	Easting (ft.)	Northing (ft.)	Elevation (ft.)	Hole Depth (ft.)
1987	487-01	297228	2001943	5405.0	171.0
	487-02	292615	2004150	5427.0	150.0
	487-03	300508	1998023	5392.0	205.0
	487-04	306666	1995716	5409.0	240.0
	487-05	300869	2006336	5372.0	199.0
1989	289-01	311850	2048950	5456.0	266.0
	289-02	315995	2047825	5381.0	256.0
	289-03	311610	2043470	5446.0	276.0
	289-04	308516	2039963	5453.0	260.0
	289-05	304350	2037300	5419.0	212.0
	389-48	300393	2023481	5378.0	217.0
	389-49	300206	2018130	5373.0	205.0
	389-50	296626	2015229	5337.0	164.0
	389-51	296785	2011839	5350.0	165.0

Table 17-2 Weighted Average of Overburden Analysis

Drill Hole	Total Sample (ft)	pH	EC (mmhos/cm) @25 c)	SAR	Boron (ppm)	H_2O Sol. Selenium (ppm)	Pyritic ABP (t/1000T)	Clay %	Sat %
487-01	121.0	9.1	1.55	20.9	1.89	0.10		37.71	124.9
487-02	122.6	9.0	1.16	32.4	0.94	0.08		28.69	103.0
487-03	152.2	9.1	1.25	34.7	0.89	0.07		34.80	96.3
487-04	190.1	9.2	1.64	38.7	1.04	0.13		44.49	102.1
487-05	159.8	8.8	1.62	34.4	1.25	0.06		36.23	94.1
289-01	229.5	8.5	2.81	30.9	0.46	0.02	52.97	20.53	83.2
289-02	228.8	8.5	2.87	27.5	0.65	0.04	47.53	24.50	108.6
289-03	244.8	8.4	2.13	26.7	0.79	0.08	41.09	27.31	96.1
289-04	227.4	8.3	2.98	29.8	0.95	0.08	43.35	31.70	97.5
289-05	165.1	8.4	3.39	28.1	0.65	0.04	61.23	34.58	96.4
489-48	163.8	8.5	4.44	33.1	33.1	0.03	53.79	27.64	95.5
489-49	145.4	8.5	3.80	25.9	0.35	0.04	43.54	28.46	88.2
489-50	107.6	7.7	5.77	32.4	0.40	0.02	37.28	23.68	82.6
489-51	111.8	8.5	3.44	32.9	0.38	0.03	70.15	23.19	74.8
Total	2,369.9								
WTD AVG	169.3	8.6	2.72	30.5	0.77	0.06	49.29	30.11	96.2

EXPLANATION

- - - - COAL MINED OUT AS OF DECEMBER 16, 1977

— - - — COAL LEASE BOUNDARY

—•—•— DECEMBER 1989 COAL MINING LIMIT (TOPDRESSING)

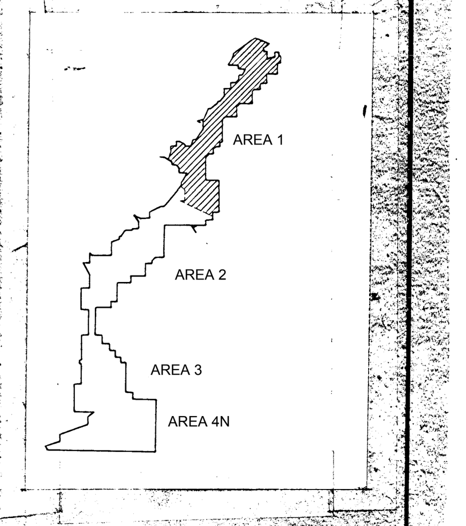
DRILL HOLE NO. — COLLAR ELEVATION

289 - 5392

5182 - 3.1' - 9956 - 8 R
5233 - 14.2' - 9379 - 8 b

TOP OF SEAM ELEVATION — SEAM THICKNESS — COAL GRADE — SEAM IDENTIFICATION

INDEX MAP



JUSTIN S. LYNCH
NEW MEXICO
8362
REGISTERED PROFESSIONAL ENGINEER

EXHIBIT 17-1

BHP MINERALS INTERNATIONAL

NAVAJO MINE

FRUITLAND, NEW MEXICO

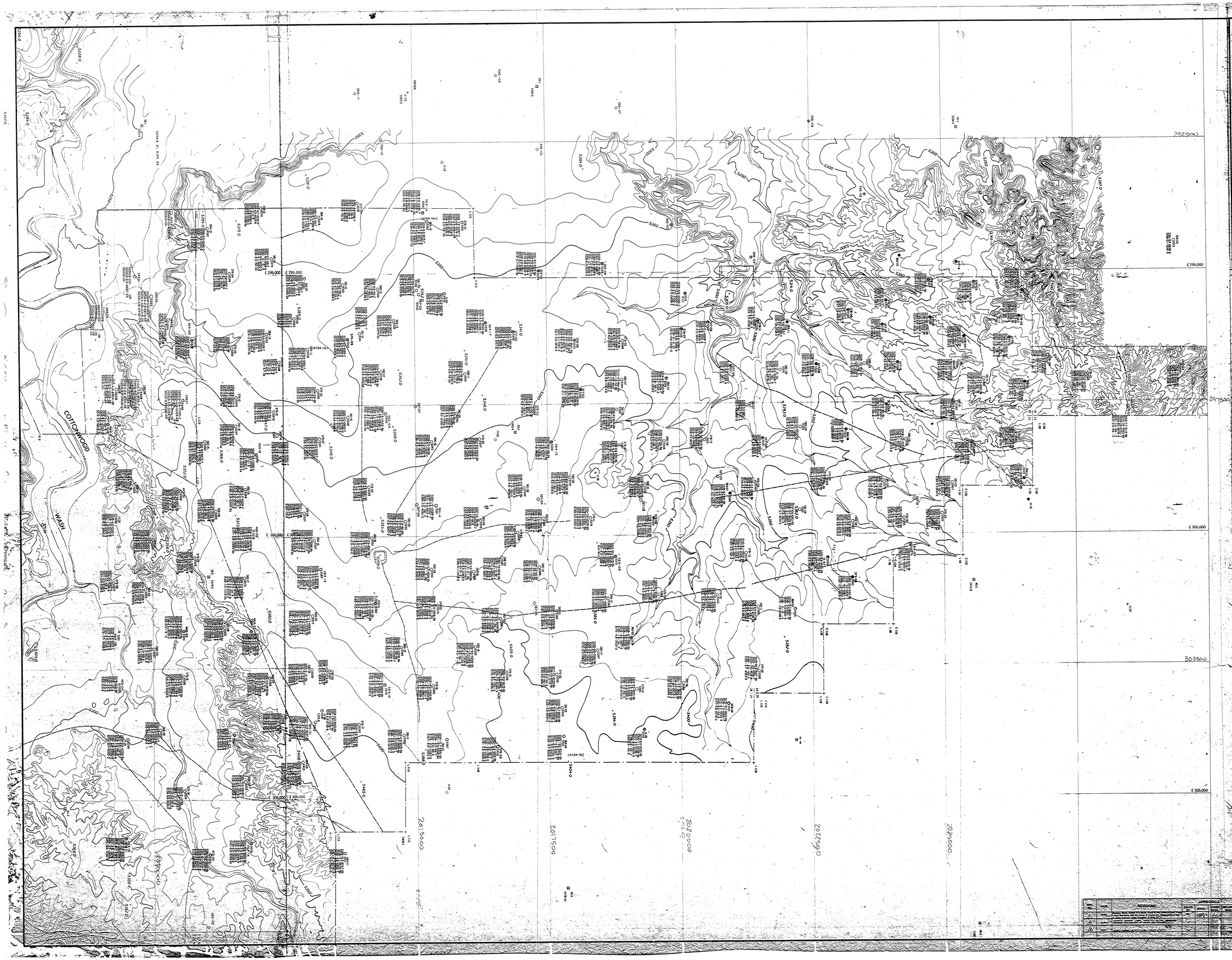
AREA 1
DRILL HOLE DATA

DRAWN BY: L. DAN | SCALE: 1" = 500' | EXHIBIT
APPROVED BY: | DATE: MAY 1987
DRAWING NO. | LOCATION NO.

APPROVALS: ENGR. | CHIEF ENGR. | PROJECT MGR.

EXPLANATION
COAL MINED OUT AS OF DECEMBER 16, 1977
EQ AND COAL LEASE BOUNDARY
DRILL HOLE NO. - COLLAR ELEVATION
326 - 5385
5270 - 129 - 9661 - 8b
5243 - 2.4' - 10699 - 7
5210 - 7.1' - 9628 - 6b
TOP OF SEAM ELEVATION
COAL GRADE
COAL THICKNESS
SEAM IDENTIFICATION
INDEX MAP
AREA I
AREA II
AREA III
AREA IV N
BHP MINERALS INTERNATIONAL
AREA 2
DRILL HOLE DATA

EXHIBIT 17-2



EXPLANATION

DRILL HOLE NO. — COLLAR ELEVATION

379-07
● 5408

5295 -	9.2' -	7917 -	8b
5282 -	7.0' -	8873 -	8a
5254 -	1.9' -	7903 -	7

TOP OF SEAM ELEVATION — COAL THICKNESS — COAL GRADE — SEAM IDENTIFICATION

COAL MINED OUT AS OF DECEMBER 16, 1977

COAL LEASE BOUNDARY

DECEMBER 1986 COAL MINING LIMIT (TOPOMESSING)

AREA 3 AND AREA 4 MINING BOUNDARY

INDEX MAP

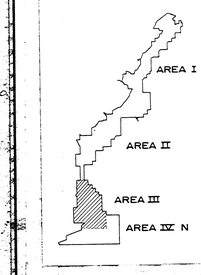


EXHIBIT 17-3

BHP MINERALS INTERNATIONAL

NAVAJO MINE

FRUITLAND, NEW MEXICO

AREA 3

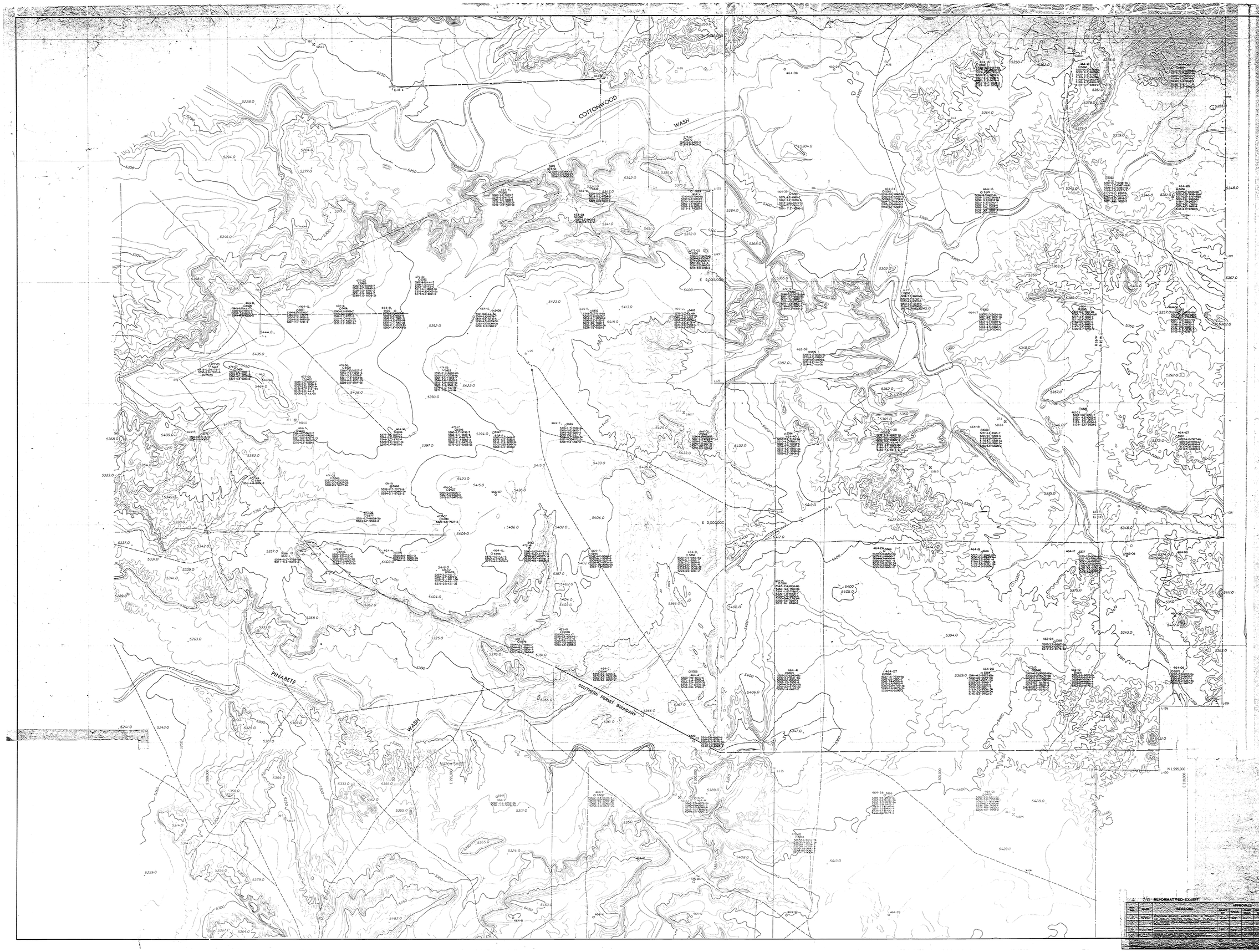
DRILL HOLE DATA

NO.	DATE	REVISIONS	DRAFT BY	APPROVALS		
1						
2						
3						
4						

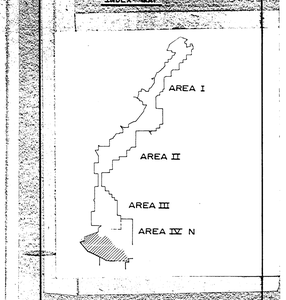
DRAWN BY: L. DAN — SCALE: 1" = 500' — EXHIBIT

DATE: — PART: — NO.:

DRAWING NO.: — LOCATION NO.:



INDEX MAP



EXPLANATION

COAL MINED OUT AS OF DECEMBER 31, 1977

COAL LEASE BOUNDARY

DECEMBER 1989 COAL MINING LIMIT (TOPDRESSING)

AREA 3 AND AREA 4 MINING BOUNDARY

DRILL HOLE NO. — COLLAR ELEVATION

379-07 — 5400

5280-93 — 7917-86

TOP OF SEAM ELEVATION — COAL GRADE

COAL THICKNESS — SEAM TOENTURGATION

EXHIBIT 17-4

BHP MINERALS INTERNATIONAL

AUSTRALIA — USA

TRUJILLO, NEW MEXICO

AREA 4 NORTH

DRILL HOLE DATA

REV. NO.	DATE	REVISIONS	APPROVALS			
			DRAWN BY	CHECKED	CHIEF ENGR.	MGR.
3	7/93	REFORMATTED EXHIBIT				
2						
1						
0						

DRAWN BY: J. SCALE: N.T.S. EXHIBIT:

APPROVED BY: DATE: 7/93 CHECKED: DRAWN BY:

CONTOUR INTERVAL-10 FEET
DAS JOB NO. 4619

LEGEND

- ROAD
- TRAIL
- FENCE LINE
- CULVERT
- PIPE LINE
- POWER LINE
- TELEPHONE LINE
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSION CONTOUR
- DRAINAGE
- DAM
- DIVERSION CANAL
- BUILDING
- TRIANGULATION STATION
- HORIZ PIC CONTROL PT
- VERT PIC CONTROL PT
- HORIZ & VERT PICTURE CONTROL POINT
- CLAIM CORNER
- BENCH MARK
- SPOT ELEVATION
- DRILL HOLE
- LEASE CORNER
- MINE
- SECTION CORNER
- RAILROAD
- HAUL ROAD
- LEASE LINE / PERMIT BOUNDARY
- SOIL DELINEATION LINE
- COAL STOCKPILE

I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.

RON C. VAN VALKENBURG
NEW MEXICO
4-26-93
REGISTERED PROFESSIONAL ENGINEER

JSL

Sheet 1 of 3

EXHIBIT 17-5

BHP MINERALS INTERNATIONAL INC.

NAVAJO MINE

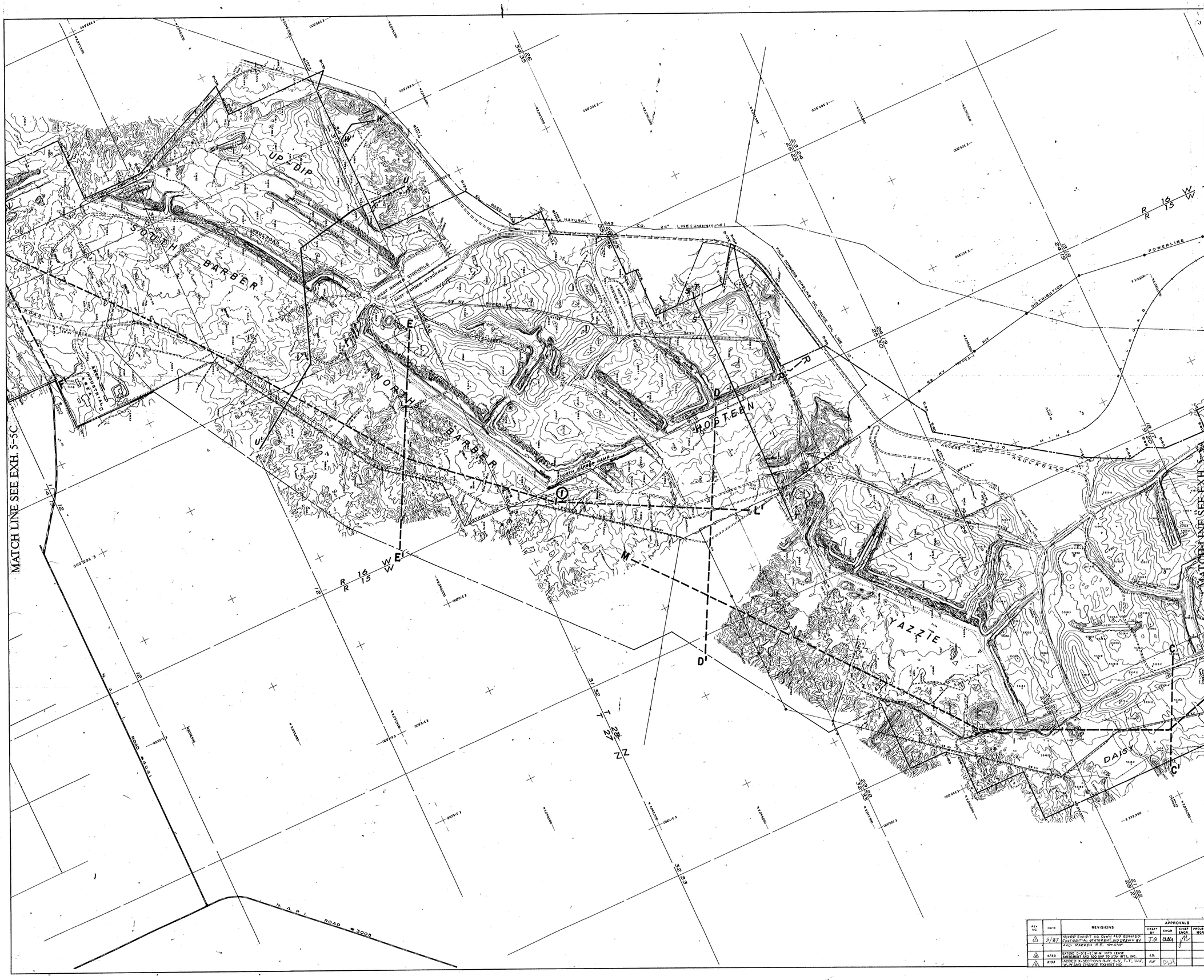
FRUITLAND, NEW MEXICO

AREAS 1, 2, 3
CROSS - SECTION
INDEX MAP

SAN JUAN COUNTY, NEW MEXICO

DRAWN BY	J. Gavin	SCALE	1" = 1000'
APPROVED BY		DATE	10-14-85
DRAWING NO		LOCATION NO	EXHIBIT

REV NO	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR	CHIEF ENGR	PROJECT MGR
3	5/87	MYEP EXHIBIT NO. DUNN AND REVISED CLASS OPTIONAL STATEMENT, AND DRAWN BY BHP SIDEBAR P.E. SPRAWL	J.G.	CLBG		
2	4/89	EXTEND D-2-E-E.-N-W INTO LEASE AREA, MAY AND ADD BHP TO CSM INFO. INC.	J.B.			
1	8/93	ADD FORMER BLOCK & CROSS SECTIONS 4, 5, 6, 7, 8	P.W.			



CONTOUR INTERVAL 10 FEET
DAS JOB NO 4619

LEGEND

- ROAD
- TRAIL
- FENCE LINE
- CULVERT
- PIPE LINE
- POWER LINE
- TELEPHONE LINE
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSION CONTOUR
- DRAINAGE
- DAM
- DIVERSION CANAL
- BUILDING
- TRIANGULATION STATION
- HORIZ PIC CONTROL PT
- VERT PIC CONTROL PT
- HORIZ & VERT PICTURE CONTROL POINT
- CLAIM CORNER
- BENCH MARK
- SPOT ELEVATION
- DRILL HOLE
- LEASE CORNER
- MINE
- SECTION CORNER
- RAILROAD
- HAUL ROAD
- LEASE LINE / PERMIT BOUNDARY
- SOIL DELINEATION LINE
- COAL STOCKPILE

RON C. VAN VALKENBURG — NEW MEXICO — REGISTERED PROFESSIONAL ENGINEER — 9264 — 9-20-85

RON C. VAN VALKENBURG — NEW MEXICO — REGISTERED PROFESSIONAL ENGINEER — 9264 — 9-14-85

Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.

L'-L2 - not cont'd to 5-5c

EXHIBIT 17-5 Sheet 2 of 3

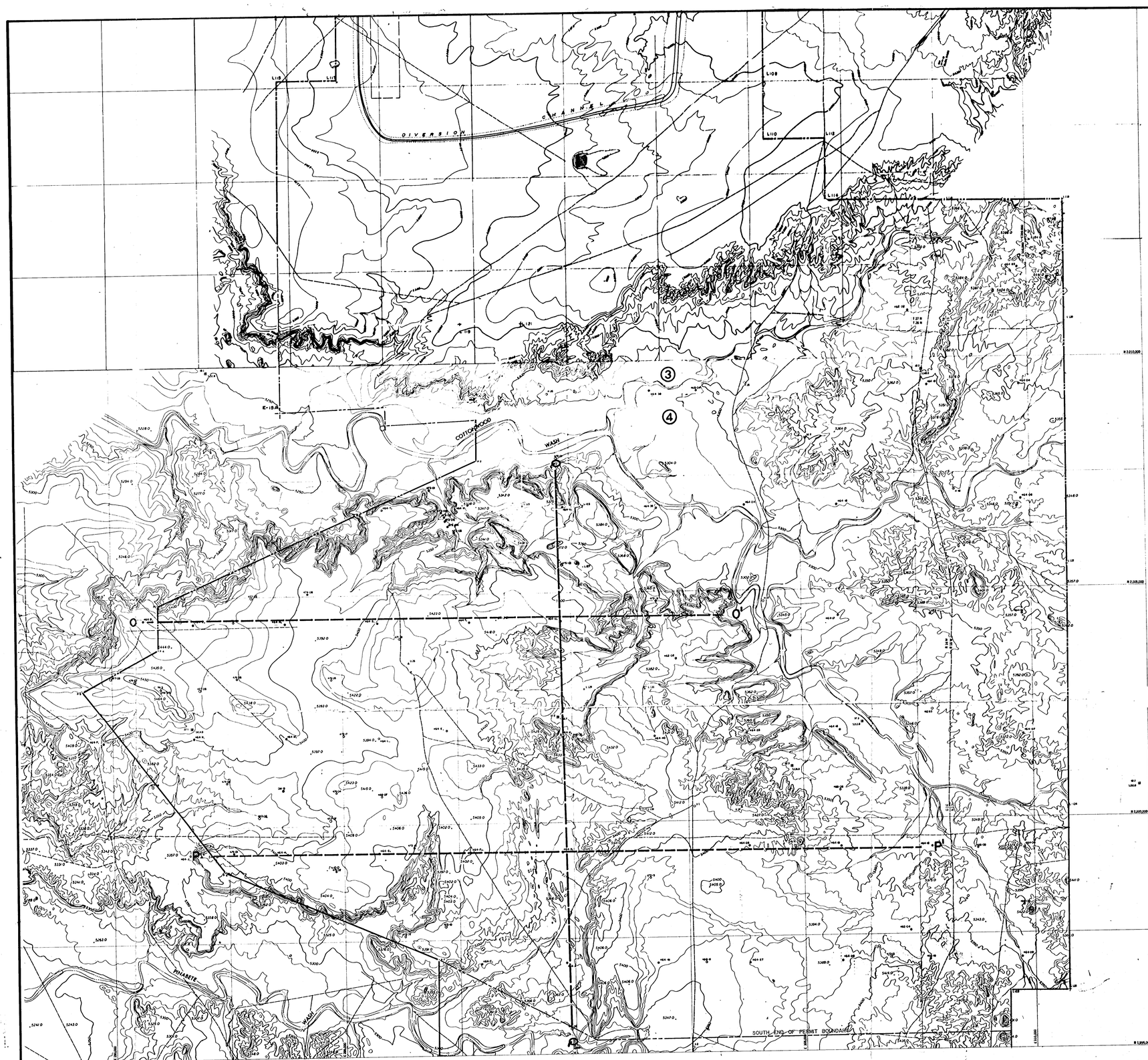
BHP MINERALS INTERNATIONAL INC.
NAVAJO MINE
FARMINGTON, NEW MEXICO

AREAS 1, 2, 3
CROSS - SECTION
INDEX MAP
SAN JUAN COUNTY, NEW MEXICO

DRAWN BY J. Gomez — SCALE 1" = 1000'
APPROVED BY — DATE 10-14-85
DRAWING NO — LOCATION NO

REV NO	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR	CHIEF ENGR	PROJECT MGR
1	5/87	MOVED EXHIBIT 18 DOWN AND REMOVED CONTINUITAL STATEMENT AND DRAWN BY AND DARREN P.E. GRAMP	JG	CLBG		
2	4/89	EXTEND D-D'E-E, L-M-W INTO LEASE EMEMENT AND ADD BHP TO (FOR INT'L INC.	J.G.			
3	8/93	ADDED X-SECTIONS R-R', S-S', T-T', J-J', W-W AND CHANGE EXHIBIT NO.	RJF	DLJ		

MATCH LINE SEE EXH. 5-5B
LOWE
DIXON
LOWE COAL STOCKPILE
DIVERSION
CHANNEL
COTTONWOOD
WASH
MASO
CONTOUR INTERVAL 10 FEET
DAS JOB NO 4619
LEGEND
ROAD
TRAIL
FENCE LINE
CULVERT
PIPE LINE
POWER LINE
TELEPHONE LINE
INDEX CONTOUR
INTERMEDIATE CONTOUR
DEPRESSION CONTOUR
DRAINAGE
DAM
DIVERSION CANAL
BUILDING
TRIANGULATION STATION
HORIZ PIC CONTROL PT
VERT PIC CONTROL PT
CLAIM CORNER
BENCH MARK
SPOT ELEVATION
DRILL HOLE
LEASE CORNER
MINE
SECTION CORNER
RAILROAD
HAUL ROAD
LEASE LINE / PERMIT BOUNDARY
SOIL DELINEATION LINE
COAL STOCKPILE
RON C. VAN VALKENBURG
NEW MEXICO
REGISTERED PROFESSIONAL ENGINEER
I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.
no drill holes for H-H'
L'-L2 not shown on H'd from 5-5B
EXHIBIT 17-5
BHP MINERALS INTERNATIONAL INC.
NAVAJO MINE
FARMINGTON, NEW MEXICO
AREAS 1, 2, 3
CROSS-SECTION
INDEX MAP
SAN JUAN COUNTY, NEW MEXICO
DRAWN BY J. Forrest
SCALE 1" = 1000'
APPROVED BY
DATE 10-14-85
DRAWING NO
LOCATION NO
REV NO | DATE | REVISIONS | APPROVALS | DRAFT BY | ENGR | CHIEF ENGR | PROJECT MGR.
5/87 | MOVED EXHIBIT 10 DOWN AND REMOVED CONFIDENTIAL STATEMENT, AND DRAWN BY AND DARREN P.E. STAMP | JG | CMcG | RC
4/89 | EXTEND D-D', E-E', M-M' INTO LEASE AMENDMENT AND ADD BHP TO UTAH INT'L. INC. | RG.
8/93 | ADDED 4 SECTIONS V-V', Y-Y', Z-Z', AND CHANGE CO. NAME AND EXHIBIT NO. | RW | DLH
Sheet 3 of 3



LEGEND

- ROAD
- TRAIL
- FENCE
- CULVERT
- PIPE LINE
- POWER LINE
- TELEPHONE LINE
- 5500 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DRAINAGE
- DAM
- DIVERSION CANAL
- BUILDING
- △U-2 TRIANGULATION STATION
- HORIZ. PIC. CONTROL POINT
- x VERT. PIC. CONTROL POINT
- HORIZ. & VERT. PICTURE CONTROL POINT
- CLAIM CORNER
- BENCH MARK
- 5324 SPOT ELEVATION
- 320 DRILL HOLE
- L-18 LEASE CORNER
- MINE
- 413/9110 SECTION CORNER
- RAILROAD
- HAUL ROAD
- LEASE LINE
- PERMIT BOUNDARY

RON C. VAN VALKENBURG, NEW MEXICO, 6863, REGISTERED PROFESSIONAL ENGINEER

I, Ron Van Valkenburg, hereby certify that this drawing since the previous certification are correct to the best of my knowledge.

JUSTIN S. LYNCH, NEW MEXICO, 8356, REGISTERED PROFESSIONAL SURVEYOR

EXHIBIT 17-6

BHP MINERALS INTERNATIONAL

NAVAJO MINE

FRUITLAND, NEW MEXICO

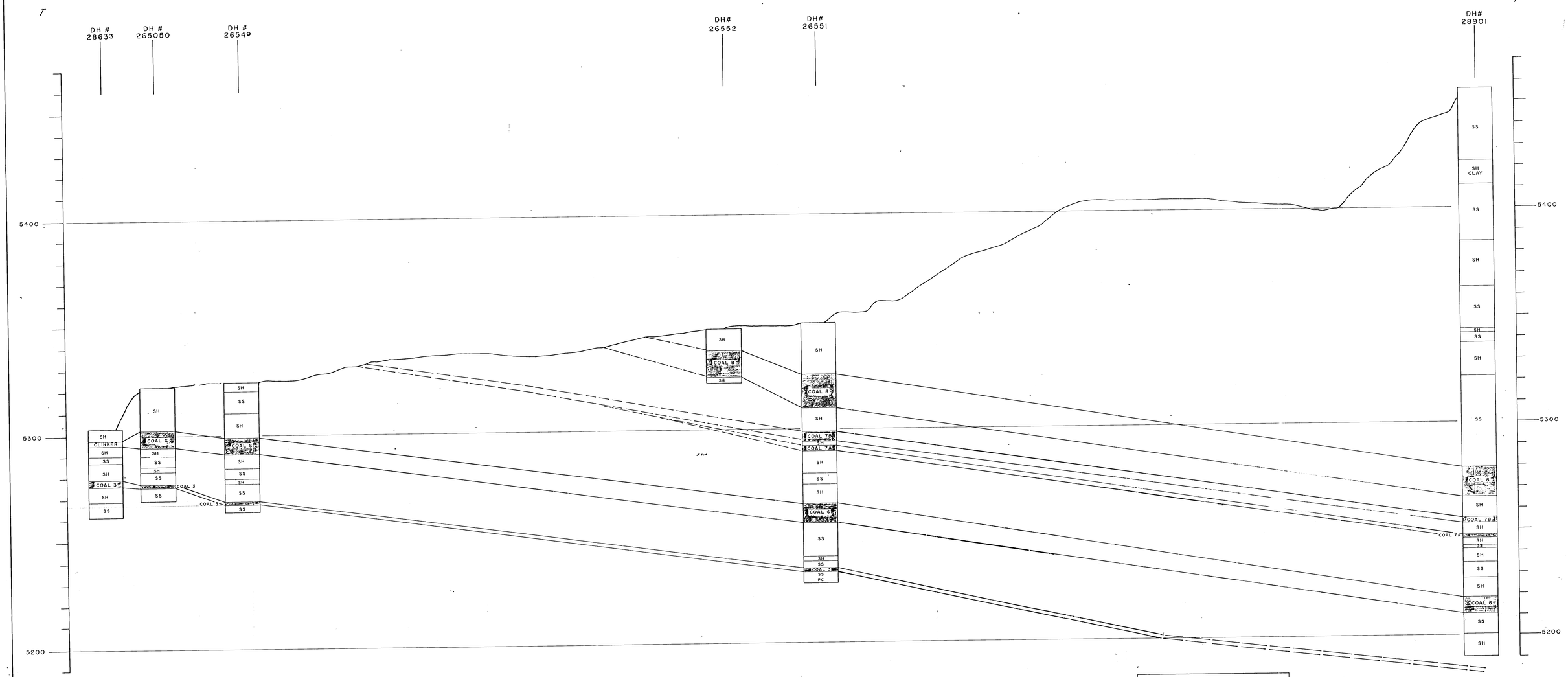
AREA 4 NORTH

CROSS-SECTION INDEX MAP

SAN JUAN COUNTY, NEW MEXICO

DRAWN BY L. DAN	SCALE 1" = 1000'	EXHIBIT:
APPROVED BY	DATE 10-14-85	
DRAWING NO.	LOCATION NO.	

REV. NO.	DATE	REVISIONS	APPROVALS: DRAFT BY:	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	12-12-1987	ADDED NEW AREA IV PERMIT BOUNDARY, PUT EXHIBIT NUMBER IN TITLE BLOCK, CHANGED CO. NAME TO BHP-UB AND WHO DRAFTED BY - L. DAN	CD			
2	2/90	REMOVED PERMIT LINE FROM WEST NORTH	JD			
3	3/93	CHANGED CO. NAME				



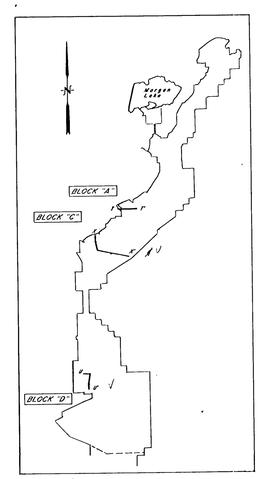


EXHIBIT 17-7
Sheet 3 of 5

THE INFORMATION DISPLAYED ON THIS EXHIBIT IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE

ROM C. VAN VALKENBURG — NEW MEXICO — REGISTERED PROFESSIONAL ENGINEER

REV. NO.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.O.	CHIEF ENG.
1	3-18-93	PJF	CHANGE A-SECT C-C' TO T-T'			

APPROVALS

BHP MINERALS INTERNATIONAL INC.

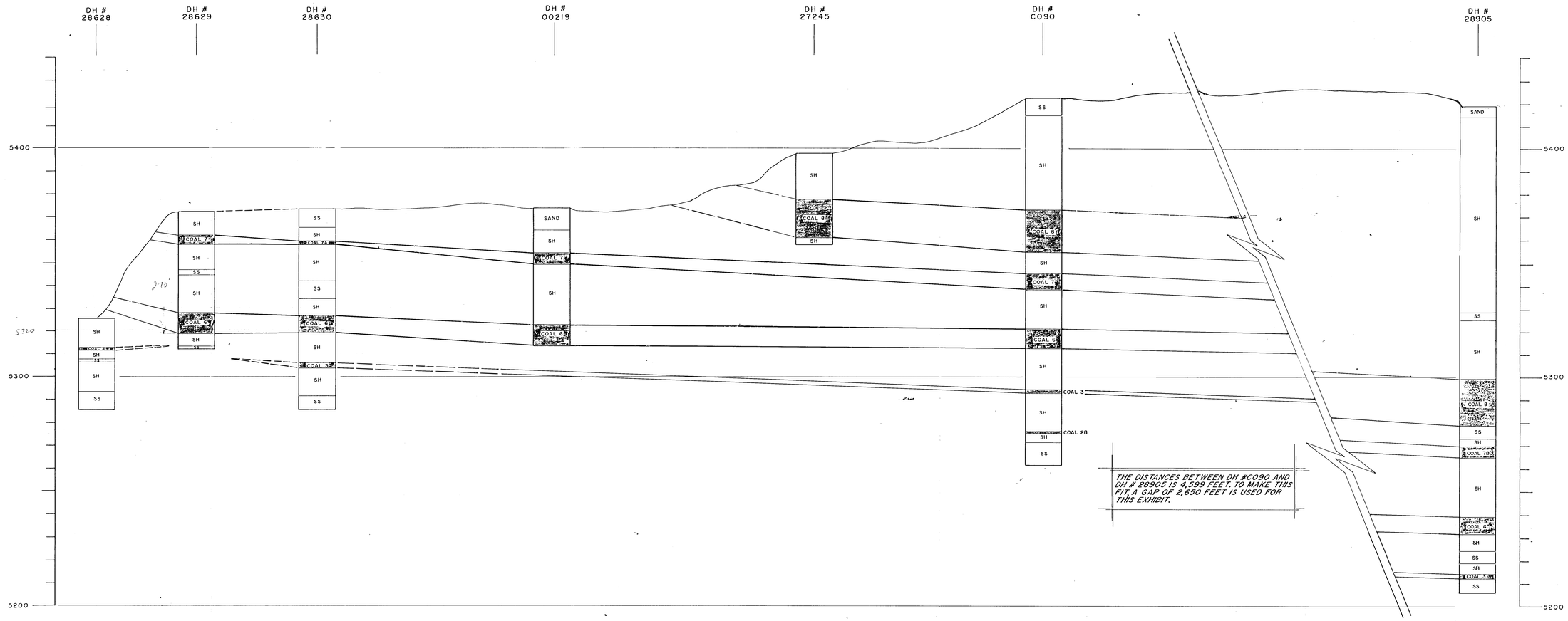
NAVAJO MINE — SAFETY PAYS

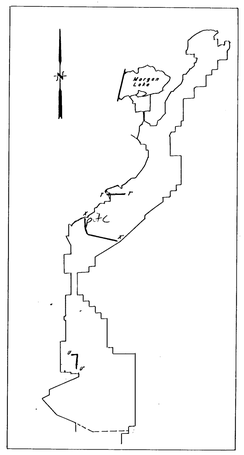
P.O. BOX 100 FRUITLAND, NEW MEXICO 87416

AREA 3 CROSS-SECTION T-T'

OVERBURDEN CORRELATION

PREPARED BY B. CONRAD	DRAWN BY PJFOSTER	SCALE: H-1"=200' V-1"=20'
APPROVED BY GAP	DATE MARCH 24, 1993	DRAWING LOCATION
DRAWING NO.	EXHIBIT NO.	





THE INFORMATION DISPLAYED ON THIS EXHIBIT IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE

REV. NO.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.O.	CHIEF ENG.
1	9-10-93	R.R.	CHANGE X-SECT D-D' TO X-X'			

APPROVALS

BHP MINERALS INTERNATIONAL INC.

NAVAJO MINE

SAFETY PAYS

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

AREA-3 CROSS-SECTION X-X'

OVERBURDEN CORRELATION

PREPARED BY B. CONRAD	DRAWN BY PJFOSTER	SCALE: H-1"=200' V-1"=20'	
APPROVED BY GAP	DATE MARCH 24, 1993	DRAWING LOCATION	
DRAWING NO.	EXHIBIT NO.		

EXHIBIT 17-7
Sheet 5 of 5

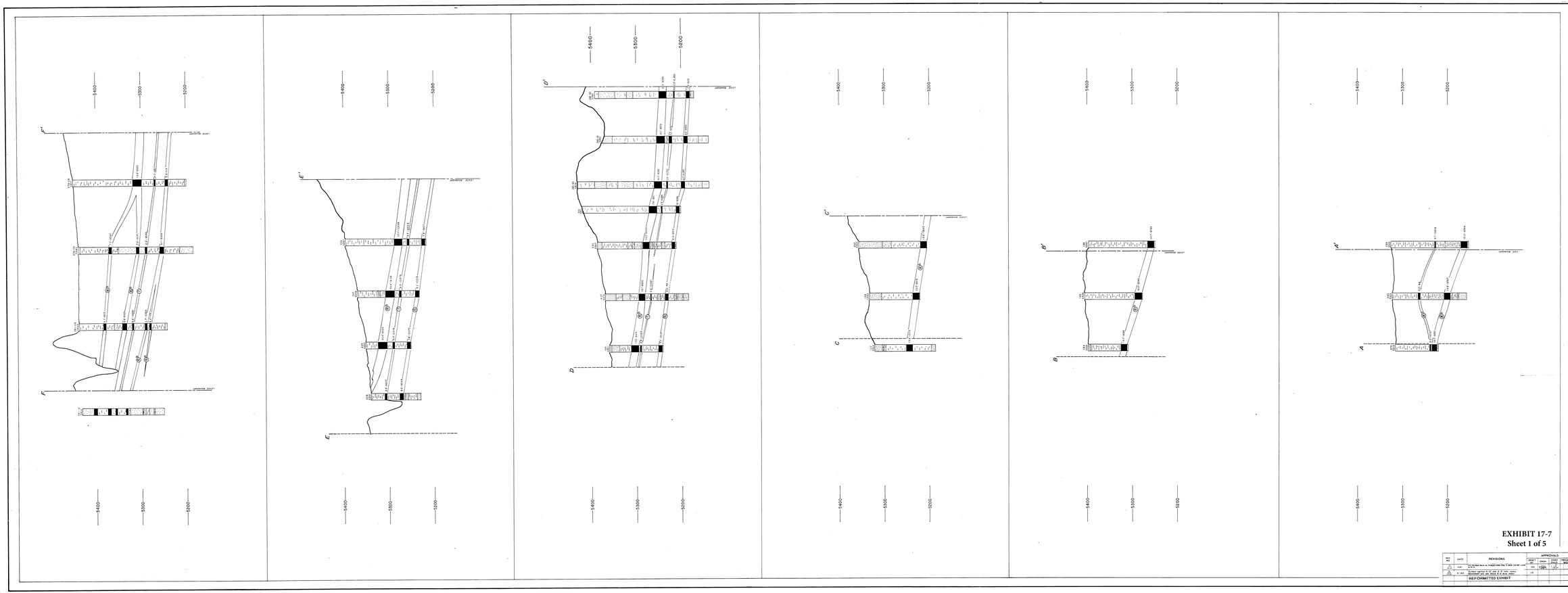


EXHIBIT 17-7
Sheet 1 of 5

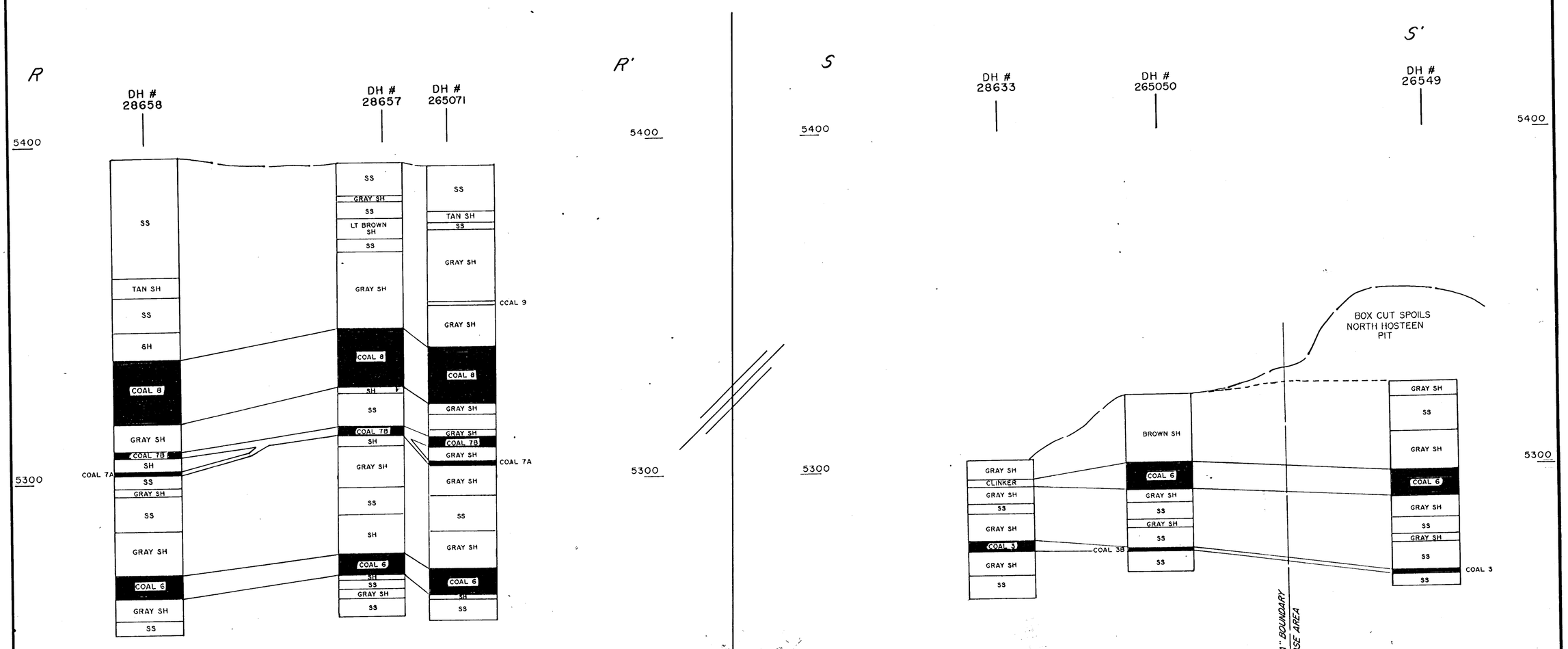


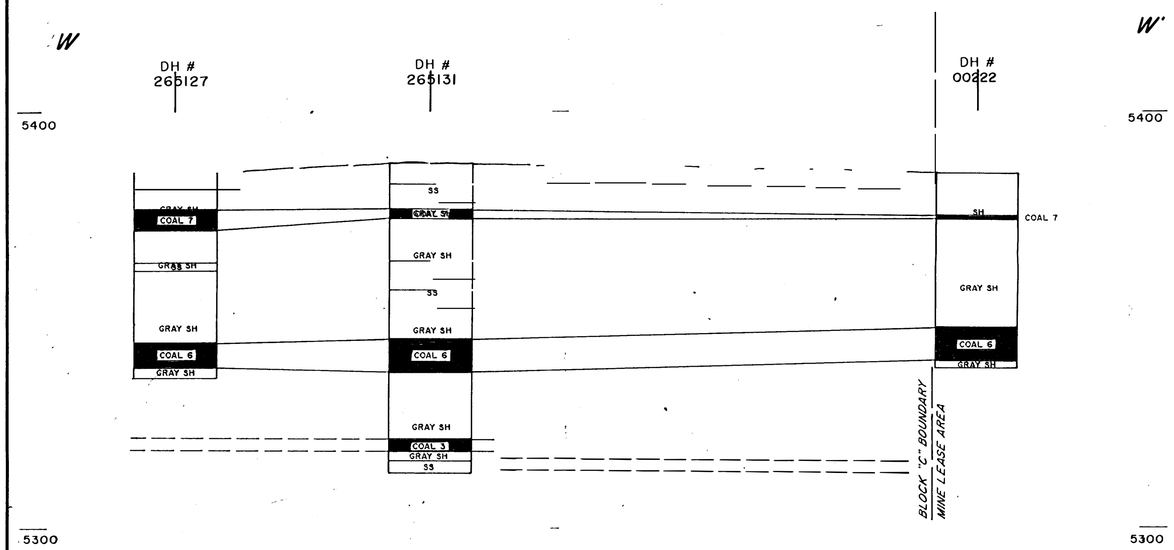
EXHIBIT 17-7
Sheet 2 of 5

REV. NO.	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	3-3-93	ADDED LETTER'S A-A', B-B', CHANGE DH 28571 to 265071 & 26550 to 265050	PJF	BFG	GAP	
2	8/93	CHANGED A-A' TO R-R', B-B' TO S-S'				

BHP MINERALS INTERNATIONAL INC.
NAVAJO MINE
FRUITLAND, NEW MEXICO

DRILL HOLE CORRELATION
BLOCK "A"

DRAWN BY PJF	SCALE H-1"=100' V-1"=20'	EXHIBIT
APPROVED BY GAP	DATE AUG. 20, 1992	PREPARED BY BC
DRAWING NO.		LOCATION NO.



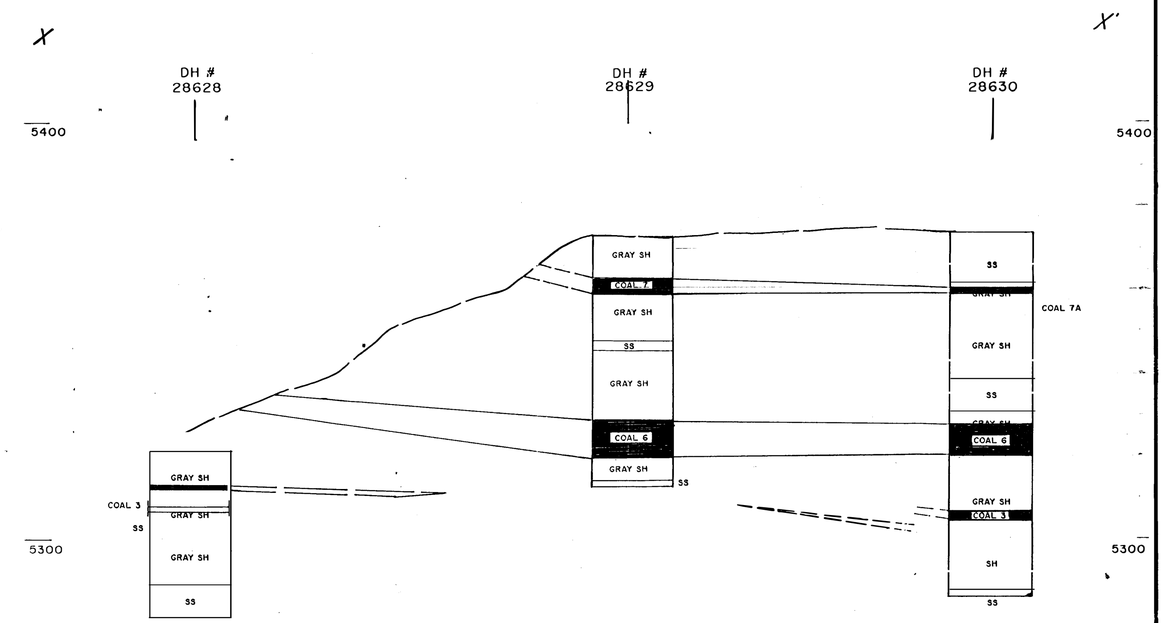


EXHIBIT 17-7
Sheet 4 of 5

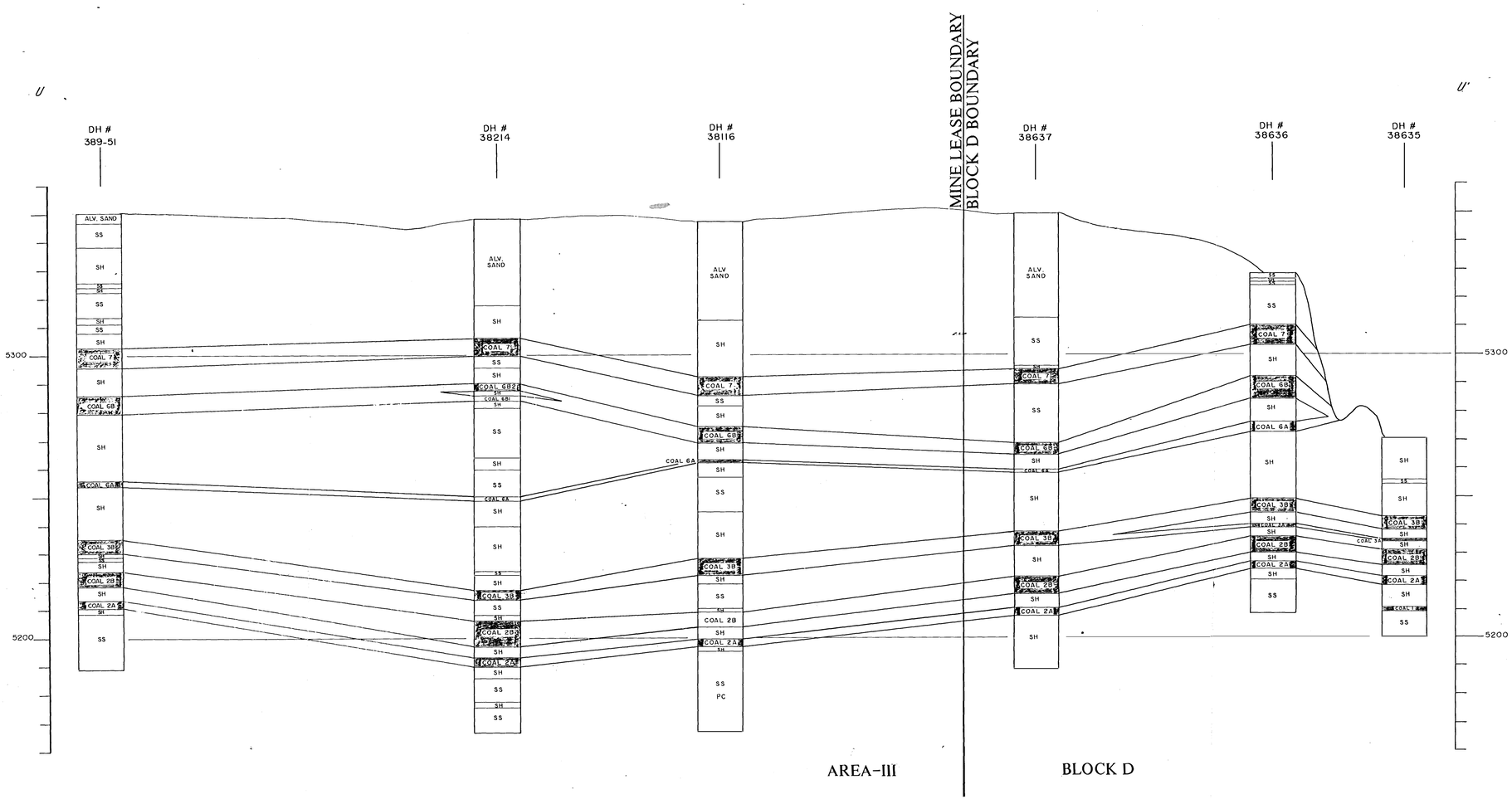
RON C. VAN VALKENBURG
NEW MEXICO
9263
REGISTERED PROFESSIONAL ENGINEER

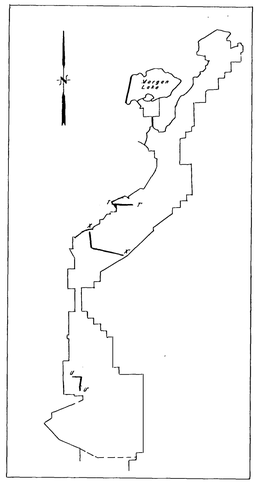
REV. NO.	DATE	REVISIONS	BY: DRAFT	APPROVALS		PROJECT MGR.
2.	3-30-93	ADDED LETTER'S A-A', B-B'				
		CHANGED A-A' TO W-W', B-B' TO X-X'				

BHP MINERALS INTERNATIONAL INC.
NAVAJO MINE
FRUITLAND, NEW MEXICO

DRILL HOLE CORRELATION
BLOCK "C"

SCALE: H-1"=100' V-1"=20'
DATE AUG. 20, 1992
EXHIBIT PREPARED B
DRAWN BY PJF
APPROVED BY GAP
LOCATION NO.
BY BC
DRAWING NO.





THE INFORMATION DISPLAYED ON THIS EXHIBIT IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE

RON C. VAN VALKENBURG NEW MEXICO 9261 REGISTERED PROFESSIONAL ENGINEER 9-20-93

REV. NO.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.O.	CHIEF ENG.
1	9-10-93	PJF	CHANGE X-SECT E-E' TO U-U'			

APPROVALS

BHP MINERALS INTERNATIONAL INC.

NAVAJO MINE

SAFETY PAYS

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

AREA-3 CROSS-SECTION' U-U'

OVERBURDEN CORRELATION

PREPARED BY B. CONRAD	DRAWN BY PJFOSTER	SCALE: H-1"=200' V-1"=20'
APPROVED BY GAP	DATE MARCH 24, 1993	DRAWING LOCATION
DRAWING NO.	EXHIBIT NO.	

EXHIBIT 17-8

Sheet 4 of 4

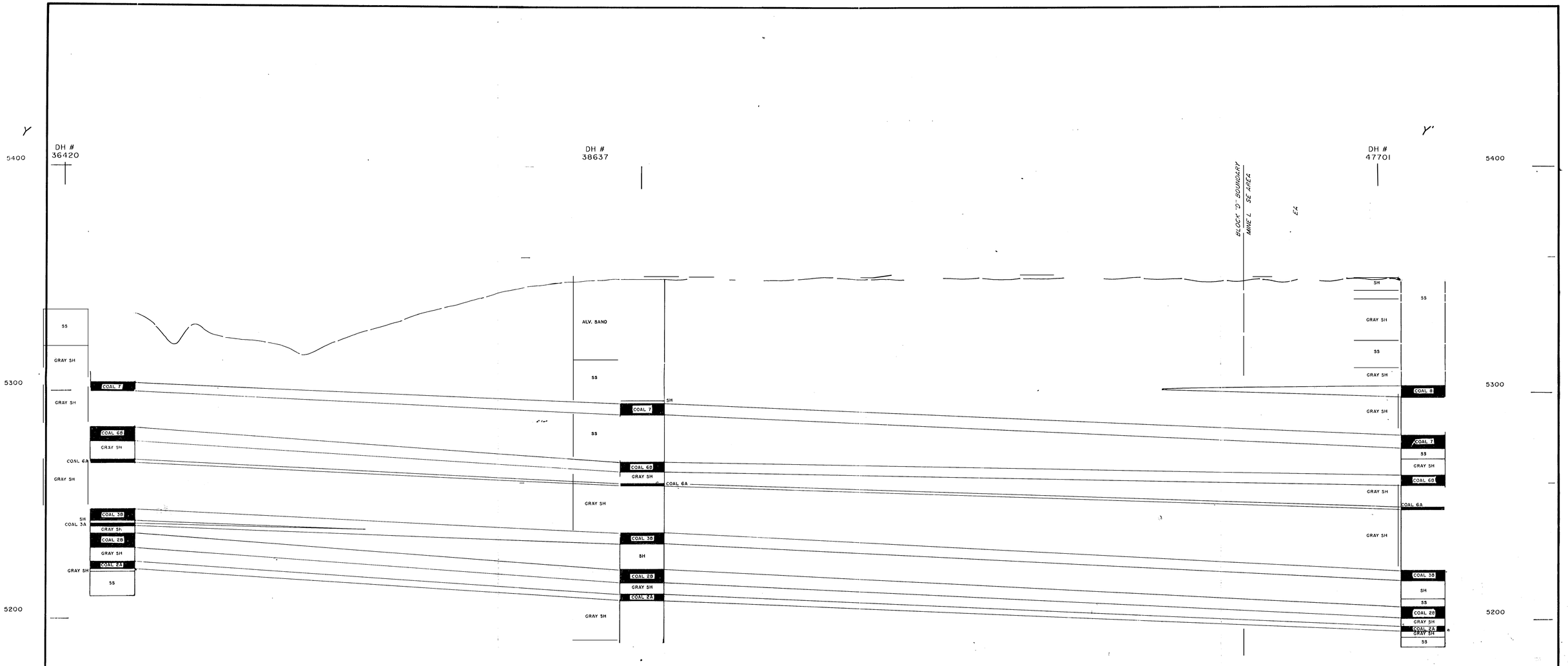


EXHIBIT 17-8
Sheet 2 of 4

REV. NO.	DATE	REVISIONS	DRAWN BY	CHK'D	CHK'D	PROJECT MGR.
1	5-5-93	ADDED LEGEND & X	PJP			
2	5/93	CHANGED SCALE				

APPROVALS

BHP MINERALS INTERNATIONAL INC.
NAVAJO MINE
FRUITLAND, NEW MEXICO

DRILL HOLE CORRELATION
BLOCK D

DRAWN BY PJP | DATE 5-5-93 | EXAMINED
REVISED BY PJP | DATE AUG 20, 1992 | PROJECT MGR.
DRAWING NO. | LOCATION NO.

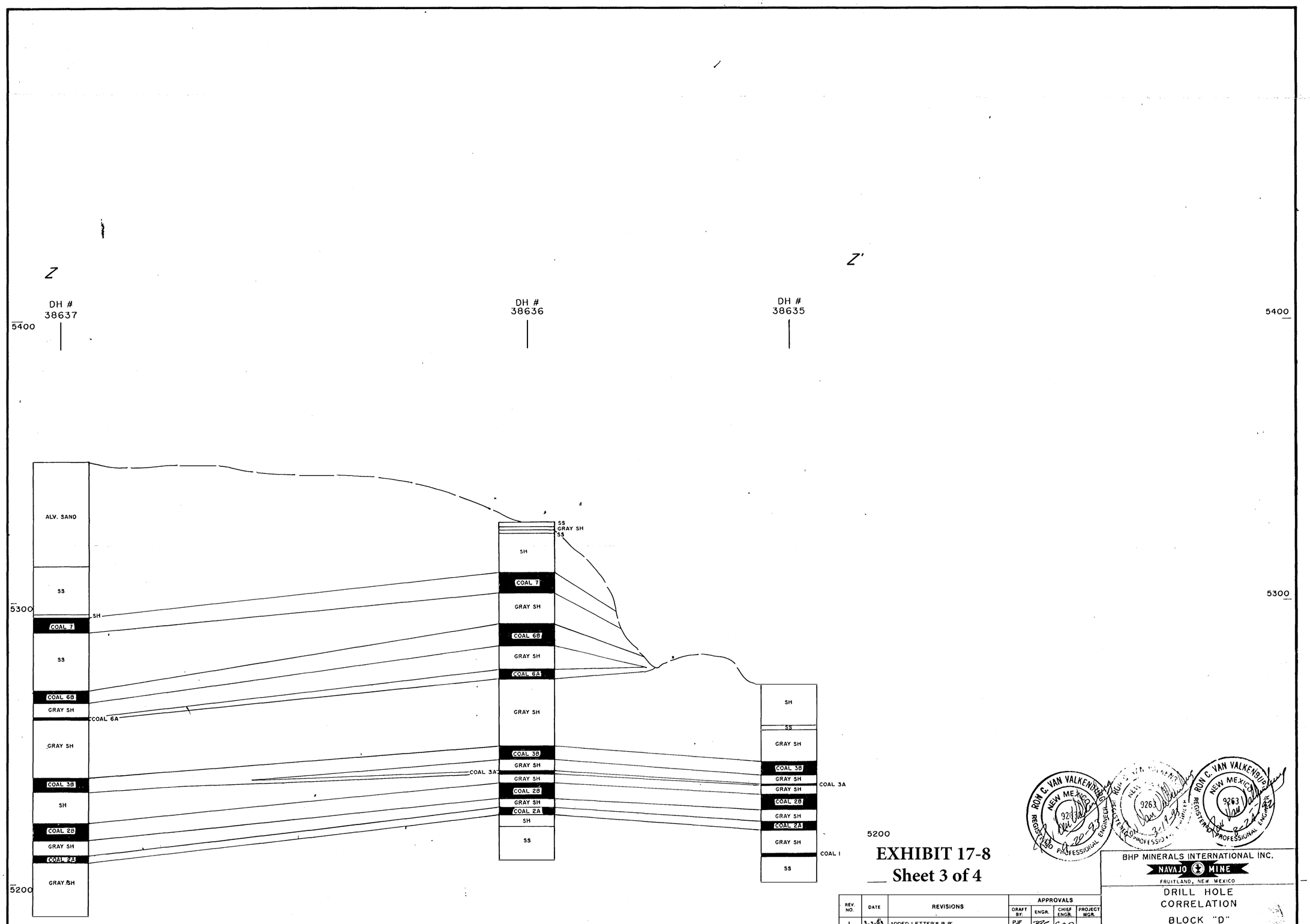


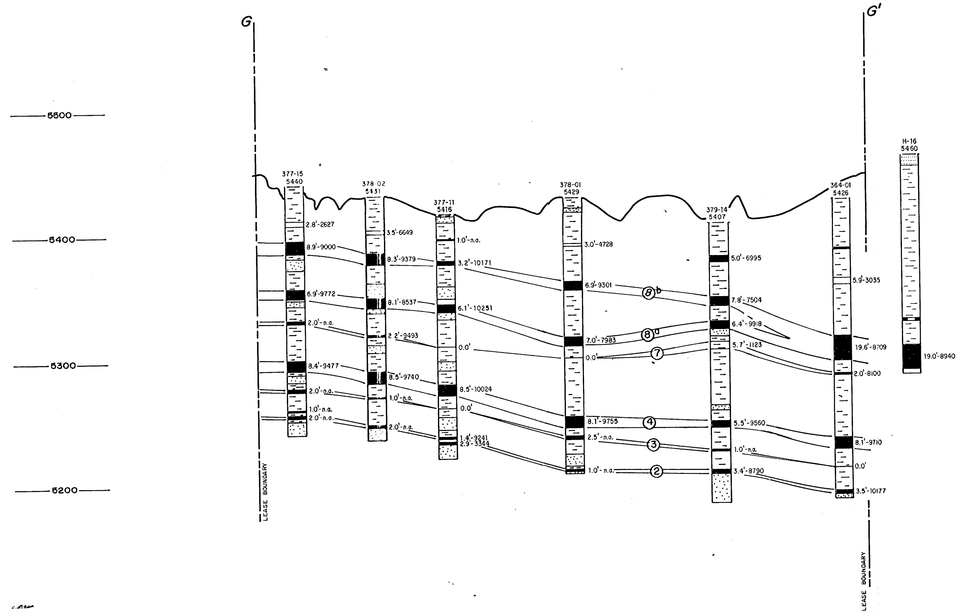
EXHIBIT 17-8
Sheet 3 of 4

REV. NO.	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	3-3-93	ADDED LETTERS B-B'	PJF	BC	GAP	
2	3/93	CHANGED B-B' TO Z-Z'				

BHP MINERALS INTERNATIONAL INC.
NAVAJO MINE
FRUITLAND, NEW MEXICO

DRILL HOLE CORRELATION
BLOCK "D"

DRAWN BY PJF | SCALE H-1"=100' V-1"=20' | EXHIBIT
APPROVED BY GAP | DATE AUG. 20, 1992 | PREPARED BY BC
DRAWING NO. | LOCATION NO.



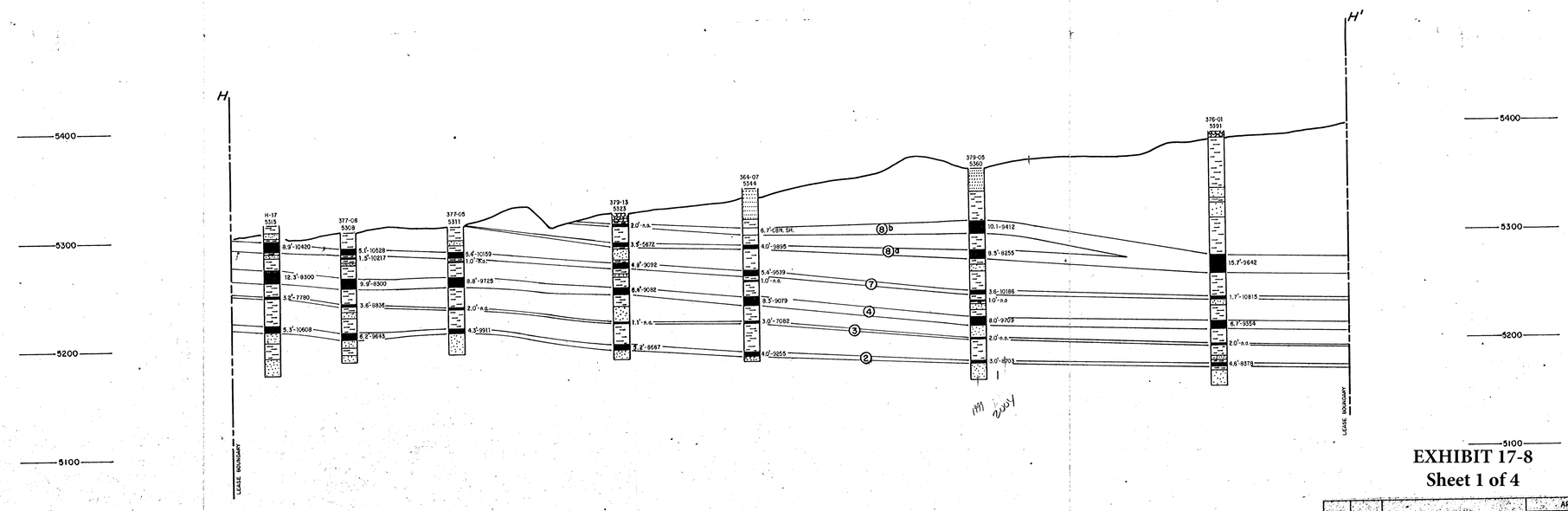


EXHIBIT 17-8
Sheet 1 of 4

REV. NO.	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR.	CHIEF ENGR.	PROJ. MGR.
1	5-95	Add Fruitland Fm. to Stratigraphic Column & show Cortez Lease	SSA	JAMA		

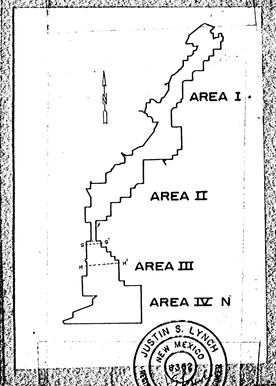
EXPLANATION

ALLUVIUM
SAND
SILTSTONE
SANDSTONE
SHALE
COAL SEAM

STRATIGRAPHIC COLUMN

Kf FRUITLAND FORMATION
Kpc PICTURED CLIFFS SANDSTONE

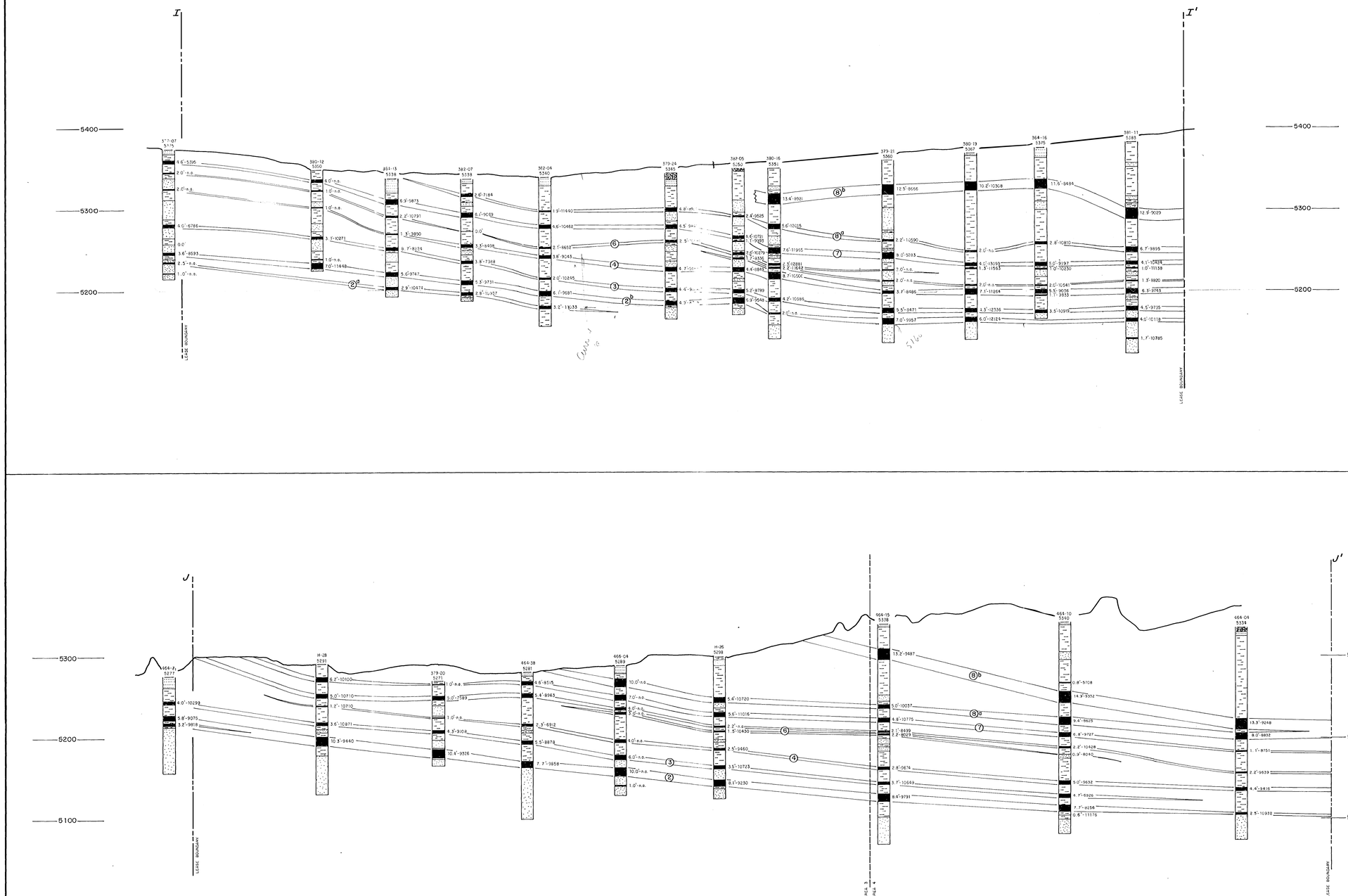
INDEX MAP



BHP MINERALS INTERNATIONAL
NAVAJO MINE
FORT WINGATE, NEW MEXICO

EAST / WEST DRILL HOLE CORRELATION SECTION
G-G' & H-H'

DRAWN: | SCALE: HORIZ. 1" = 200' VERT. 1" = 100' | DATE:
DESIGNED BY: | LOCATION: | TRACING:
DRAWING NO.: | LOCATION NO.: | 17



EXPLANATION

ALLUVIUM
SAND
SILTSTONE
SANDSTONE
SHALE
COAL SEAM

STRATIGRAPHIC COLUMN

Kf — FRUITLAND FORMATION

Kpc — PICTURED CLIFFS SANDSTONE

I, RON C. VAN VALKENBURG, HEREBY CERTIFY CHANGES ON THIS DRAWING SINCE THE PREVIOUS CERTIFICATION ARE ACCURATE TO THE BEST OF MY KNOWLEDGE.

INDEX MAP

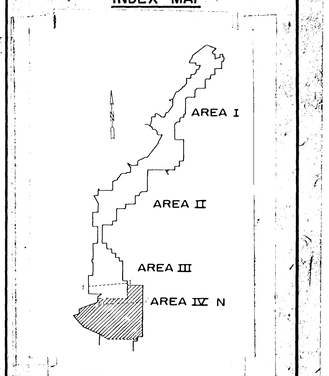


EXHIBIT 17-9

BHP MINERALS INTERNATIONAL

NAVAJO MINE

FRUITLAND, NEW MEXICO

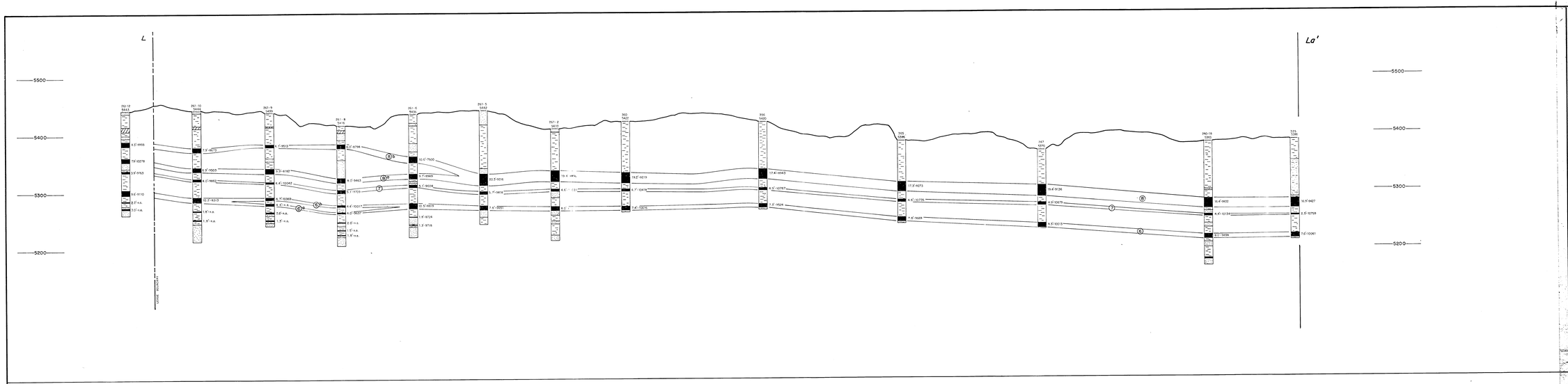
AREAS 3, & 4N

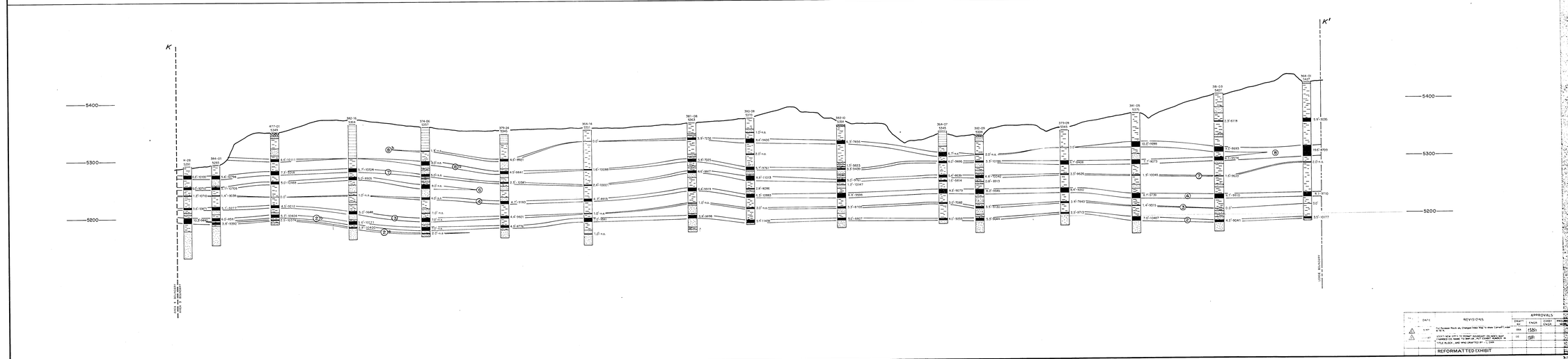
EAST-WEST DRILL HOLE CORRELATION SECTION I-I', J-J'

REV. NO.	DATE	REVISIONS	DRAWN BY	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	5-87	Put Paraloc Back, Changed Index Map To Show Current Lease & TV's	CDA			
2	11-1-87	ADDED NEW AREA IV PERMIT BOUNDARY ON INDEX MAP, PUT "CURRENT" NUMBER IN TITLE BLOCK, CHANGED CO. NAME TO BHP-CIR AND WHO DRAFTED BY L. DAN	CG			

REFORMATTED EXHIBIT

DRAWN BY:	SCALE: HORIZ. 1" = 500' VERT. 1" = 50'
APPROVED BY:	DATE:
DRAWING NO:	EXHIBIT:
	LOCATION NO:





EXPLANATION

- ALLUVIUM
- SAND
- SILTSTONE
- SANDSTONE
- SHALE
- COAL SEAM

STRATIGRAPHIC COLUMN

Kf — FRUITLAND FORMATION

Kpc — PICTURED CLIFFS SANDSTONE

INDEX MAP

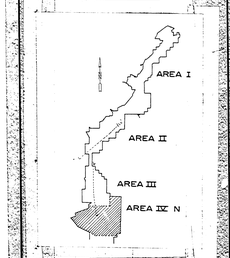


EXHIBIT 17-10

BHP MINERALS INTERNATIONAL

AREAS 2,3 & 4-N

NORTH - SOUTH DRILL HOLE CORRELATION SECTION

K-K'-L-L'

	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR	CHIEF ENGR	PROJECT MANAGER
1	3-90	R.O.Rucker Much as, Changed Index Map to show Carroll's area	BBA	[illegible]		
2	1-91	2-91: BBA, KPS & TJ REPORT REVISED PER REC.BHP. CHANGED CO. NAME TO BHP LP. PLT CHART HEADER. M.	LK	[illegible]		
		TITLE BLOCK, AND WAS CRAFTED BY - L.LUK				

REFORMATTED EXHIBIT

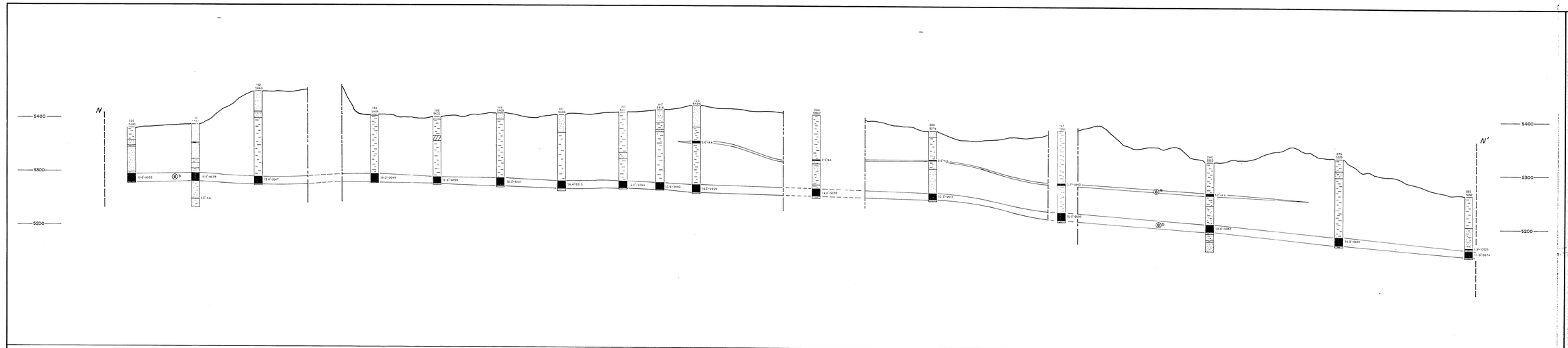
SCALE: HORIZ. 1" = 500' VERT. 1" = 50'

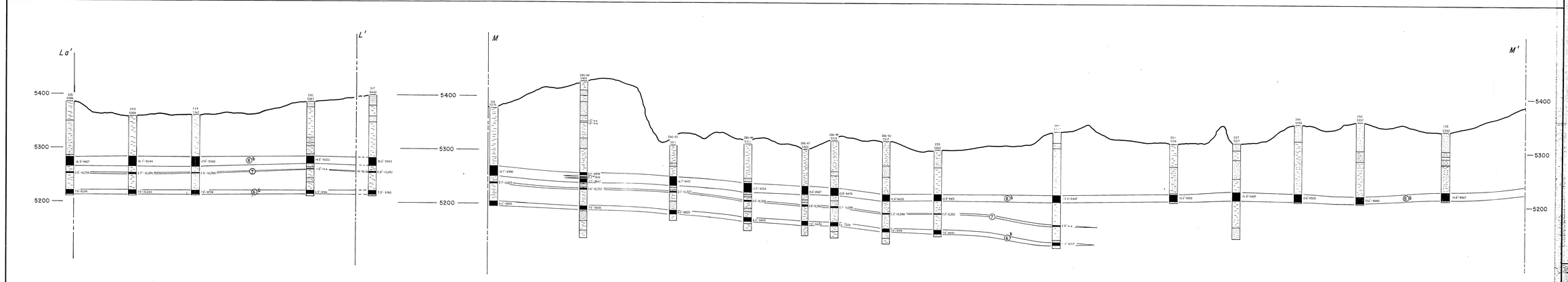
DRAWN BY: BBA DATE: 3-90

APPROVED BY: DATE:

DRAWING NO. EXHIBIT

LOCATION NO.





EXPLANATION

ALLUVIUM
SAND
SILTSTONE
SANDSTONE
SHALE
COAL SEAM

STRATIGRAPHIC COLUMN

Kf FRUITLAND FORMATION

Kpc PICTURED CLIFFS SANDSTONE

INDEX MAP

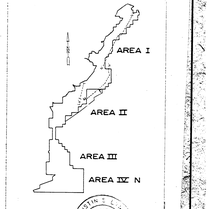


EXHIBIT 17-11

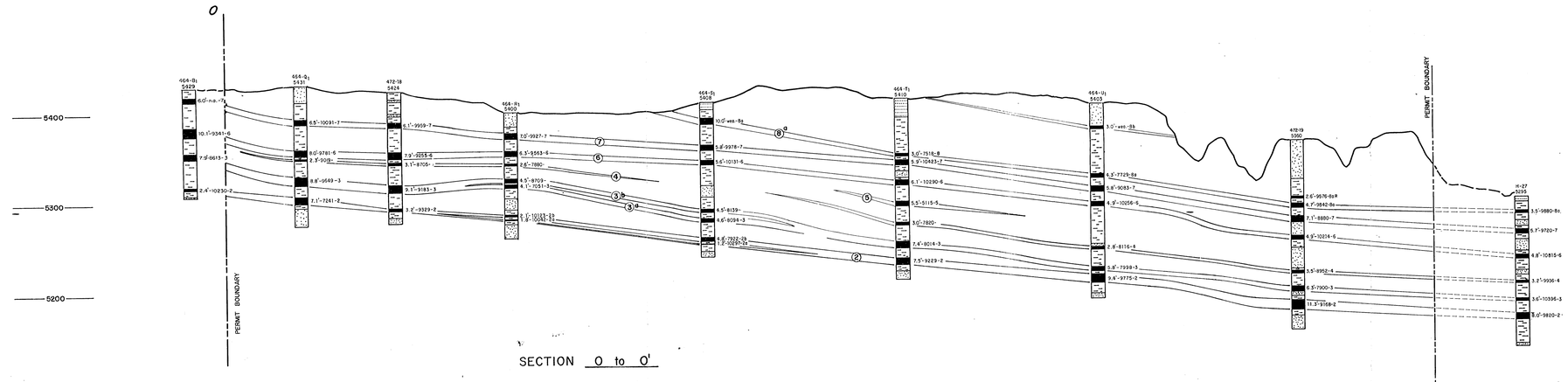
REV. NO.	DATE	REVISIONS	APPROVALS: DRAWN	CHECK	CHIEF ENGR.	PROJECT ENGR.
1	3-84	Fruitland Area to Chaco Area Map to show Carson Creek Area	SAM			
2	4-85	Added Horiz. 1" = 1000' Cross Section and Add Area IV N Area, Map		JS		
3	7-85	REFORMATTED EXHIBIT				

BHP MINERALS INTERNATIONAL

SAN JUAN MINE
FRUITLAND, NEW MEXICO

AREAS I & IV
NORTH - SOUTH DRILL HOLE CORRELATION SECTION
L2'-L, M-M', N-N'

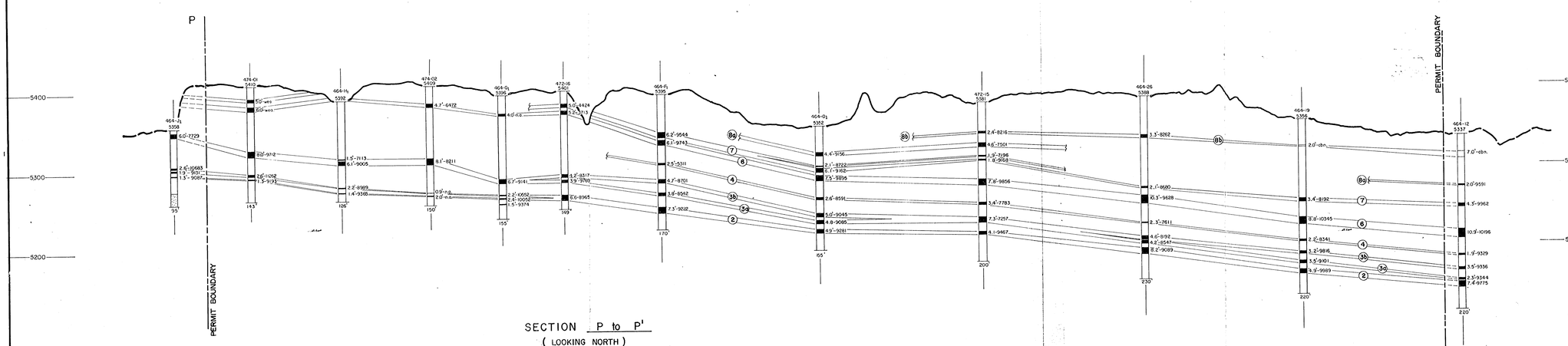
DRAWN BY: SCALE: VERT. 1" = 200' CASE: 8"x10"
HORZ. 1" = 1000'
APPROVED BY: EXHIBIT: 17-11
DRAWING NO.: LOCATION NO.:



SECTION O to O'

(LOOKING NORTH)

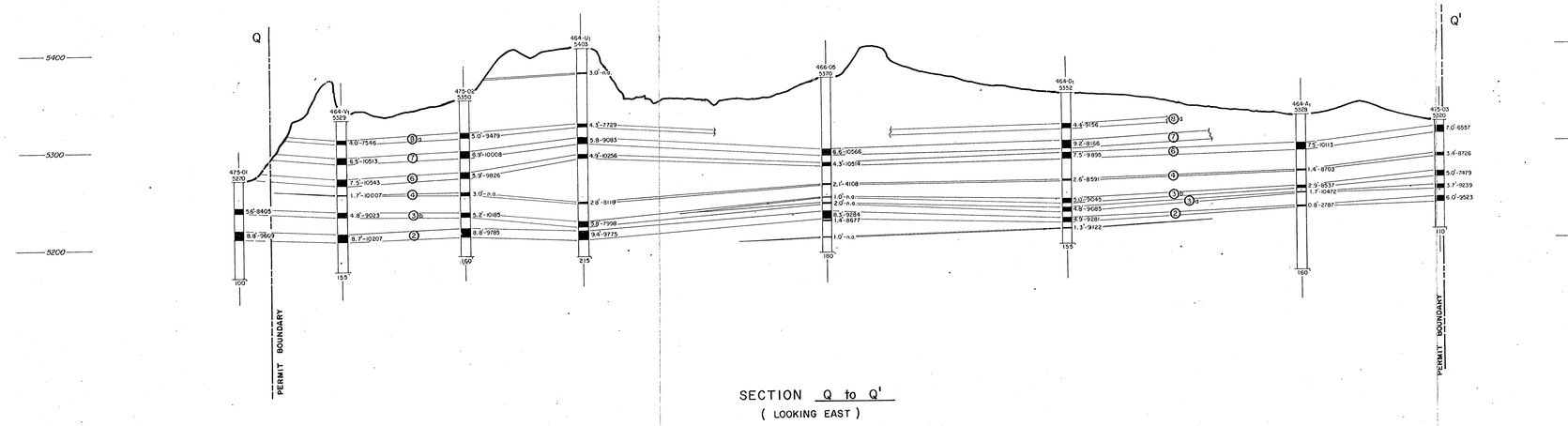
HORIZ. SCALE : 1" = 500'
VERT. SCALE : 1" = 50'



SECTION P to P'

(LOOKING NORTH)

HORIZ. SCALE : 1" = 500'
VERT. SCALE : 1" = 50'



SECTION Q to Q'

(LOOKING EAST)

HORIZ. SCALE : 1" = 500'
VERT. SCALE : 1" = 50'

EXPLANATION

- ALLUVIUM
- SAND
- SILTSTONE
- SANDSTONE
- SHALE
- COAL SEAM

STRATIGRAPHIC COLUMN

FRUITLAND FORMATION

PICTURED CLIFFS SANDSTONE

I HEREBY CERTIFY THAT THIS DRAWING IS A TRUE AND CORRECT REPRESENTATION OF THE SAME AS PREVIOUSLY CERTIFIED ON 10-19-88

INDEX MAP

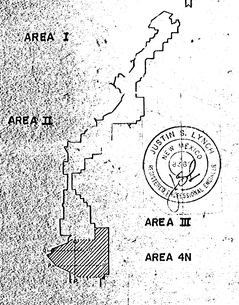


EXHIBIT 17-12

BHP MINERALS INTERNATIONAL
NAVAJO MINE
FRUITLAND, NEW MEXICO

AREA 4N
EAST-WEST, NORTH-SOUTH CORRELATION SECTION
O-O', P-P', Q-Q'

REV. NO.	DATE	REVISIONS	DRAFT. BY	ENGR.	CHIEF ENGR.	PROJ. ENGR.
1	11/88	ADDED WEST AND SOUTH NEW AREA (FROM REFERENCE 1) AND CHANGED ALL OTHER SECTIONS TO MATCH				
2	1/89	REFORMATTED EXHIBIT				

GRAPH. BY: [illegible] SCALE: NOTED EXHIBIT:
APPROVED BY: DATE: 10-19-88
DRAWING NO: LOCATION NO:

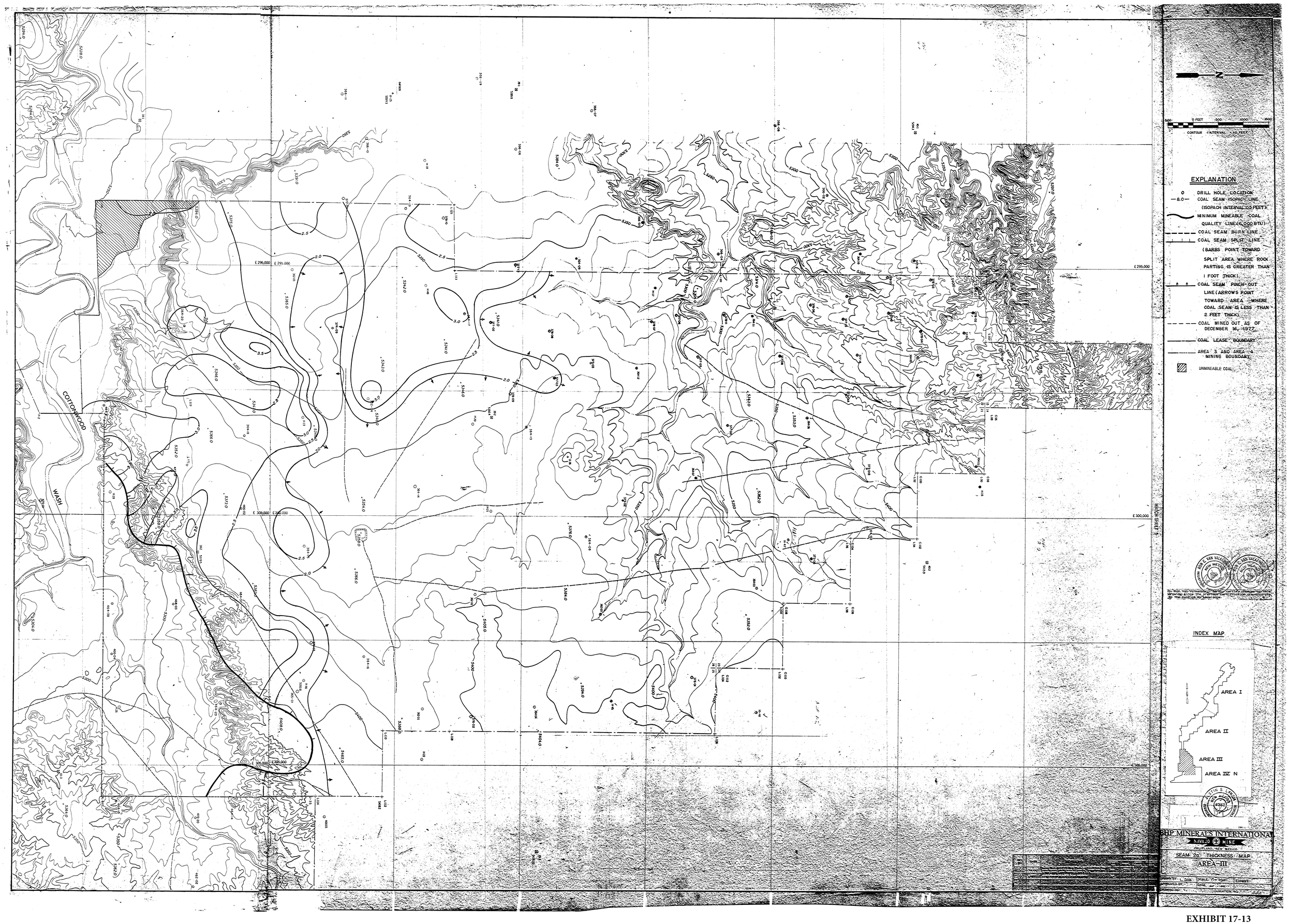
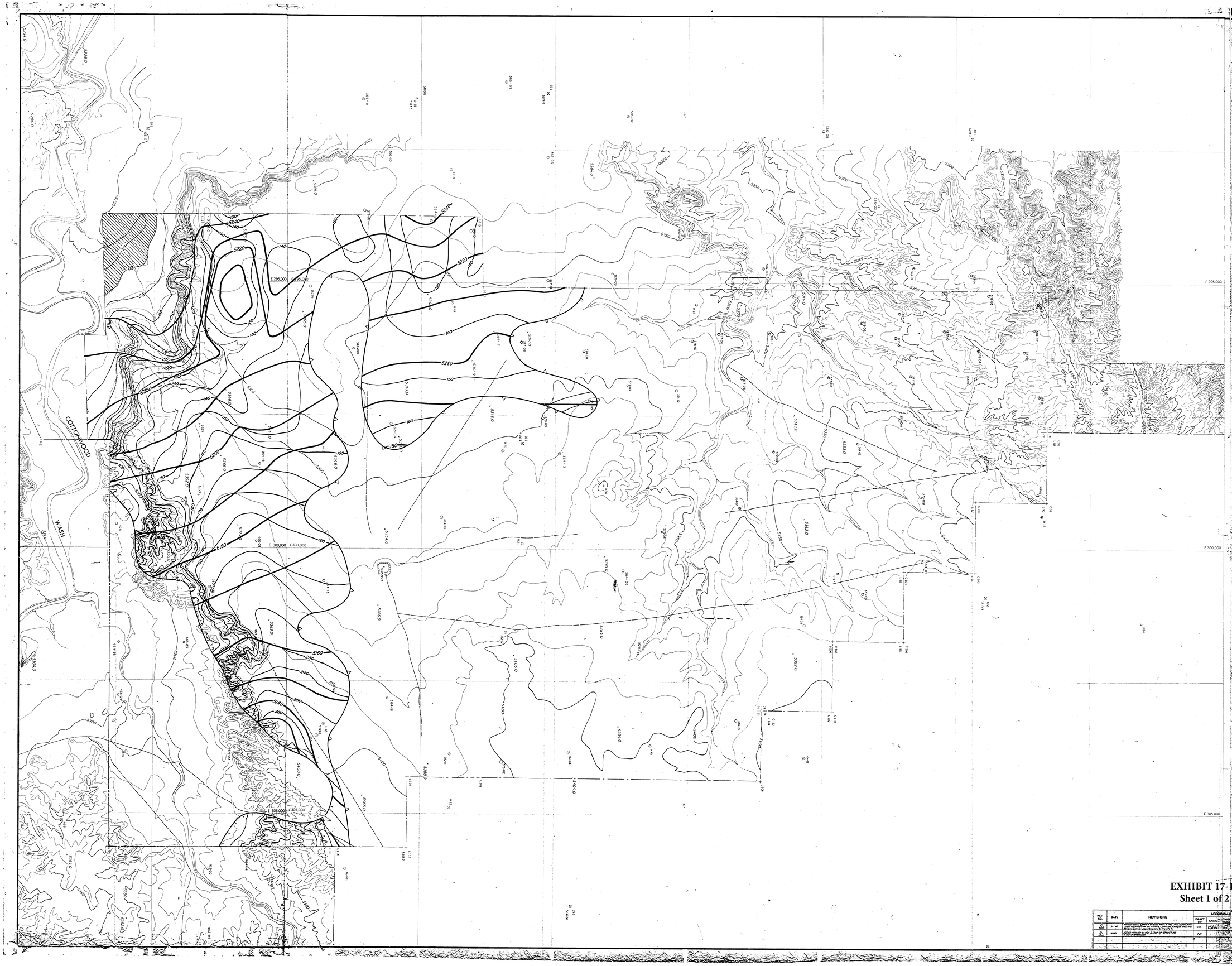
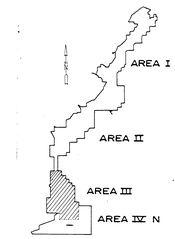


EXHIBIT 17-13
Sheet 2 of 2



INDEX MAP



500 0 FEET 500 1000 1500

CONTOUR INTERVAL = 10 FEET

EXPLANATION

- DRILL HOLE LOCATION
- 5280 — TOP OF COAL SEAM STRUCTURE CONTOURS (CONTOUR INTERVAL 10 FEET)
- 50 — OVERBURDEN ISOPACH LINES-ISOPACH INTERVAL 10 FEET)
- MINIMUM MINEABLE COAL QUALITY LINE(6,000 BTU)
- COAL SEAM BURN LINE
- COAL SEAM SPLIT LINE (BARBS POINT TOWARD SPLIT AREA-WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
- COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK)
- COAL MINED OUT AS OF DECEMBER 16, 1977.
- COAL LEASE BOUNDARY
- 50' 60' 5240 70' — OVERBURDEN TO TOP OF SEAM; TOP OF SEAM CONTOUR
- AREA 3 AND AREA 4 MINING BOUNDARY.
- UNMINEABLE COAL

I, Ron Van Valkenburg, hereby certify that this map is a true and correct representation of the current mining boundaries to the best of my knowledge.

SHEET INDEX

N

EXHIBIT 17-13
Sheet 1 of 2

REV. NO.	DATE	REVISIONS	DRAFT BY	APPROVALS ENGINEER	CHIEF ENGINEER	PROJECT MGR.
1	5/1/87	Added Barbs, Corrected Area 3 Boundary, Added Area 4 Boundary, Added Burned Coal Line, Added Area 3 Pit	RRA	CEM	[illegible]	[illegible]
2	8/1/83	ADDED CURRENT MINE & LEASE OF STRUCTURE & ISO-OVERBURDEN MAP	PJF			

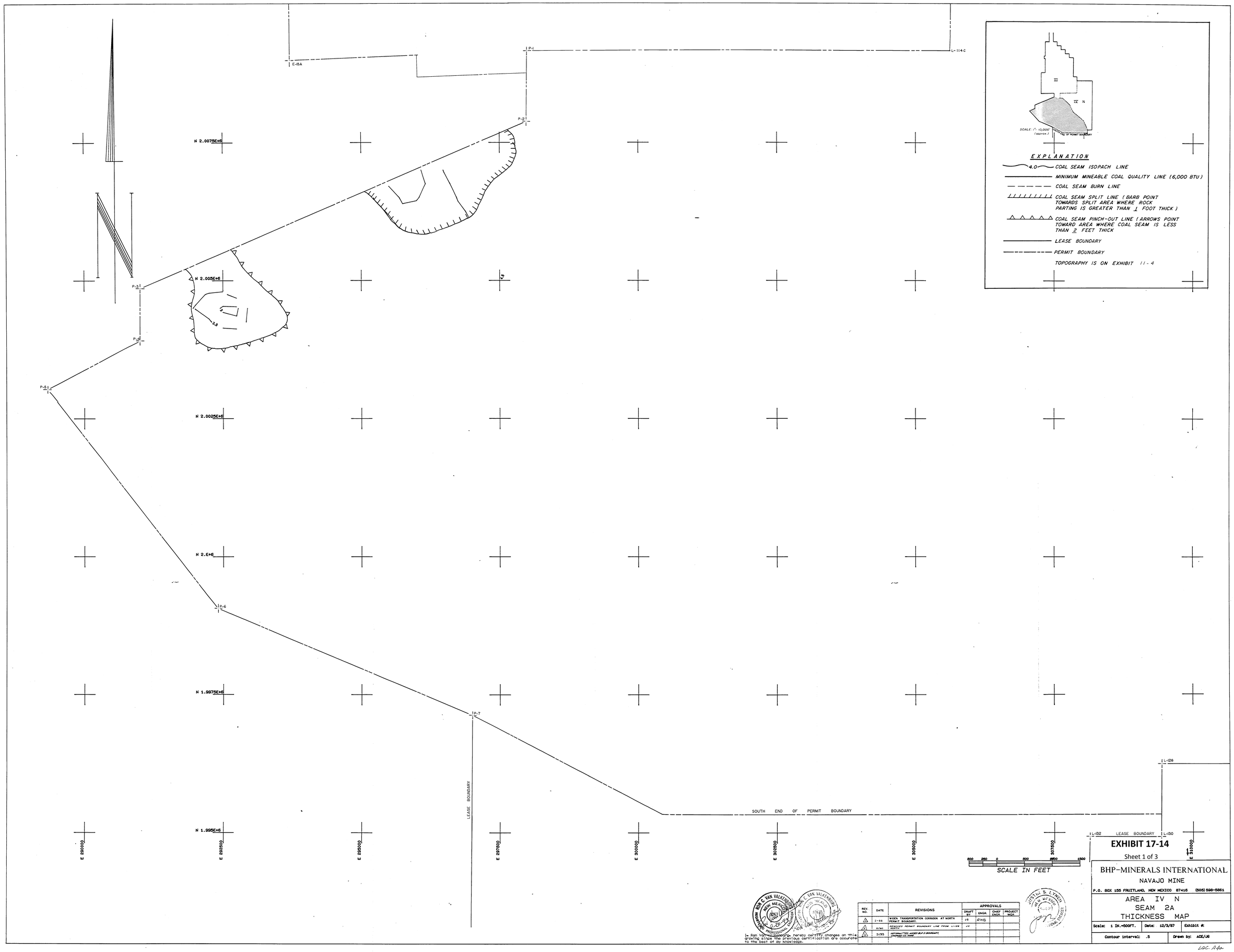
BHP MINERALS INTERNATIONAL

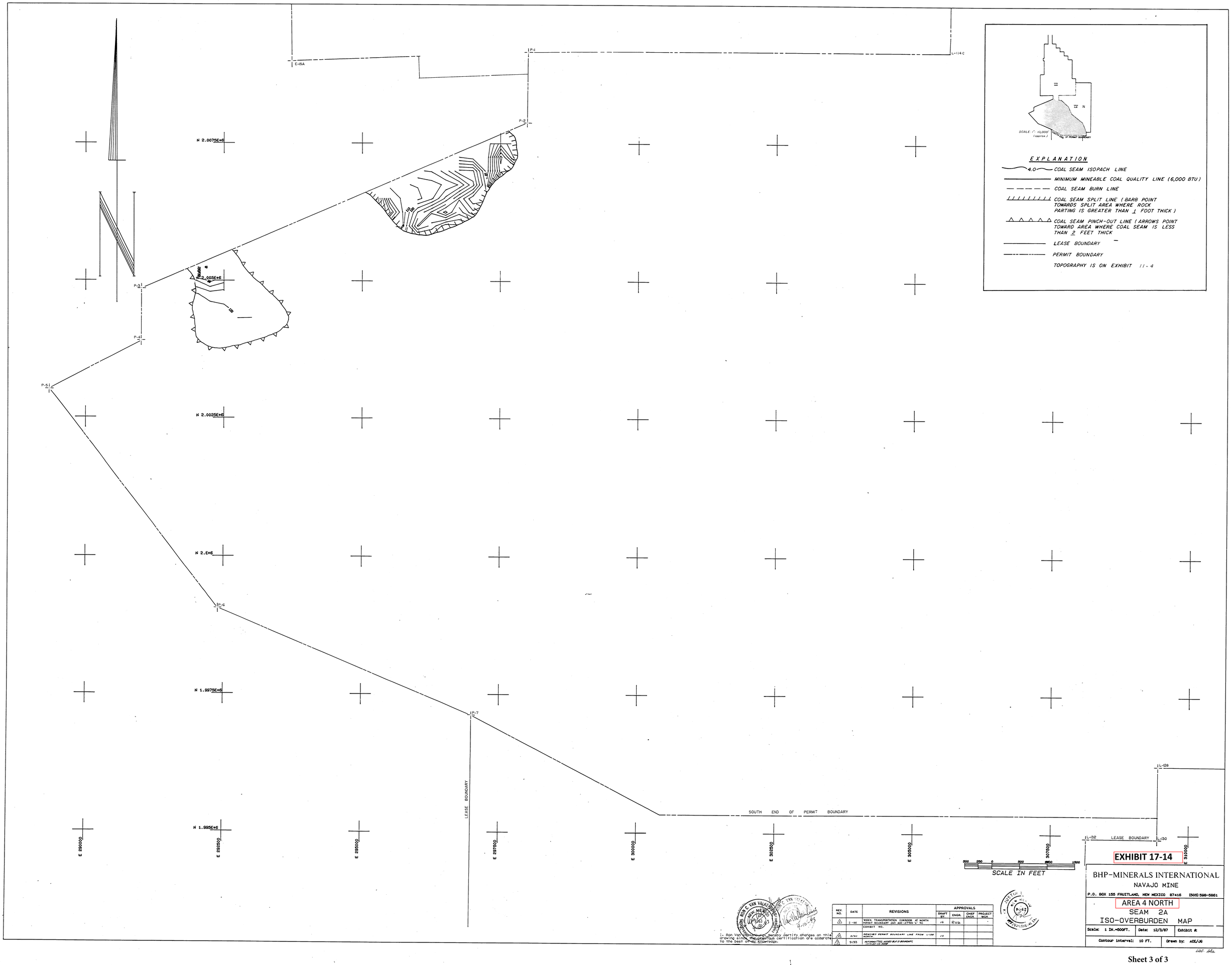
NERCO MINE

HUITLAND, NEW MEXICO

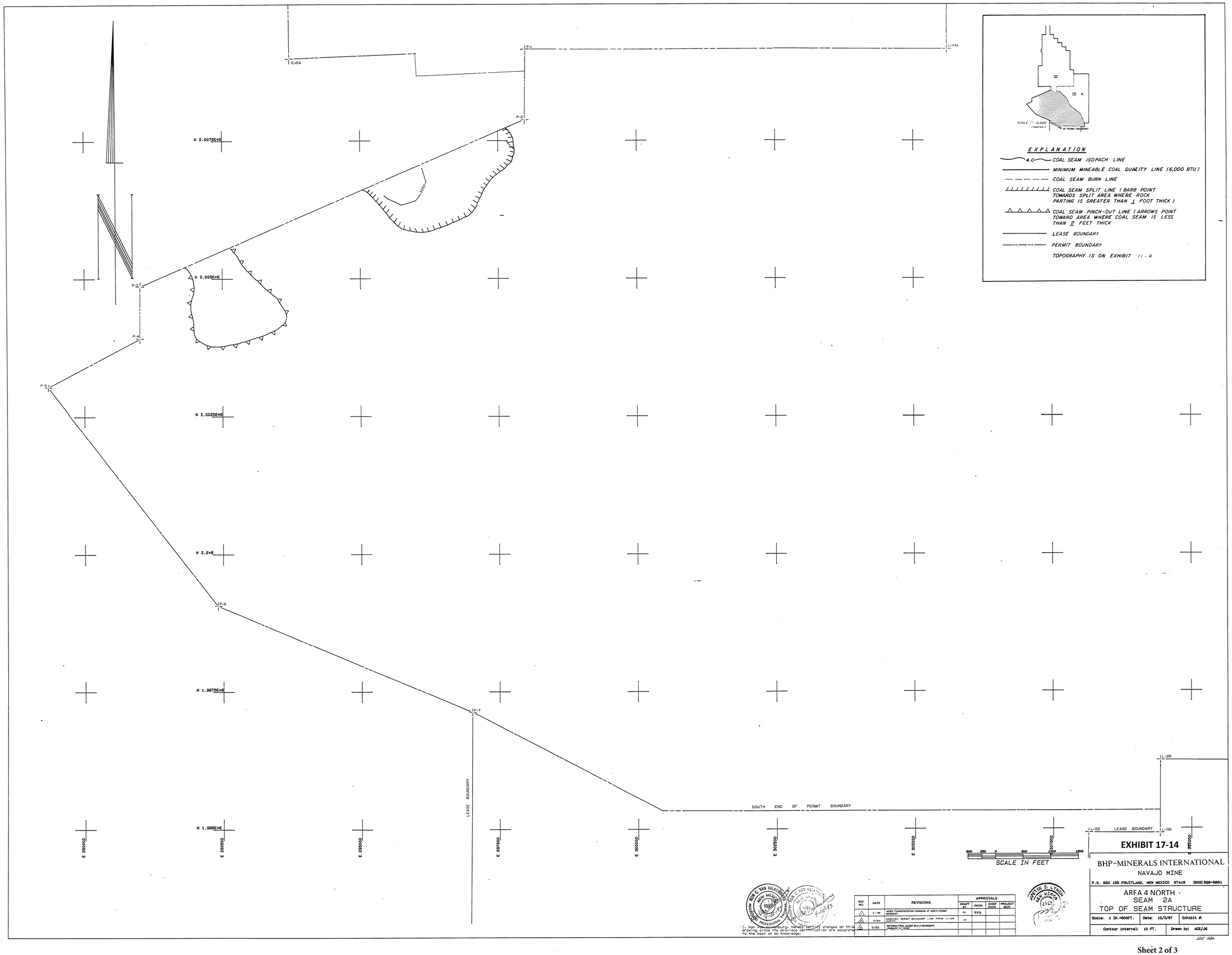
SEAM 2a
AREA III
TOP OF SEAM STRUCTURE
AND ISO-OVERBURDEN MAP

DRAWN BY: L. DAN | SCALE: 1" = 500' | EXHIBIT:
APPROVED BY: | DATE: MAY - 1987
DRAWING NO. | LOCATION NO.

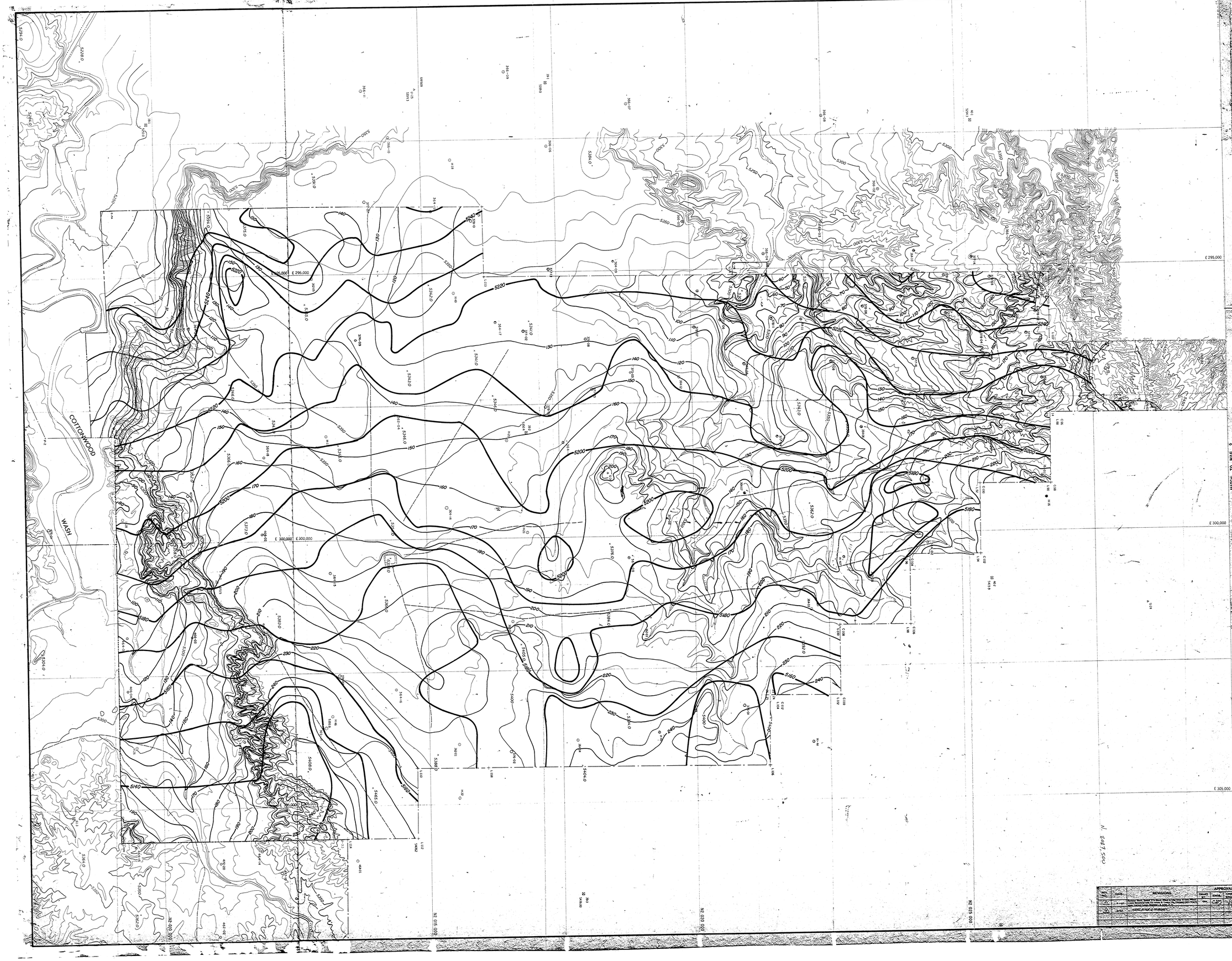

E-15A
P-4
L-114C
P-2
N 2.0075E+6
N 2.005E+6
P-3
P-1
P-5
N 2.0025E+6
N 2.E+6
P-6
N 1.9975E+6
P-7
LEASE BOUNDARY
SOUTH END OF PERMIT BOUNDARY
L-128
L-132
LEASE BOUNDARY
L-130
N 1.995E+6
E 290000
E 292500
E 295000
E 297500
E 300000
E 302500
E 305000
E 307500
E 310000
500 250 0 500 1000 1500
SCALE IN FEET
III
IV N
SCALE: 1" = 10,000' (approx.)
END OF PERMIT BOUNDARY
EXPLANATION
4.0 COAL SEAM ISOPACH LINE
MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
COAL SEAM BURN LINE
COAL SEAM SPLIT LINE (BARB POINT TOWARDS SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK
LEASE BOUNDARY
PERMIT BOUNDARY
TOPOGRAPHY IS ON EXHIBIT 11-4
RON C. VAN VALKENBURG NEW MEXICO 6063 LICENSED PROFESSIONAL ENGINEER
JUSTIN S. LYNCH NEW MEXICO 7521 LICENSED PROFESSIONAL ENGINEER
I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.
REV. NO. | DATE | REVISIONS | APPROVALS: DRAFT BY | ENGR. | CHIEF ENGR. | PROJECT MGR.
1 | 2-88 | WIDEN TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY | JG | RHB
2 | 3/90 | REMOVED PERMIT BOUNDARY LINE FROM L-128 NORTH | JG
3 | 3/93 | REFORMATTED ADDED BLK & BOUNDARY CHANGED LEASE NAME
EXHIBIT 17-14
Sheet 1 of 3
BHP-MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5661
AREA IV N
SEAM 2A
THICKNESS MAP
Scale: 1 IN.=500FT.
Date: 12/3/87
Exhibit #:
Contour interval: .5
Drawn by: ACE/JG


E-15A
P-1
L-114 C
P-2
N 2.0075E+6
N 2.005E+6
P-3
P-4
P-5
N 2.0025E+6
N 2.E+6
P-6
N 1.9975E+6
P-7
N 1.995E+6
LEASE BOUNDARY
SOUTH END OF PERMIT BOUNDARY
L-128
L-132
LEASE BOUNDARY
L-130
E 292000
E 292500
E 293000
E 297500
E 300000
E 302500
E 305000
E 307500
E 310000
200 250 0 500 1000 1500
SCALE IN FEET
III
IV N
SCALE: 1" 10,000' (APPROX.)
PORTIONS OF PERMIT BOUNDARY
EXPLANATION
4.0 COAL SEAM ISOPACH LINE
MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
COAL SEAM BURN LINE
COAL SEAM SPLIT LINE (BARB POINT TOWARDS SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK
LEASE BOUNDARY
PERMIT BOUNDARY
TOPOGRAPHY IS ON EXHIBIT 11-4
I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.
RON E. VAN VALKENBURG
NEW MEXICO
14263
REGISTERED PROFESSIONAL ENGINEER
9-10-93
REV. NO. | DATE | REVISIONS | DRAFT BY | ENGR. | CHIEF ENGR. | PROJECT MGR.
2 | 2-88 | WIDEN TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY AND ADD LETTER 'L' TO EXHIBIT NO. | JG | R.V.V.B.
3 | 3/93 | REVISING PERMIT BOUNDARY LINE FROM L-128 NORTH | JG
4 | 9/93 | REFORMATTED, ADDED BLK & O BOUNDARY, REVISED LEGEND
APPROVALS
EXHIBIT 17-14
BHP-MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861
AREA 4 NORTH
SEAM 2A
ISO-OVERBURDEN MAP
Scale: 1 IN.=500FT.
Date: 12/3/87
Exhibit #:
Contour interval: 10 FT.
Drawn by: ACE/JG

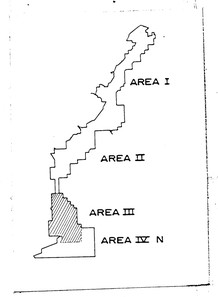
Sheet 3 of 3


E-15A
P-1
L-114c
P-2
N 2.0075E+6
5200
N 2.005E+6
P-3
P-4
P-5
N 2.0025E+6
N 2.E+6
P-6
N 1.9975E+6
P-7
LEASE BOUNDARY
SOUTH END OF PERMIT BOUNDARY
L-128
N 1.995E+6
L-132
LEASE BOUNDARY
L-130
E 290000
E 292500
E 295000
E 297500
E 300000
E 302500
E 305000
E 307500
E 310000
500 250 0 500 1000 1500
SCALE IN FEET
III
IV
N
SCALE 1" = 10,000 (approx.)
SOUTH END OF PERMIT BOUNDARY
EXPLANATION
4.0 COAL SEAM ISOPACH LINE
MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
COAL SEAM BURN LINE
COAL SEAM SPLIT LINE (BARB POINT TOWARDS SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK
LEASE BOUNDARY
PERMIT BOUNDARY
TOPOGRAPHY IS ON EXHIBIT 11-4
I, RON C. VAN VALKENBURG, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.
RON C. VAN VALKENBURG
NEW MEXICO
9368
PROFESSIONAL ENGINEER
12-22-87
REV. NO. | DATE | REVISIONS | APPROVALS: DRAFT BY | ENGR. | CHIEF ENGR. | PROJECT MGR.
1 | 2/88 | NOCK TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY | GG | RRB
2 | 3/90 | REVISED PERMIT BOUNDARY LINE FROM L-128 NORTH | JG
3 | 9/93 | REFORMAT TITLE, ADDED BLK & D BOUNDARY, CHANGED CO. NAME
JAMES H. S. LYNCH
NEW MEXICO
9509
EXHIBIT 17-14
BHP-MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861
AREA 4 NORTH
SEAM 2A
TOP OF SEAM STRUCTURE
Scale: 1 IN.=500FT.
Date: 12/3/87
Exhibit #:
Contour interval: 10 FT.
Drawn by: ACE/JG

Sheet 2 of 3



INDEX MAP

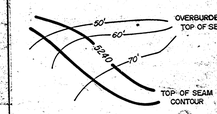


500 0 FEET 500 1000 1500

CONTOUR INTERVAL = 10 FEET
DAS JOB NO. 4619

LEGEND

- O — DRILL HOLE LOCATION
- ~5280~ — TOP OF COAL SEAM STRUCTURE CONTOURS (CONTOUR INTERVAL 10 FEET)
- ~50~ — OVERBURDEN - ISOPACH LINES (ISOPACH INTERVAL 10 FEET)
- MINIMUM MINEABLE COAL QUALITY LINE (6,000BTU)
- COAL SEAM BURN LINE
- COAL SEAM SPLIT LINE (BARBS POINT TOWARD SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
- COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK)
- COAL MINED OUT AS OF DECEMBER 16, 1977
- COAL LEASE BOUNDARY
- AREA 3 AND AREA 4 MINING BOUNDARY



I, Ron Van Valkenburgh, hereby certify that this map is an accurate drawing showing the previous and the current mining occupied as of the date of my knowledge.

N

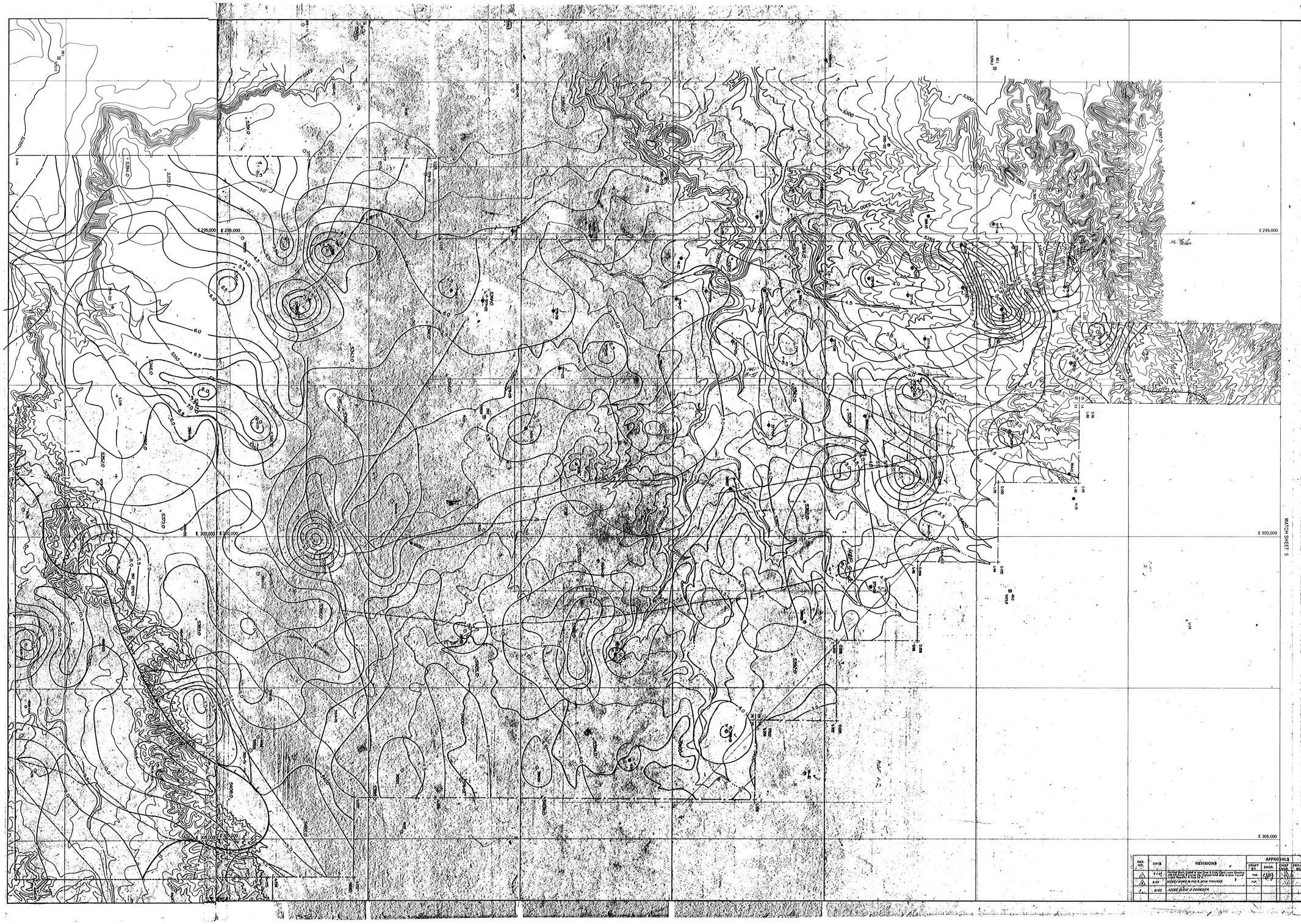
EXHIBIT 17-15
Sheet 1 of 2

BHP MINERALS INTERNATIONAL
BHP MINERALS
HILLTOP MINE
HILLTOP, NEW MEXICO

SEAM: 2b
TOP OF SEAM STRUCTURE AND "TSO-OVERBURDEN" MAP

NO.	DATE	REVISIONS	DRAFT BY	APPROVALS ENGR.	CHIEF	DATE
1	8-1-83	Revised Mined Out Area, Revised Overburden Contours, Revised Coal Lease Boundary	GBL	GBP		
2	3-1-83	Added Area 4 Mining Boundary				

DRAWN BY: L. DAN DATE: 4-1-1980 CHECKED:
APPROVED BY: DATE: DEC. 1980
DRAWING NO.: 1-2-2b-TOP-OVERBURDEN



REV. NO.	DATE	REVISIONS	DRAFT BY:	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	1/14	REVISED BASED ON NEW DATA & ISOPACH LINES ADDED				
2	6/23	ADDED SEAM 2b DRILL HOLES & SEAM THICKNESS				
3	5/22	ADDED AREA 3 & 4 BOUNDARIES				

APPROVALS

EXPLANATION

- DRILL HOLE LOCATION
- 8.0 — COAL SEAM ISOPACH LINE (ISOPACH INTERVAL = 0.5 FEET).
- MINIMUM MINABLE COAL QUALITY LINE (6,000 BTU).
- COAL SEAM BURN LINE.
- COAL SEAM SPLIT LINE (BARBS POINT TOWARD SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK).
- COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK).
- COAL MINED OUT AS OF DECEMBER 16, 1977.
- COAL LEASE BOUNDARY
- AREA 3 AND AREA 4 MINING BOUNDARY.

N

0 FEET 500 1000 1500

CONTOUR INTERVAL = 10 FEET
DAS JOB NO. 4619

I, Ron Van Valkenburg, hereby certify that this map was drawn since the previous certification and accurate to the best of my knowledge.

RON VAN VALKENBURG
NEW MEXICO
PROFESSIONAL SURVEYOR
9367

INDEX MAP

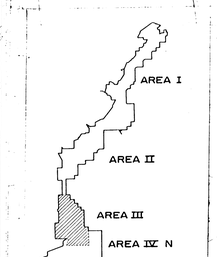


EXHIBIT 17-15 Sheet 2 of 2

BHP MINERALS INTERNATIONAL
NAVAJO MINE
BURNHAM, NEW MEXICO

AREA 3

SEAM 2b THICKNESS MAP

SAN JUAN COUNTY, NEW MEXICO

DRAWN	SCALE 1" = 200'	EXHIBIT	
	DATE Dec 1984		
	LOCATION NO.		

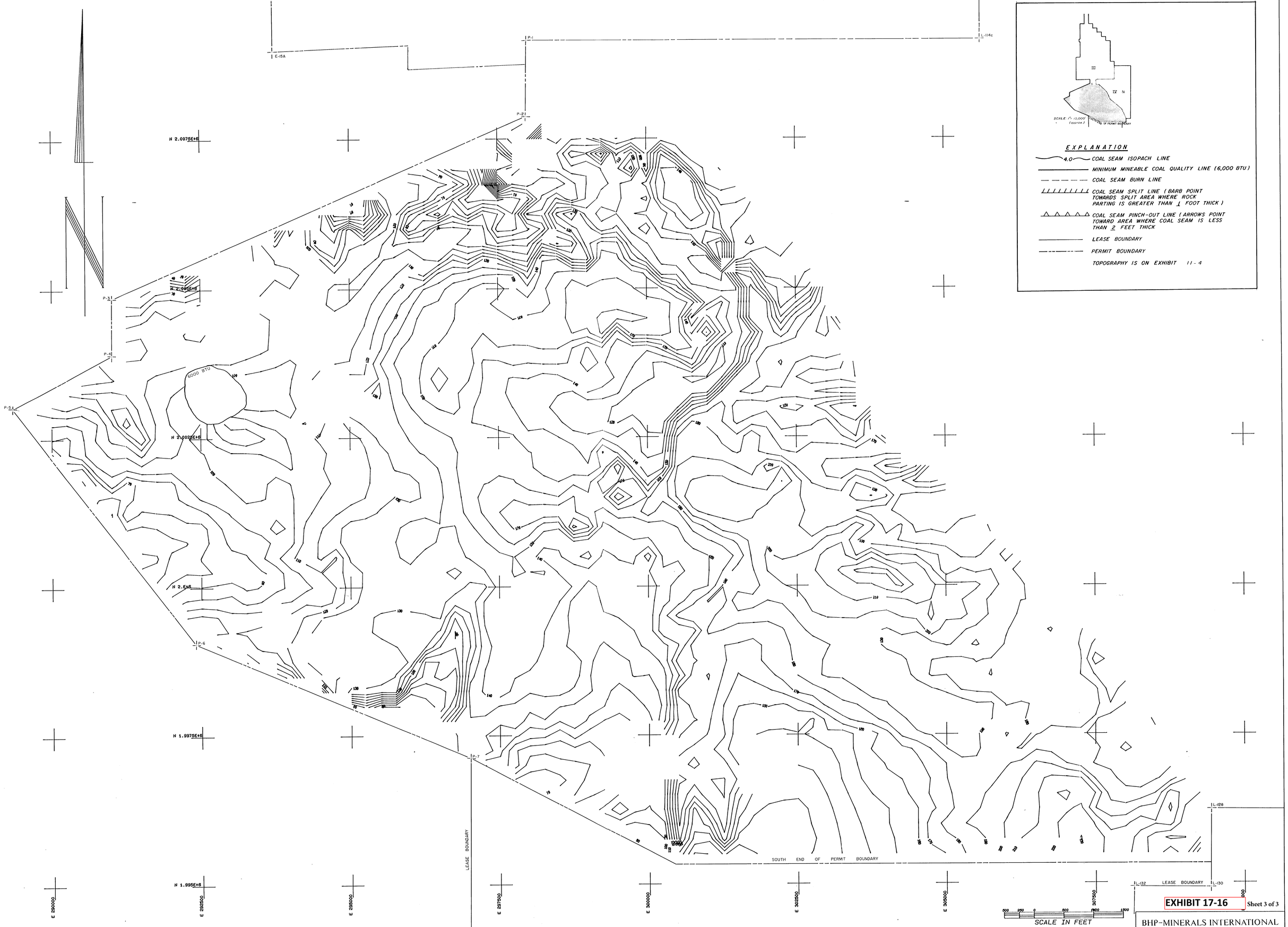


EXHIBIT 17-16 Sheet 3 of 3

I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.

REV. NO.	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR	CHIEF ENGR	PROJECT MGR
1	2/88	WIDER TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY	CB	RRB		
2	3/90	REVISED PERMIT BOUNDARY LINE FROM L-128 NORTH	JB			
3	3/93	REFORMATTED, ADDED NEW P.B. BOUNDARY, CHANGED LEASE NAME				

BHP-MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5661

AREA 4 NORTH
SEAM 2B
ISO-OVERBURDEN MAP

Scale: 1 IN.=500FT.	Date: 12/3/87	Exhibit #:
Contour interval: 10 FT.	Drawn by: ACE/JB	

Sheet 1 of 3

EXHIBIT 17-16

I, Ron Van Valkenburg, hereby certify, changes on this drawing since the previous certification are accurate to the best of my knowledge.

REV NO.	DATE	REVISIONS	APPROVALS: DRAFT BY:	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	2-88	WIDEN TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY	JG	RWB		
2	3/90	REVISED PERMIT BOUNDARY LINE FROM LEASE NORTH.	JG			
3	9/93	INFORMATION ADDED BLK 3 BOUNDARY, CHANGED CB NAME				

BHP-MINERALS INTERNATIONAL

NAVAJO MINE

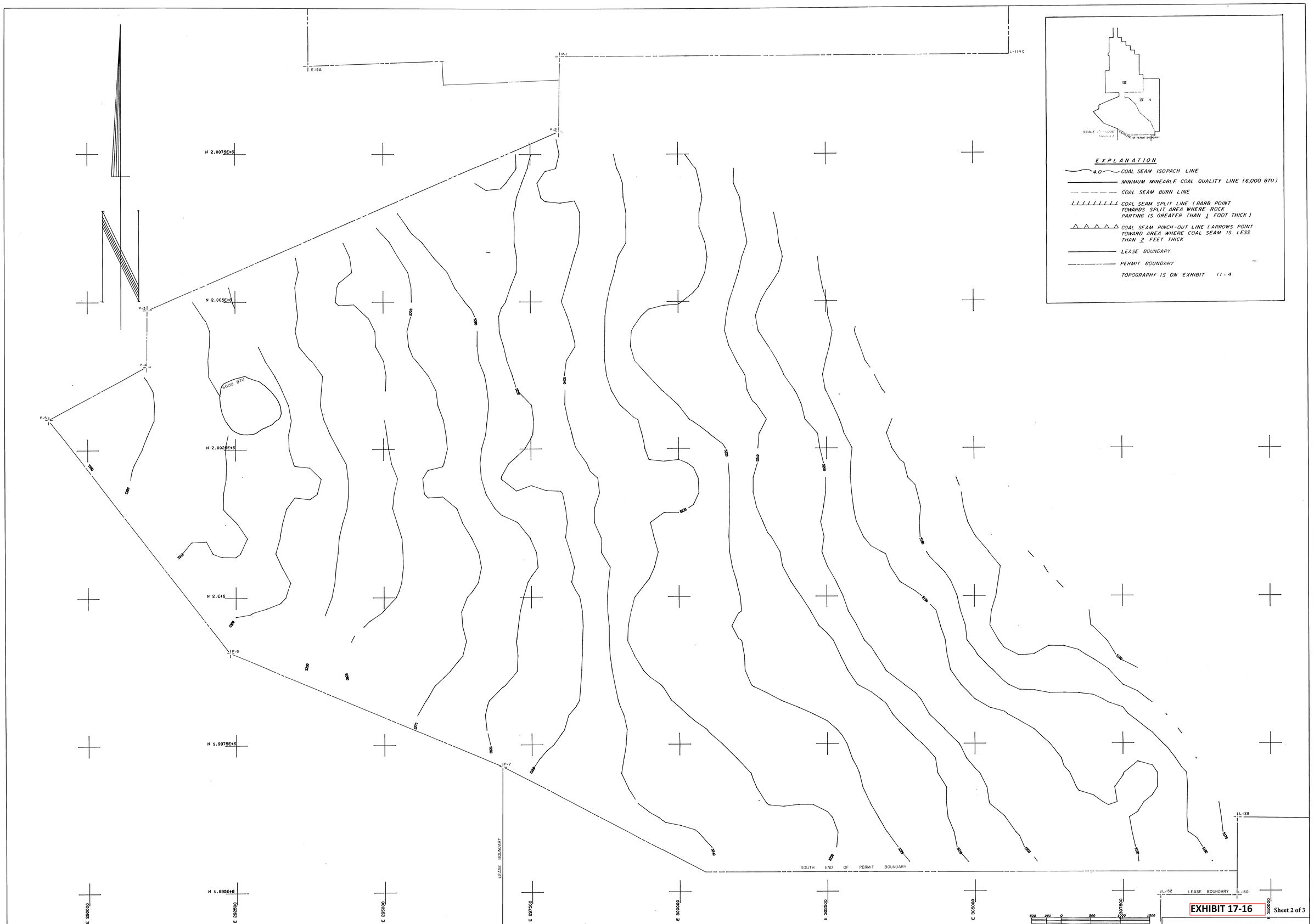
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861

AREA 4 NORTH

SEAM 2B

THICKNESS MAP

Scale: 1 IN.=500FT.	Date: 12/3/87	Exhibit #:
Contour Interval: 0.5 FT.	Drawn by: ACE/JG	



I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.

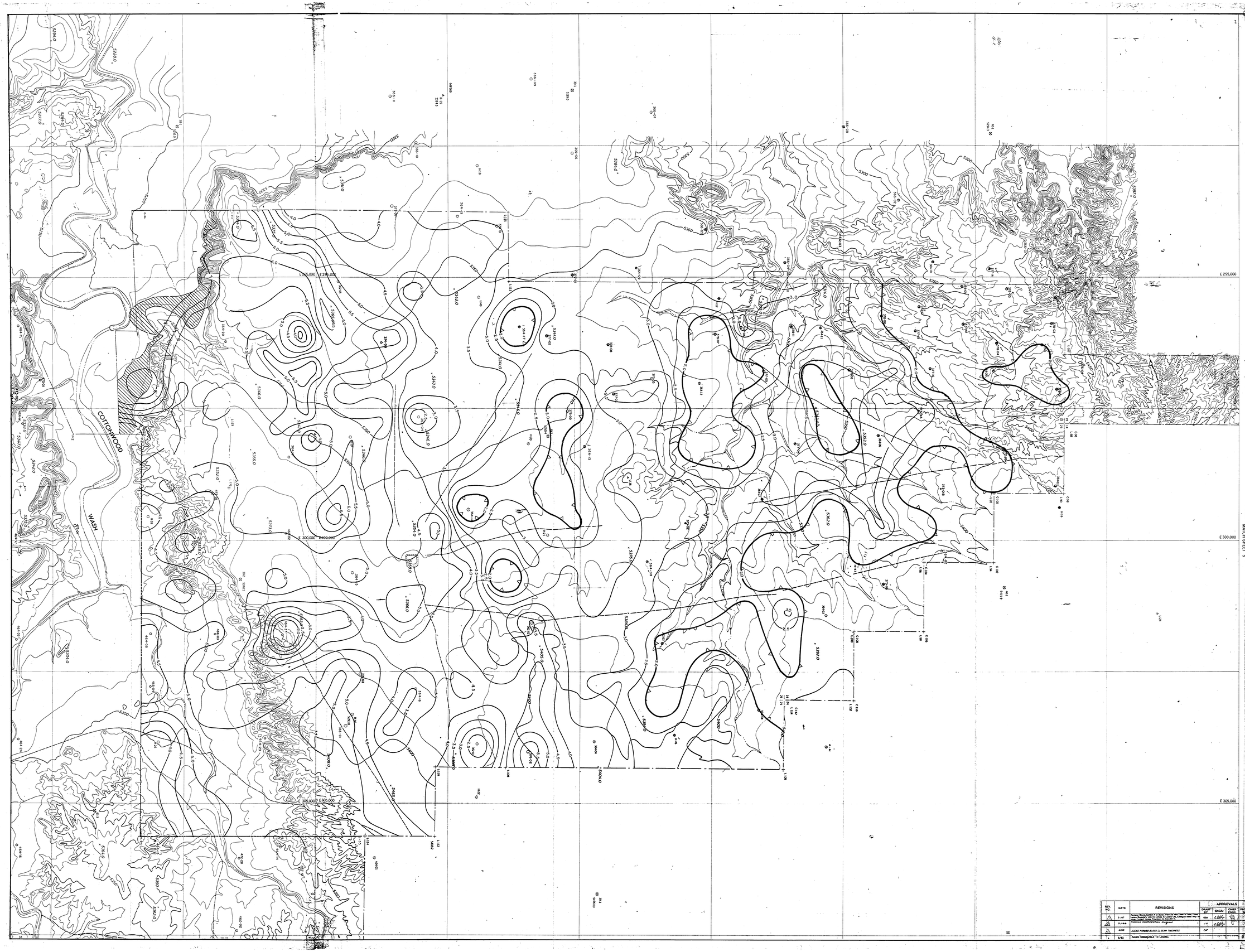
REV. NO.	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR	CHIEF ENGR.	PROJECT MGR.
1	2-88	MOEN TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY	JG	RHB		
2	3/93	REMOVED PERMIT BOUNDARY LINE FROM L-128 NORTH	JG			
3	9/93	REFORMATTED, ADDED BLK 3 BOUNDARY, CHANGED LG NAME				

EXHIBIT 17-16 Sheet 2 of 3

BHP-MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861

AREA 4 NORTH
SEAM 2B
TOP OF SEAM STRUCTURE

Scale: 1 IN.=500FT. | Date: 12/3/87 | Exhibit #:
Contour Interval: 10 FT. | Drawn by: ACE/JG



N

500 0 FEET 500 1000 1500

CONTOUR INTERVAL = 10 FEET

EXPLANATION

- 0 — DRILL HOLE LOCATION
- —8.0— COAL SEAM ISOPACH LINE (ISOPACH INTERVAL : 0.5 FEET)
- MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
- COAL SEAM BURN LINE
- COAL SEAM SPLIT LINE (BARBS POINT TOWARD SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
- COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK)
- COAL MINED OUT AS OF DECEMBER 16, 1977.
- COAL LEASE BOUNDARY
- AREA 3 AND AREA 4 MINING BOUNDARY.
- UNMINEABLE COAL

RON C. VAN VALKENBURG NEW MEXICO 8894 PROFESSIONAL ENGINEER

I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.

9-20-85

INDEX MAP

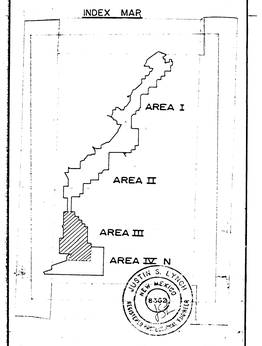


EXHIBIT 17-17 Sheet 2 of 2

BHP MINERALS INTERNATIONAL

NAVAJO MINE

FRUITLAND, NEW MEXICO

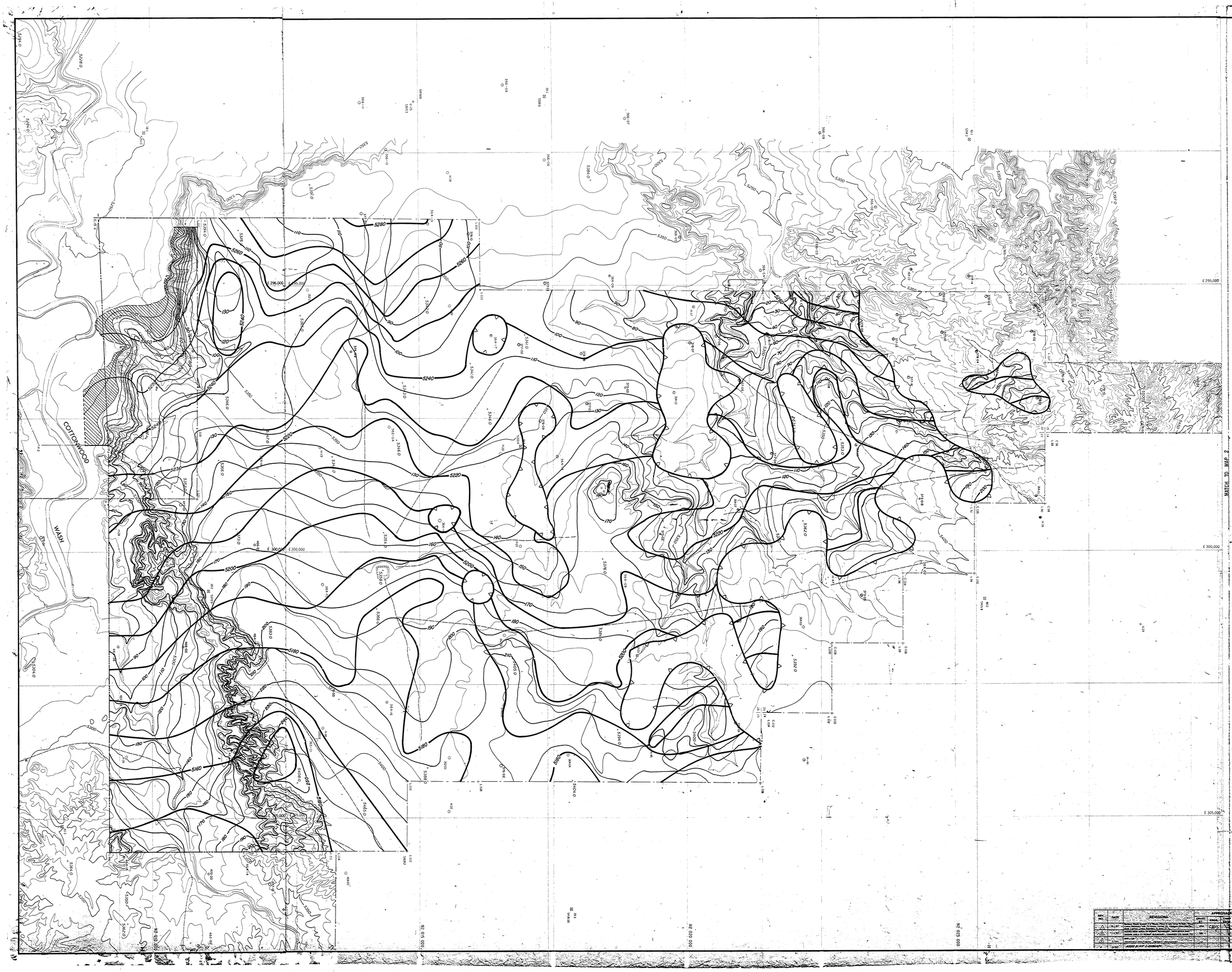
SEAM 3

THICKNESS MAP

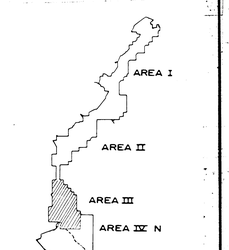
REV. NO.	DATE	REVISIONS	DRAWN BY	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	5-187	Revised Mining Limit F & Mine Limit A on the Lease & Limit Lease Changed to Add Mine Area & Limit Ac. Changed Index Map No. Added Coal Burn Area & Coal Burn Line	GBA	GBA		
2	9-1-88	Removed Unmineable Area	" "	GBA		
3	4-90	ADDED FORMER BLOCK G SEAM THICKNESS	RJF			
4	5/93	ADDED UNMINEABLE TO LEGEND				

APPROVALS

DRAWN BY	L. DAN	SCALE	1" = 1000'	EXHIBIT
APPROVED BY		DATE	DEC. 1984	
		LOCATION NO.		



INDEX MAP



500 0 FEET 500 1000 1500

CONTOUR INTERVAL - 10 FEET

LEGEND

- O DRILL HOLE LOCATION
- ~5280~ TOP OF COAL SEAM STRUCTURE CONTOURS (CONTOUR INTERVAL 10 FEET)
- ~ 50 ~ OVERBURDEN ISOPACH LINES (ISOPACH INTERVAL 10 FEET)
- MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
- COAL SEAM BURN LINE
- COAL SEAM SPLIT LINE (BARBS POINT TOWARD SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
- COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK)
- COAL MINED OUT AS OF DECEMBER 16, 1977.
- COAL LEASE BOUNDARY
- AREA 3 AND AREA 4 MINING BOUNDARY.
- 50' 60' 5240 70' — OVERBURDEN TO TOP OF SEAM; TOP OF SEAM CONTOUR

I HEREBY CERTIFY THAT THIS MAP IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

EXHIBIT 17-17 Sheet 1 of 2

BHP MINERALS INTERNATIONAL

KIRTLAND, NEW MEXICO

SEAM 3

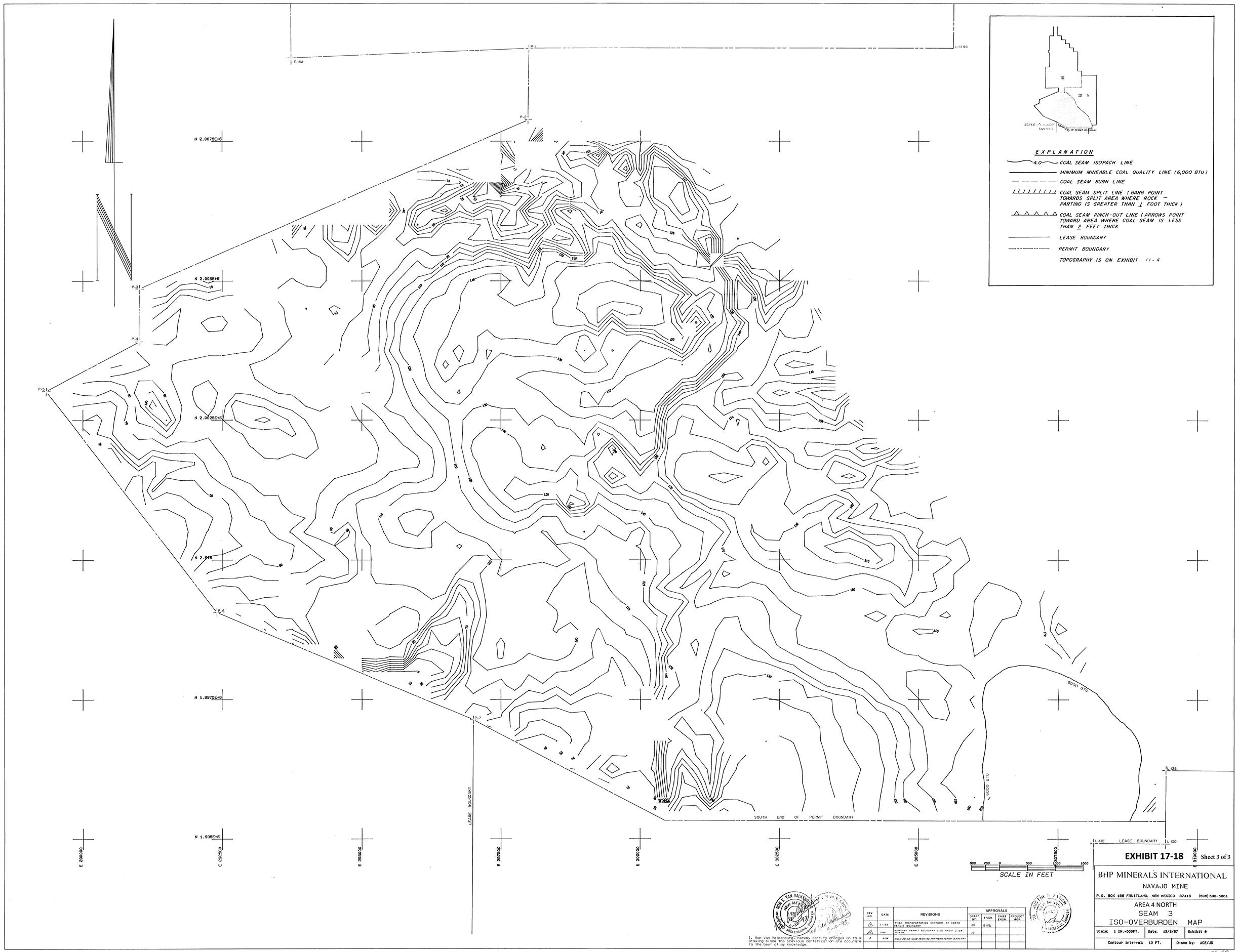
TOP OF SEAM STRUCTURE AND ISO-OVERBURDEN MAP

REV. NO.	DATE	REVISIONS	DRAWN BY	CHKD.	APPROVAL	
1	12-15-77	[illegible]	[illegible]	[illegible]	[illegible]	
2	11-1-78	[illegible]	[illegible]	[illegible]	[illegible]	
3	11-1-79	[illegible]	[illegible]	[illegible]	[illegible]	
4	12-1-80	[illegible]	[illegible]	[illegible]	[illegible]	
5	12-1-81	[illegible]	[illegible]	[illegible]	[illegible]	

DRAWN BY: L. DAN — SCALE: 1" = 500' — EXHIBIT:

APPROVED BY: — DATE: Dec 1986

DRAWING NO. — LOCATION NO.


E-15A
P-1
L-114C
P-2
P-3
P-4
P-5
P-6
P-7
N 2.0075E+6
N 2.005E+6
N 2.0025E+6
N 2.000E+6
N 1.9975E+6
N 1.995E+6
E 290000
E 292500
E 295000
E 297500
E 300000
E 302500
E 305000
E 307500
E 310000
LEASE BOUNDARY
SOUTH END OF PERMIT BOUNDARY
6000 BTU
L-128
L-132
L-130
SCALE IN FEET
III
IV
N
EXPLANATION
4.0 COAL SEAM ISOPACH LINE
MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
COAL SEAM BURN LINE
COAL SEAM SPLIT LINE (BARB POINT TOWARDS SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK
LEASE BOUNDARY
PERMIT BOUNDARY
TOPOGRAPHY IS ON EXHIBIT 11-4
RON E. VAN VALKENBURG
NEW MEXICO
9206
PROFESSIONAL SURVEYOR
I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.
REV NO. | DATE | REVISIONS | APPROVALS: DRAFT BY | ENGR | CHIEF ENGR | PROJECT MGR
1 | 2-88 | MOEN TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY | JG | RVG
2 | 5/90 | REMOVED PERMIT BOUNDARY LINE FROM LEASE BOUNDARY | JG
3 | 3/93 | CHANGED LEASE BOUNDARY REVISED NORTHERN PERMIT BOUNDARY
EXHIBIT 17-18
Sheet 3 of 3
BHP MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861
AREA 4 NORTH
SEAM 3
ISO-OVERBURDEN MAP
Scale: 1 IN.=500FT.
Date: 12/3/87
Exhibit #:
Contour Interval: 10 FT.
Drawn by: ACE/JG

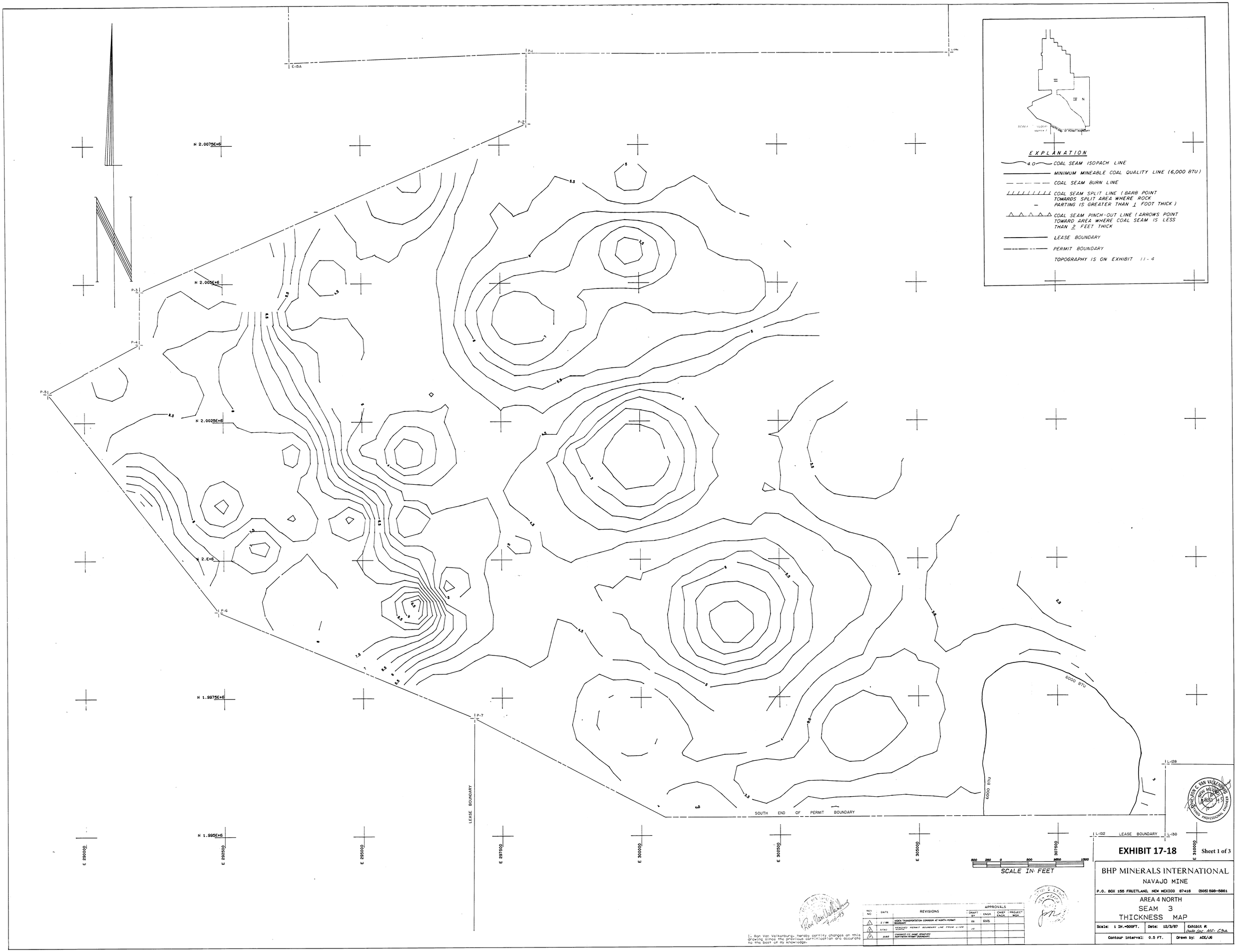


EXHIBIT 17-18

Sheet 1 of 3

BHP MINERALS INTERNATIONAL

NAVAJO MINE

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861

AREA 4 NORTH

SEAM 3

THICKNESS MAP

Scale: 1 IN.=500FT.	Date: 12/3/87	Exhibit #: Code for Mr. Cha
Contour Interval: 0.5 FT.		Drawn by: ACE/JG

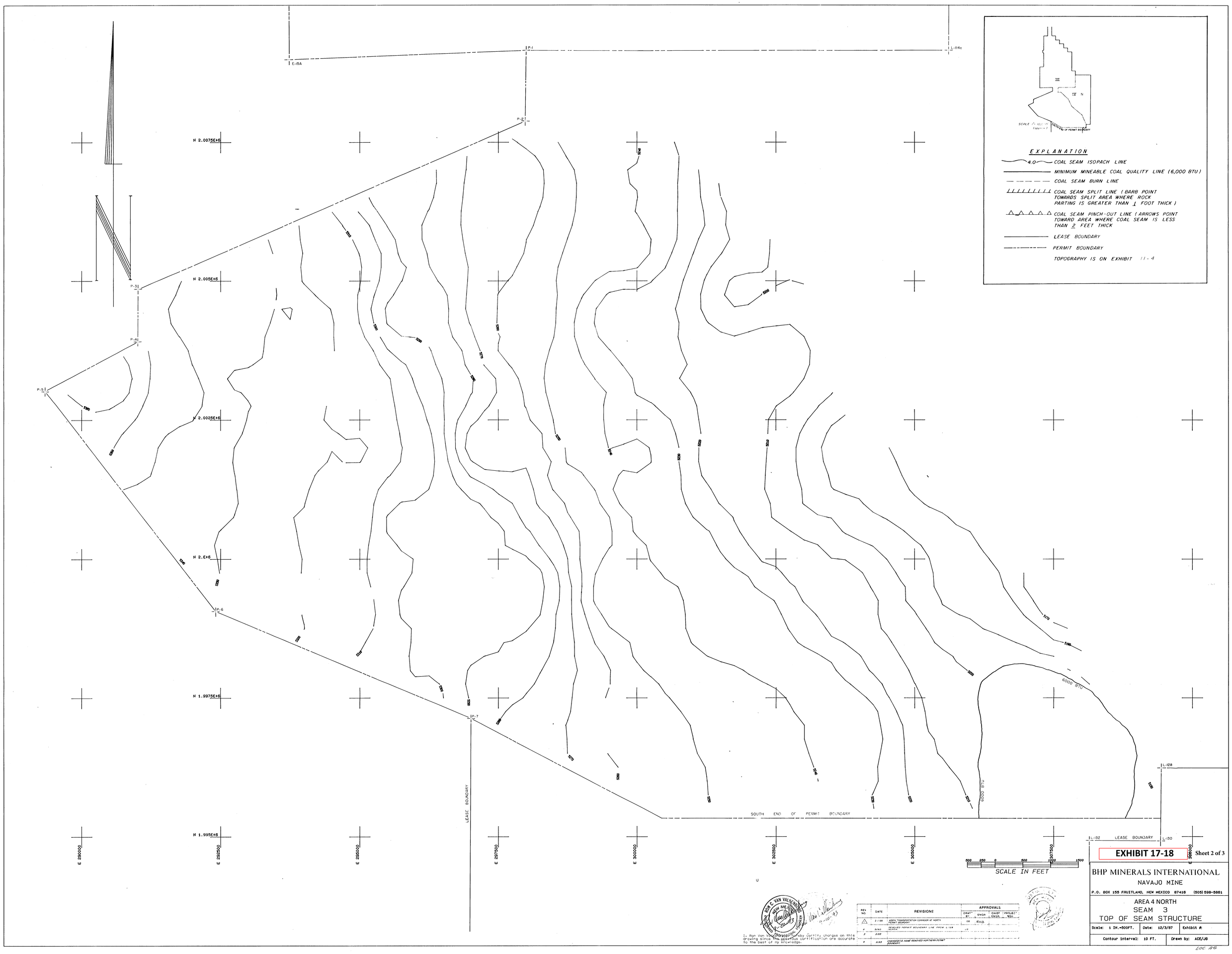
REV NO	DATE	REVISIONS	DRAFT BY	ENGR	CHIEF ENGR	PROJECT MGR
1	2/88	HOGEN TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY	GG	RHB		
2	3/90	REVISED PERMIT BOUNDARY LINE FROM L-128 NORTH	JG			
3	9/93	CHANGED CO. NAME, REVISED NORTHERN PERMIT BOUNDARY				

I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.

Ron Van Valkenburg 9-10-93

APPROVALS

JOHN C. VAN VALKENBURG NEW MEXICO 8257 REGISTERED PROFESSIONAL ENGINEER


E-15A
P-1
L-114c
P-2
P-3
P-4
P-5
P-6
P-7
N 2.0075E+6
N 2.005E+6
N 2.0025E+6
N 2.E+6
N 1.9975E+6
N 1.995E+6
E 290000
E 292500
E 295000
E 297500
E 300000
E 302500
E 305000
E 307500
E 310000
LEASE BOUNDARY
SOUTH END OF PERMIT BOUNDARY
6000 BTU
L-128
L-132
L-130
SCALE IN FEET
500 250 0 500 1000 1500
III
IV
N
SCALE 1" = 10,000'
(approx.)
SOUTH END OF PERMIT BOUNDARY
EXPLANATION
4.0 COAL SEAM ISOPACH LINE
MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
COAL SEAM BURN LINE
COAL SEAM SPLIT LINE (BARB POINT TOWARDS SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK
LEASE BOUNDARY
PERMIT BOUNDARY
TOPOGRAPHY IS ON EXHIBIT 11-4
I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.
RON C. VAN VALKENBURG
NEW MEXICO
PROFESSIONAL ENGINEER
9-10-93
REV NO. | DATE | REVISIONS | APPROVALS: DRAFT BY | ENGR | CHIEF ENGR | PROJECT MGR.
2/88 | ADDED "TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY" | DG | RHB
2 | 5/90 | REVISED PERMIT BOUNDARY LINE FROM L-128 TO P-6 | JG
3 | 3/93
4 | 3/93 | CHANGED L-5 NAME REMOVED NORTHERN PERMIT BOUNDARY
EXHIBIT 17-18
Sheet 2 of 3
BHP MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5881
AREA 4 NORTH
SEAM 3
TOP OF SEAM STRUCTURE
Scale: 1 IN.=500FT.
Date: 12/3/87
Exhibit #:
Contour Interval: 10 FT.
Drawn by: ACE/JG
LOC 16

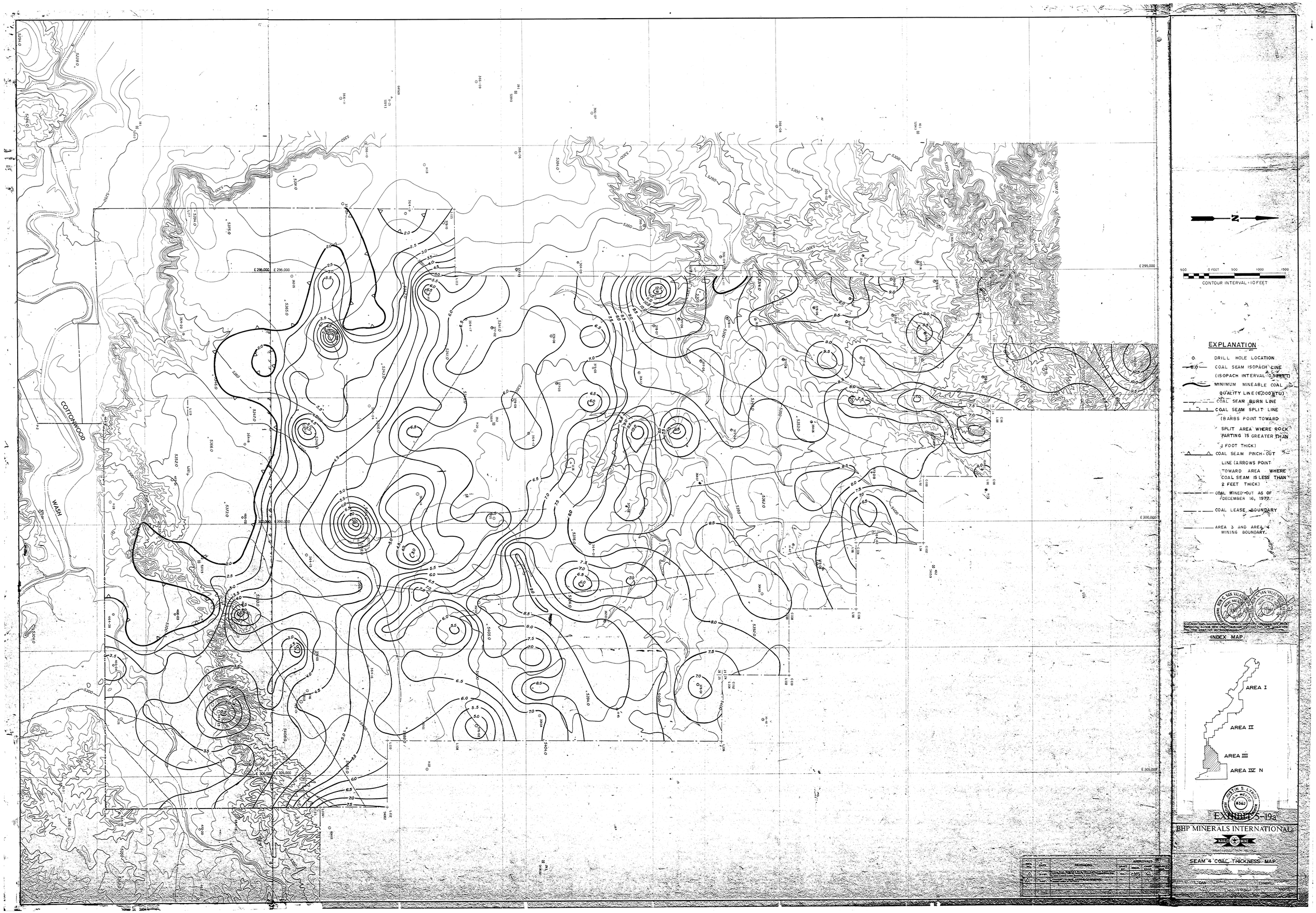
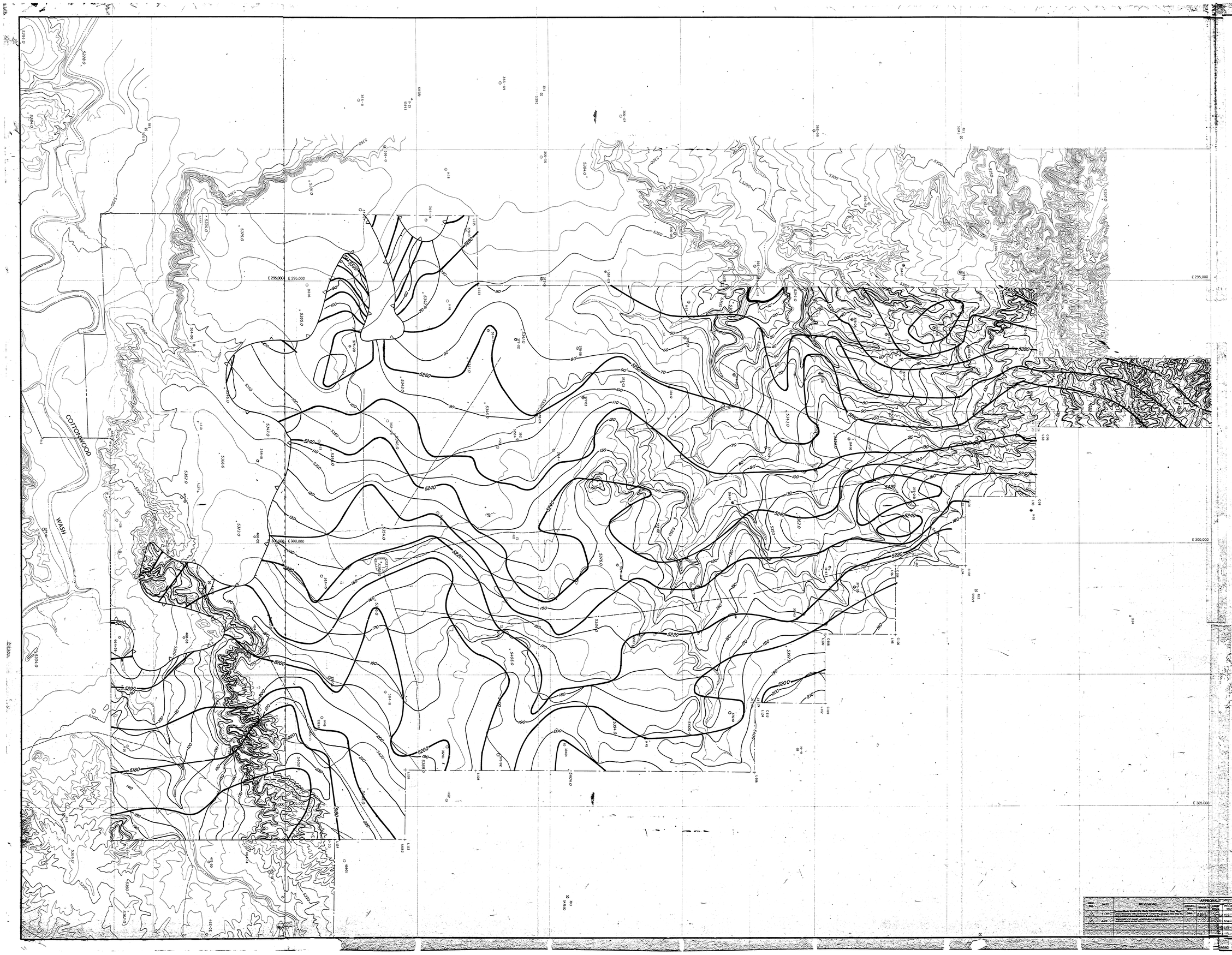


EXHIBIT 17-19 Sheet 2 of 2


COTTONWOOD
WASH
E 295,000
E 300,000
E 305,000
5280
5240
5200
5180
INDEX MAP
AREA I
AREA II
AREA III
AREA IV N
0 FEET
500
1000
1500
CONTOUR INTERVAL = 10 FEET
LEGEND
DRILL HOLE LOCATION
TOP OF COAL SEAM STRUCTURE CONTOURS (CONTOUR INTERVAL 10 FEET)
OVERBURDEN ISOPACH LINES (ISOPACH INTERVAL 10 FEET)
MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
COAL SEAM BURN LINE
COAL SEAM SPLIT LINE (BARBS POINT TOWARD SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK)
COAL MINED OUT AS OF DECEMBER 16, 1977
COAL LEASE BOUNDARY
AREA 3 AND AREA 4 MINING BOUNDARY
OVERBURDEN TO TOP OF SEAM
TOP OF SEAM CONTOUR
N
EXHIBIT 17-19 Sheet 1 of 2
BHP MINERALS INTERNATIONAL
NAVAJO MINE
FRUITLAND, NEW MEXICO
SEAM 4
AREA III
TOP OF SEAM STRUCTURE
AND ISO-OVERBURDEN MAP
REVISIONS
APPROVALS

I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.

Ron Van Valkenburg 9-10-93

REV NO	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	2/88	MOEX TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY	DB	KHB		
2	9/90	REVISED PERMIT BOUNDARY LINE FROM L-128 NORTH	"	"		
3	9/93	CHANGED CO. NAME REVISED NORTHERN PERMIT BOUNDARY				

EXHIBIT 17-20

Sheet 3 of 3

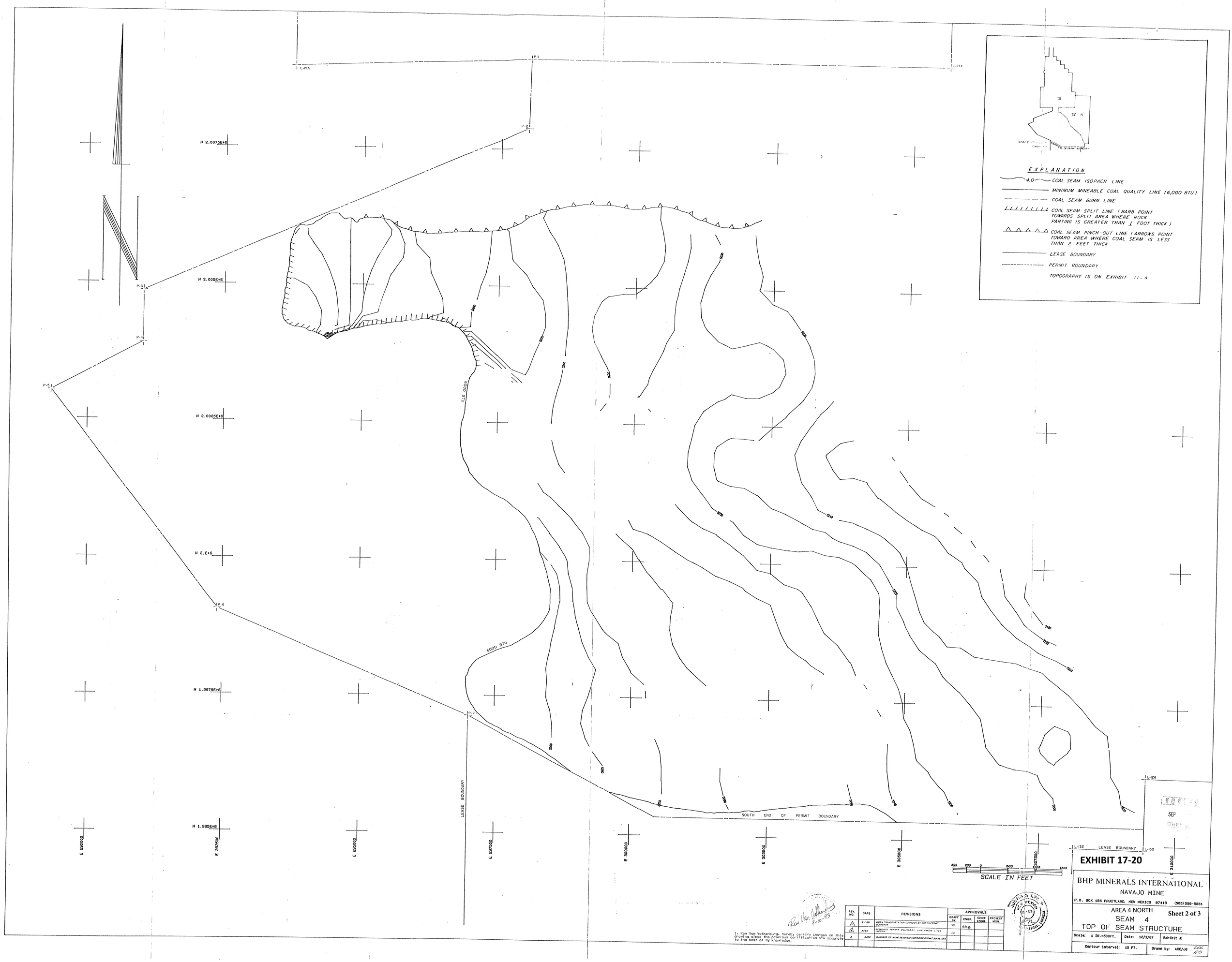
BHP MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861

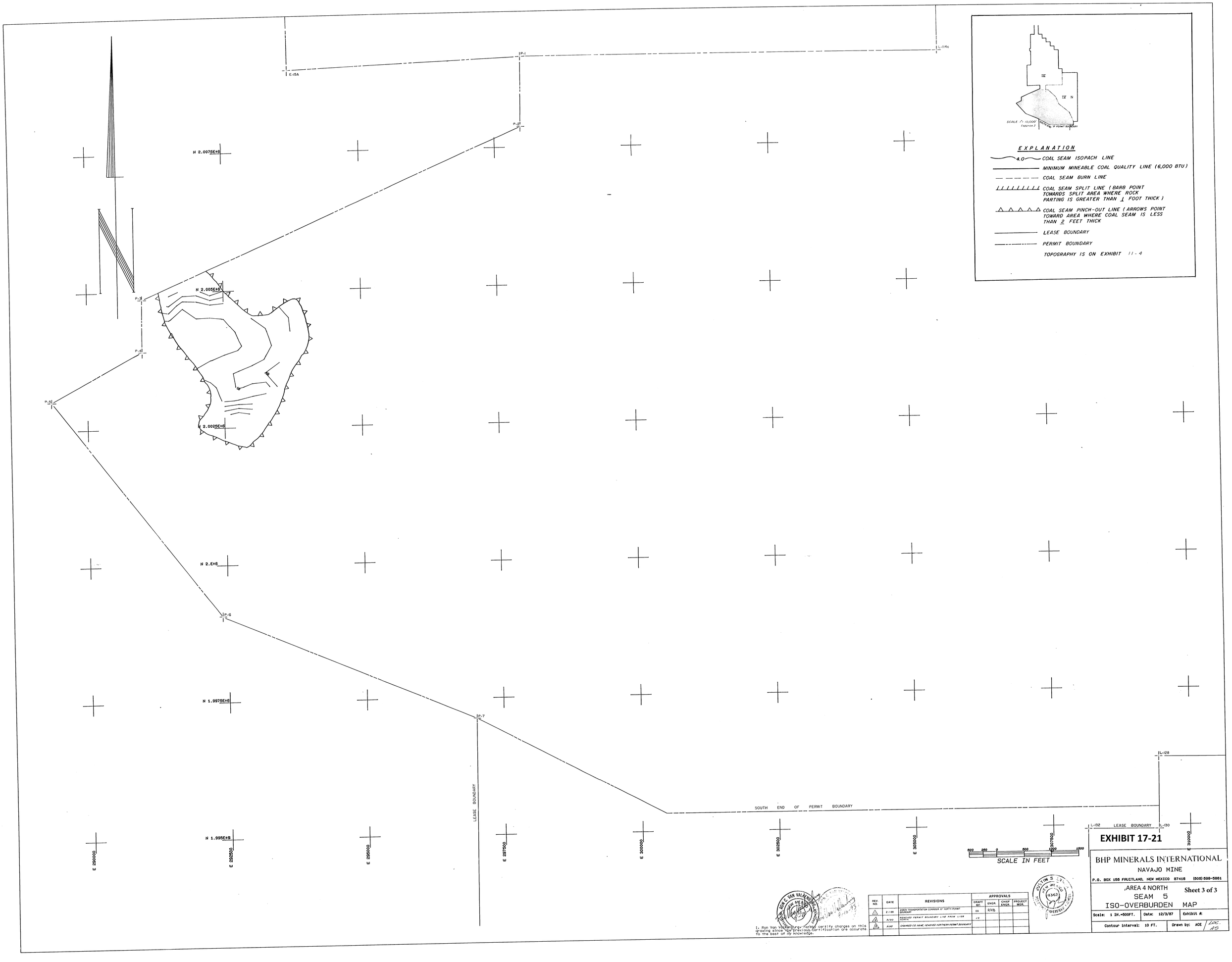
AREA 4 NORTH
SEAM 4
ISO-OVERBURDEN MAP

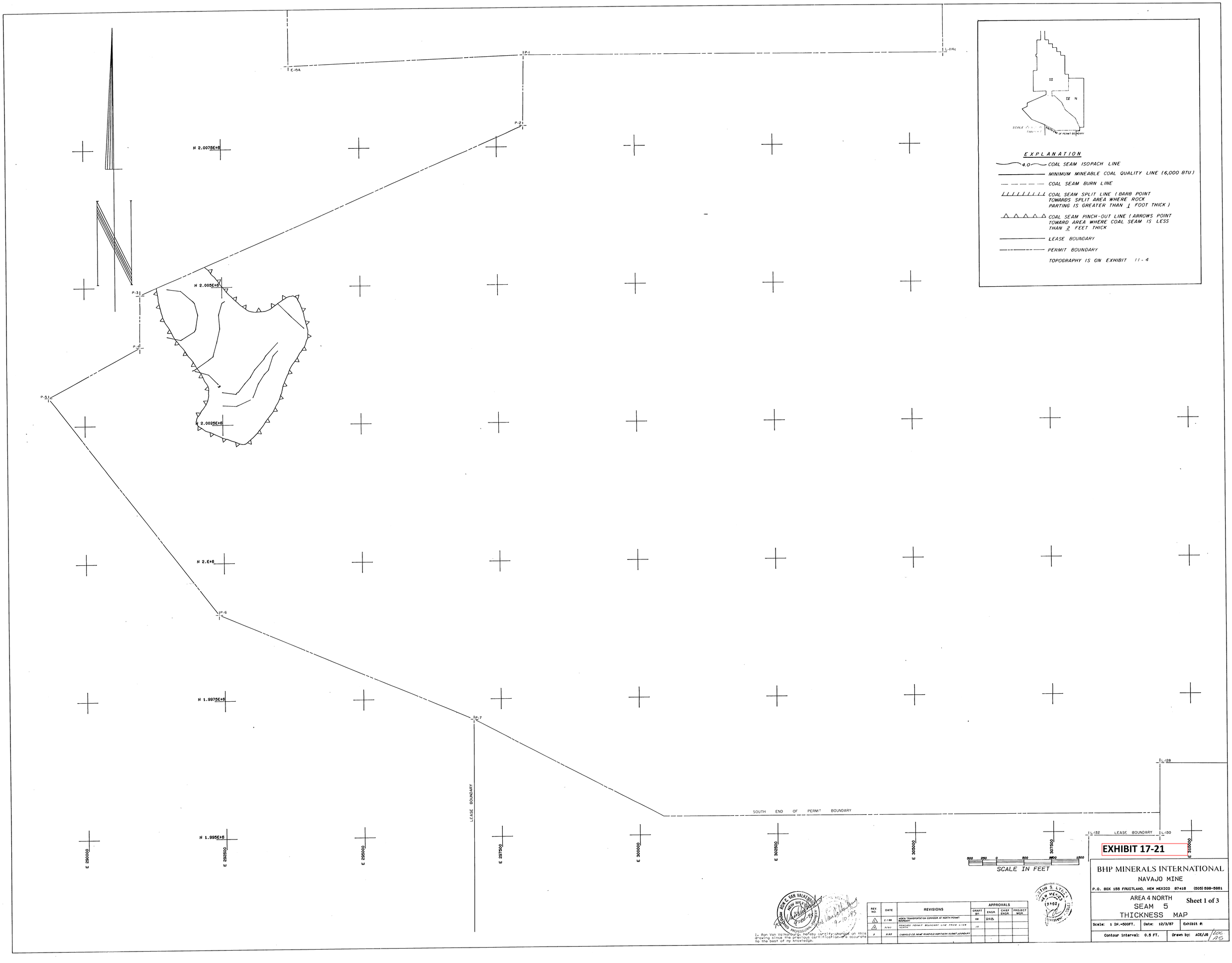
Scale: 1 IN.=500FT. | Date: 12/3/87 | Exhibit #: Exist. Doc. NF-C2a

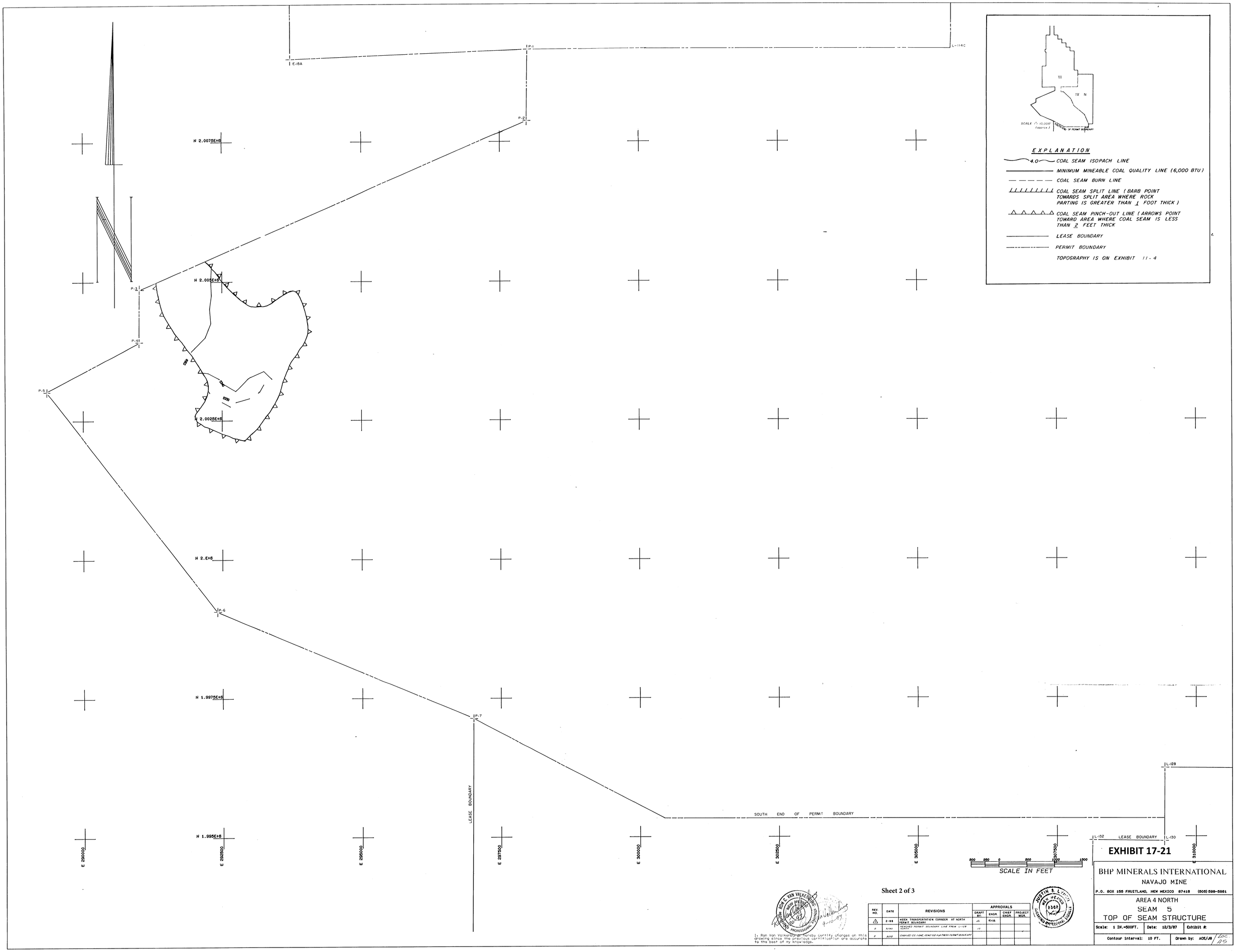
Contour Interval: 10 FT. | Drawn by: ACE/JG

EXPLANATION
4.0 COAL SEAM ISOPACH LINE
MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
COAL SEAM BURN LINE
COAL SEAM SPLIT LINE (BARB POINT TOWARDS SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK
LEASE BOUNDARY
PERMIT BOUNDARY
TOPOGRAPHY IS ON EXHIBIT 11-4
III
IV
N
SCALE 1" = 10,000'
NORTH END OF PERMIT BOUNDARY
E-15A
P-1
L-114 C
P-2
P-3
P-4
P-5
P-6
P-7
N 2.0075E+6
N 2.005E+6
N 2.0025E+6
N 2.E+6
N 1.9975E+6
N 1.995E+6
E 290000
E 292500
E 295000
E 297500
E 300000
E 302500
E 305000
E 307500
E 310000
6000 BTU
BURNT
LEASE BOUNDARY
SOUTH END OF PERMIT BOUNDARY
L-128
L-132
L-130
2.5
3
3.5
4
4.5
SCALE IN FEET
500 250 0 500 1000 1500
EXHIBIT 17-20
Sheet 1 of 3
BHP MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861
AREA 4 NORTH
SEAM 4
THICKNESS MAP
Scale: 1 IN.=500FT.
Date: 12/3/87
Exhibit #:
Contour Interval: 0.5
Drawn by: ACE/JB
RON C. VAN VALKENBURG NEW MEXICO PROFESSIONAL ENGINEER
I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.
REV NO | DATE | REVISIONS | APPROVALS: DRAFT BY | ENGR | CHIEF ENGR | PROJECT MGR.
2 | 2-88 | WIDEN TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY | JB | RHB
1 | 3/90 | REVISED PERMIT BOUNDARY LINE FROM L-128 NORTH. | JB
0 | 3/83 | CHANGED C.B. NAME FROM P.O. NORTH TO PERMIT BOUNDARY.
NEW MEXICO PROFESSIONAL ENGINEER
ACE


E-15A
P-1
L-114c
P-2
N 2.0075E+6
N 2.005E+6
P-3
P-4
P-5
N 2.0025E+6
N 2.E+6
P-6
N 1.9975E+6
P-7
N 1.995E+6
6000 BTU
LEASE BOUNDARY
SOUTH END OF PERMIT BOUNDARY
L-128
L-132
LEASE BOUNDARY
L-130
E 290000
E 292500
E 295000
E 297500
E 300000
E 302500
E 305000
E 307500
E 310000
5200
5210
5190
5180
5170
5160
5150
5140
5130
5120
5110
5100
5090
5080
5070
500 250 0 500 1000 1500
SCALE IN FEET
III
IV
N
SCALE IN FEET
EXPLANATION
4.0 COAL SEAM ISOPACH LINE
MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
COAL SEAM BURN LINE
COAL SEAM SPLIT LINE (BARB POINT TOWARDS SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK
LEASE BOUNDARY
PERMIT BOUNDARY
TOPOGRAPHY IS ON EXHIBIT 11-4
I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.
Ron Van Valkenburg 2-10-93
REV. NO. | DATE | REVISIONS | APPROVALS: DRAFT BY | ENGR. | CHIEF ENGR. | PROJECT MGR.
2 | 2/88 | MOKEN TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY | GO | RHB
1 | 11/90 | REMOVED PERMIT BOUNDARY LINE FROM L-128 NORTH | JG
0 | 2/93 | CHANGED CO. NOW REVISED NORTHERN PERMIT BOUNDARY
NAVAJO LAND SURVEYOR NO. 5152 STATE OF NEW MEXICO PROFESSIONAL ENGINEER
EXHIBIT 17-20
BHP MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5881
AREA 4 NORTH
Sheet 2 of 3
SEAM 4
TOP OF SEAM STRUCTURE
Scale: 1 IN.=500FT.
Date: 12/3/87
Exhibit #
Contour Interval: 10 FT.
Drawn by: ACE/JG


E-15A
P-1
L-114c
P-2
N 2.0075E+6
N 2.005E+6
P-3
P-4
P-5
N 2.0025E+6
N 2.E+6
P-6
N 1.9975E+6
P-7
N 1.995E+6
LEASE BOUNDARY
SOUTH END OF PERMIT BOUNDARY
L-128
L-132 LEASE BOUNDARY L-130
E 290000
E 292500
E 295000
E 297500
E 300000
E 302500
E 305000
E 307500
E 310000
500 250 0 500 1000 1500
SCALE IN FEET
III
IV N
SCALE 1" = 10,000' (approx.)
SOUTH END OF PERMIT BOUNDARY
EXPLANATION
4.0 COAL SEAM ISOPACH LINE
MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
COAL SEAM BURN LINE
COAL SEAM SPLIT LINE (BARB POINT TOWARDS SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK
LEASE BOUNDARY
PERMIT BOUNDARY
TOPOGRAPHY IS ON EXHIBIT 11-4
I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.
RON C. VAN VALKENBURG NEW MEXICO 9362 REGISTERED PROFESSIONAL ENGINEER
JUSTIN S. STYLES NEW MEXICO 9362 REGISTERED PROFESSIONAL ENGINEER
REV. NO. | DATE | REVISIONS | APPROVALS: DRAFT REV. | ENGR | CHIEF ENGR. | PROJECT MGR.
1 | 2/88 | HOGEN TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY | CG | RHB
2 | 8/90 | REMOVED PERMIT BOUNDARY LINE FROM LEASE NORTH | JB
3 | 9/93 | CHANGED CO. NAME, REVISED NORTHERN PERMIT BOUNDARY
EXHIBIT 17-21
BHP MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861
AREA 4 NORTH
SEAM 5
ISO-OVERBURDEN MAP
Sheet 3 of 3
Scale: 1 IN.=500FT.
Date: 12/3/87
Exhibit #:
Contour interval: 10 FT.
Drawn by: ACE
LDC. 15


E-15A
P-1
L-114c
P-2
N 2.0075E+6
N 2.005E+6
P-3
P-4
P-5
N 2.0025E+6
N 2.E+6
P-6
N 1.9975E+6
P-7
N 1.995E+6
LEASE BOUNDARY
SOUTH END OF PERMIT BOUNDARY
L-128
L-132
LEASE BOUNDARY
L-130
E 290000
E 292500
E 295000
E 297500
E 300000
E 302500
E 305000
E 307500
E 310000
500 250 0 500 1000 1500
SCALE IN FEET
III
IV
N
SCALE
SOUTH END OF PERMIT BOUNDARY
EXPLANATION
4.0 COAL SEAM ISOPACH LINE
MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
COAL SEAM BURN LINE
COAL SEAM SPLIT LINE (BARB POINT TOWARDS SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK
LEASE BOUNDARY
PERMIT BOUNDARY
TOPOGRAPHY IS ON EXHIBIT 11-4
EXHIBIT 17-21
BHP MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5851
AREA 4 NORTH
SEAM 5
THICKNESS MAP
Sheet 1 of 3
Scale: 1 IN.=500FT.
Date: 12/3/87
Exhibit #:
Contour interval: 0.5 FT.
Drawn by: ACE/JB
I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.
RON E. VAN VALKENBURG
NEW MEXICO
REGISTERED PROFESSIONAL ENGINEER
JIM S. LYONS
NEW MEXICO
REGISTERED PROFESSIONAL ENGINEER
APPROVALS
DRAFT BY: CB
ENGR: RWB
CHIEF ENGR:
PROJECT MGR:
REV NO. | DATE | REVISIONS
1 | 2/88 | HDER TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY
2 | 5/93 | REMOVED PERMIT BOUNDARY LINE FROM L-128 NORTH
3 | 9.93 | CHANGED CO. NAME PREVIOUS NORTHERN PERMIT BOUNDARY



Sheet 2 of 3

I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.

REV. NO.	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	2-88	WIDEN TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY	JG	RVB		
2	3/90	REVISED PERMIT BOUNDARY LINE FROM L-128 NORTH	JG			
3	3/93	CHANGED CO. NAME, REMOVED FLA PARCH PERMIT BOUNDARY				

EXHIBIT 17-21

BHP MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861

AREA 4 NORTH
SEAM 5
TOP OF SEAM STRUCTURE

Scale: 1 IN.=500FT.	Date: 12/3/87	Exhibit #:
Contour Interval: 10 FT.	Drawn by: ACE/JG	Loc. 19

N

500 0 FEET 500 1000 1500

CONTOUR INTERVAL-10 FEET

EXPLANATION

- O DRILL HOLE LOCATION
- 8.0 COAL SEAM ISOPACH LINE (ISOPACH INTERVAL 0.5 FEET)
- MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
- COAL SEAM BURN LINE
- COAL SEAM SPLIT LINE (BARBS POINT TOWARD SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
- 6 COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK)
- COAL MINED OUT AS OF DECEMBER 16, 1977.
- COAL LEASE BOUNDARY

1. RUN THE TOPOGRAPHIC DATA FROM THE ORIGINAL DRAWING BEFORE THE OPERATING CERTIFICATION SIGNATURE TO THE RIGHT OF BY HAND.

INDEX MAP

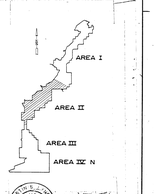


Exhibit 17-22 Sheet 2 of 2

REV. NO.	DATE	REVISIONS	APPROVALS			
			DRAFT	CHECK	CHIEF ENGR.	PROJECT ENGR.
1	11-18	CHANGE PROJECT NAME TO NAVAJO MINE, ADD TITLE BLOCK, ADD LEGEND, ADD SCALE, ADD ISOPACH LINE, ADD CONTOUR LINE				
2	2-80	ADDED BURNT & PARTY TO SUMMARY				

BHP-MINERALS INTERNATIONAL

NAVAJO MINE

FRUITLAND, NEW MEXICO

AREA I

SEAM Ga

THICKNESS MAP

SAN JUAN COUNTY, NEW MEXICO

DRAWN BY	L. DAN	SCALE 1" = 500'	SHEET
APPROVED BY		DATE	
DRAWING NO.		LOCATION NO.	

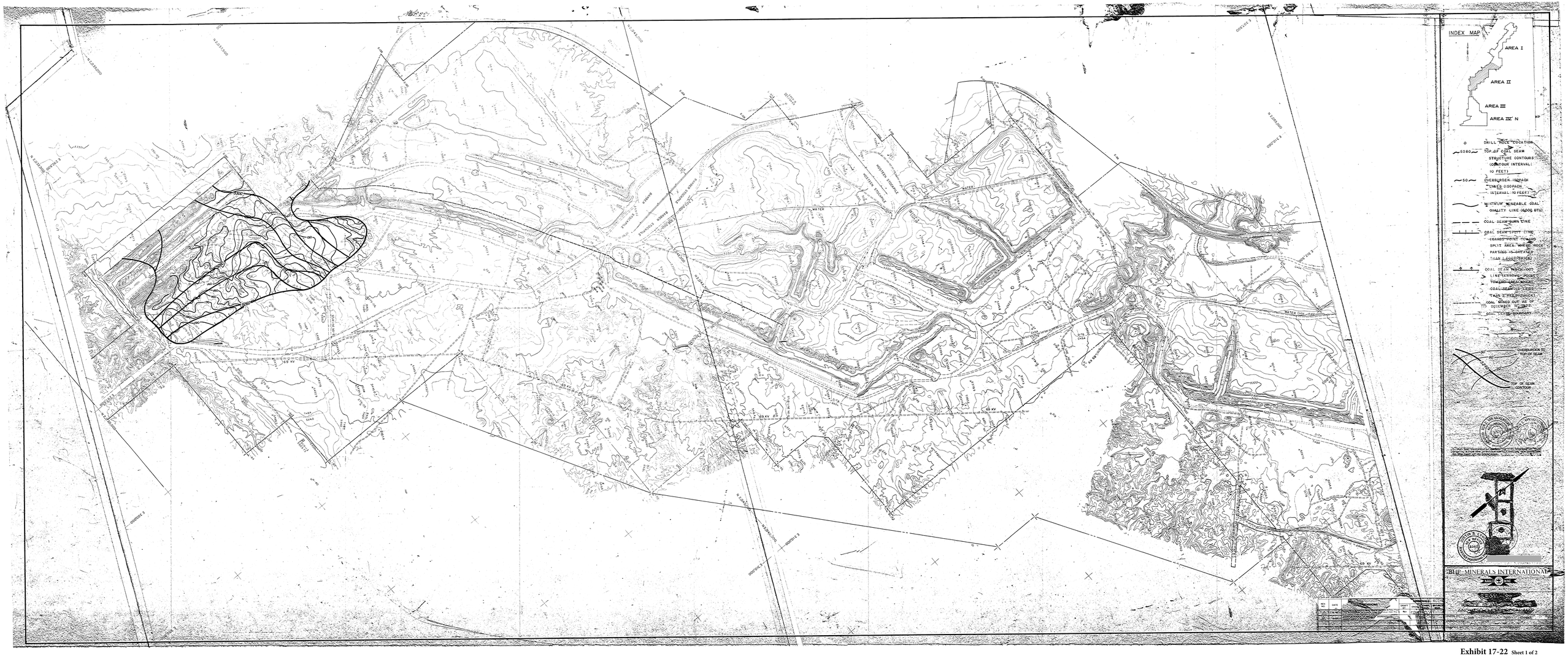


Exhibit 17-22 Sheet 1 of 2

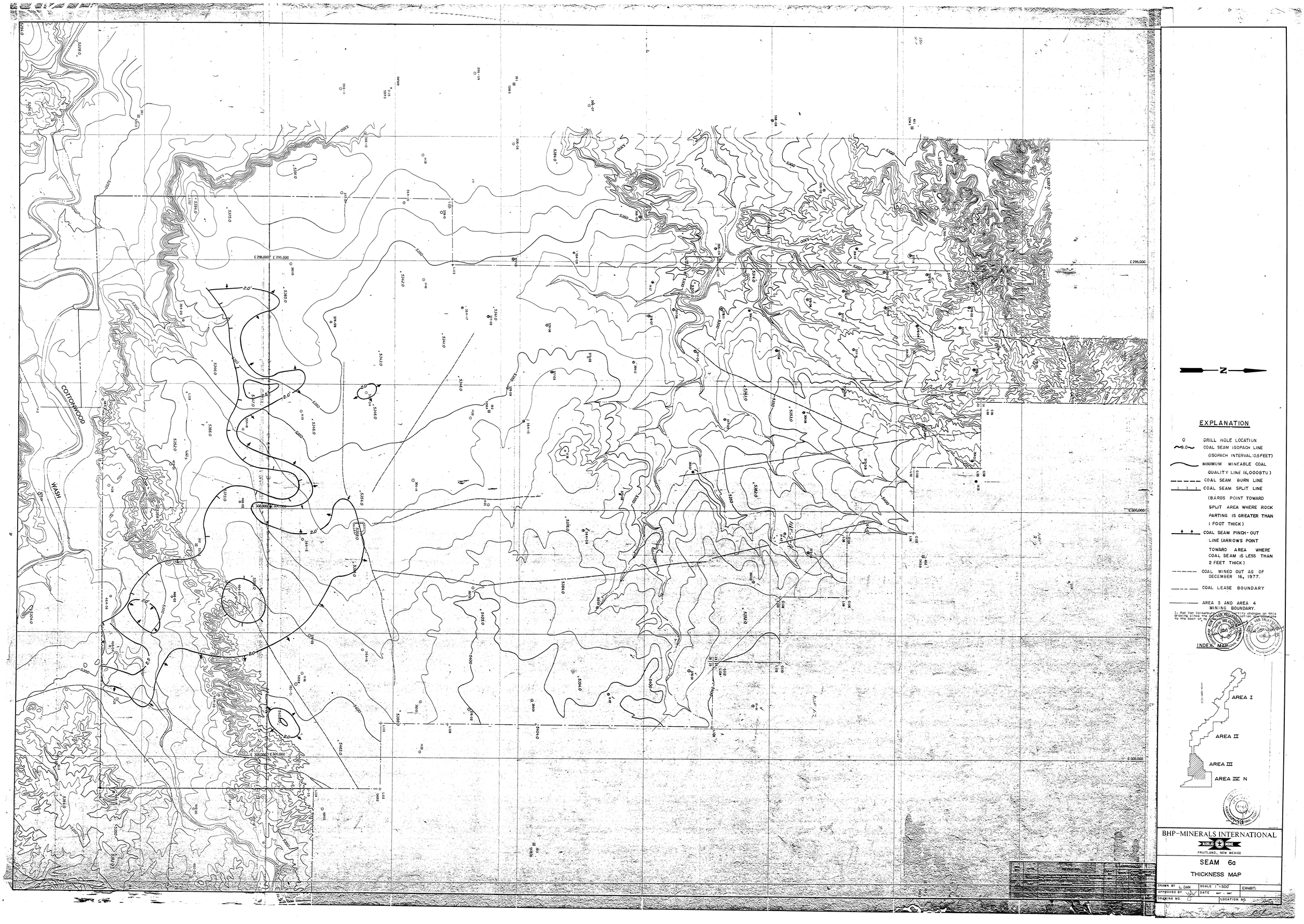
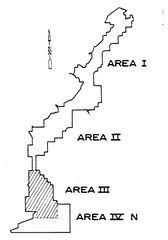


EXHIBIT 17-23 Sheet 2 of 2

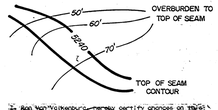
INDEX MAP



N

EXPLANATION

- DRILL HOLE LOCATION
- 5280 — TOP OF COAL SEAM STRUCTURE CONTOURS (CONTOUR INTERVAL = 10 FEET).
- 50' — OVERBURDEN ISO-PACH LINES (ISO-PACH INTERVAL = 10 FEET).
- MINIMUM MINABLE COAL QUALITY LINE (6,000 BTU).
- COAL SEAM BURN LINE.
- COAL SEAM SPLIT LINE (BARBS POINT TOWARD SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK).
- COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK).
- COAL MINED OUT AS OF DECEMBER 16, 1977.
- AREA 3 AND AREA 4 MINING BOUNDARY.



I, BOB WOFFORD, HEREBY CERTIFY THAT THE ORIGINAL OF THIS DRAWING LIES IN THE OFFICE OF BHP MINERALS INTERNATIONAL INC. AND IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

NEW MEXICO PROFESSIONAL ENGINEER — 9-10-93

JUSTIN S. TEUTH — NEW MEXICO — MINERALS PROFESSIONAL ENGINEER

Exhibit 17-23 Sheet 1 of 2

BHP-MINERALS INTERNATIONAL

FRUITLAND MINE

FRUITLAND, NEW MEXICO

AREA III

SEAM 6a

TOP OF SEAM STRUCTURE AND ISO-OVERBURDEN MAP

REV. NO.	DATE	REVISIONS	APPROVALS: DRAWN	CHIEF ENGR.	PROJECT ENGR.
1	1-1-92	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

DRAWN BY: [illegible] SCALE: 1" = 500' CONTR.:

APPROVED BY: [illegible] DATE: [illegible] 1992

DRAWING NO. LOCATION NO. SEAM

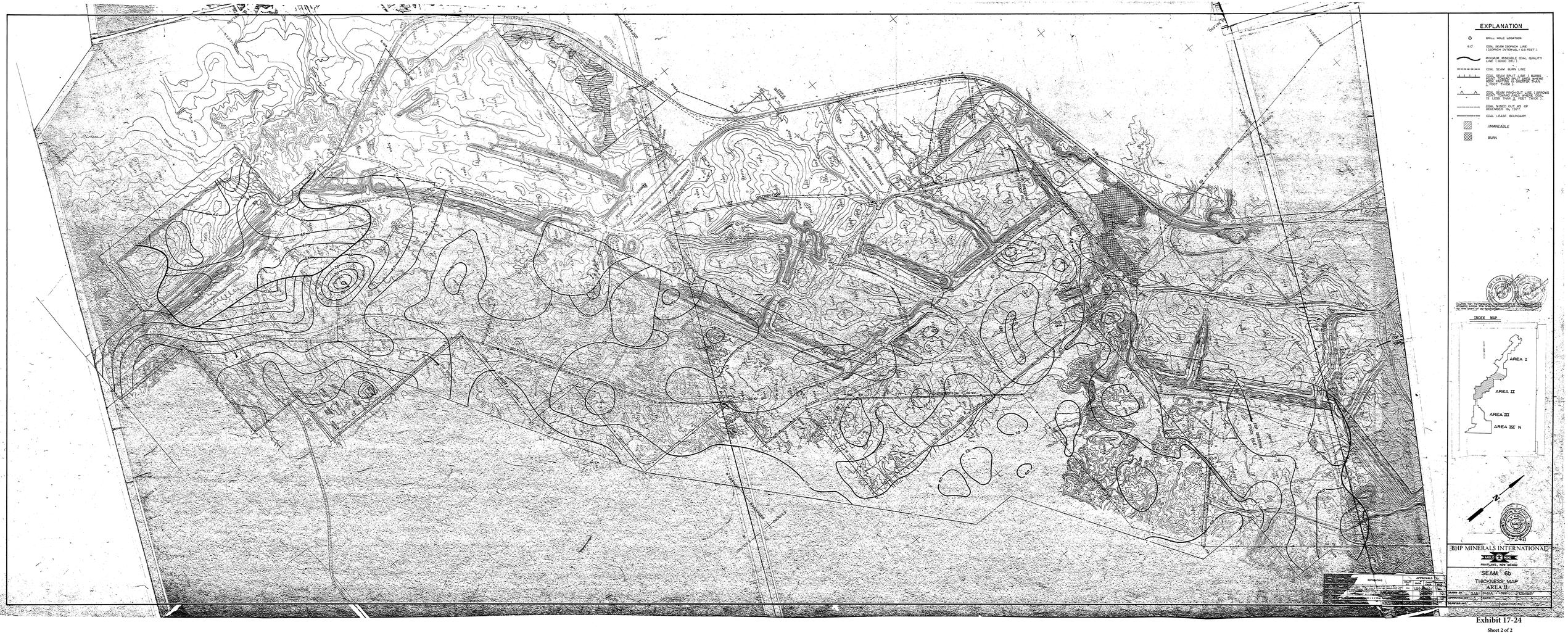
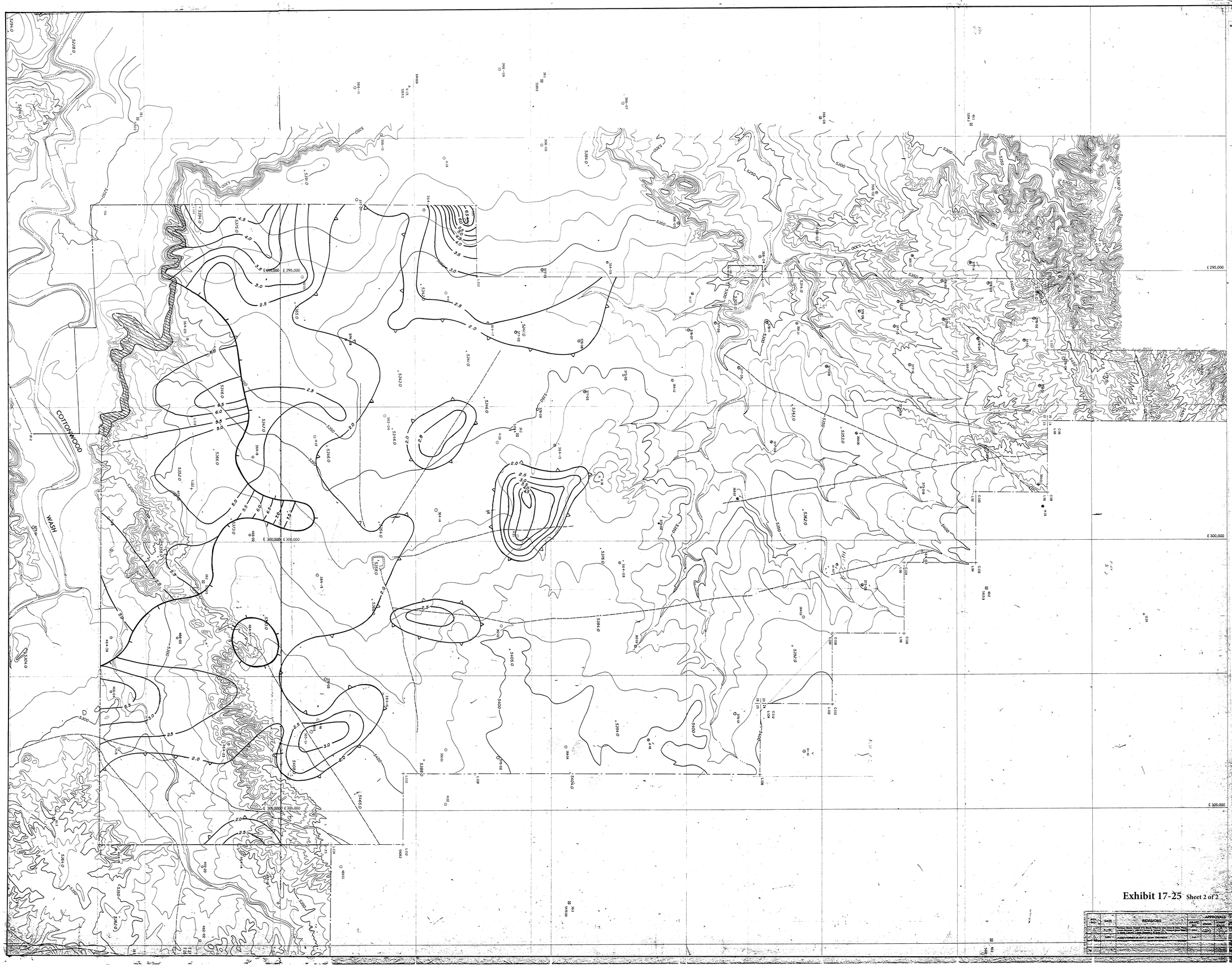


Exhibit 17-24

Sheet 2 of 2

Exhibit 17-24 Sheet 1 of 2



N

500 0 FEET 500 1000 1500

CONTOUR INTERVAL = 10 FEET

EXPLANATION

- DRILL HOLE LOCATION
- 8.0 COAL SEAM ISOPACH LINE (ISOPACH INTERVAL: 0.5 FEET)
- MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
- COAL SEAM BURN LINE
- COAL SEAM SPLIT LINE (BARBS POINT TOWARD SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
- COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK)
- COAL MINED OUT AS OF DECEMBER 16, 1977.
- COAL LEASE BOUNDARY
- AREA 3 AND AREA 4 MINING BOUNDARY.
- UNMINEABLE COAL

I, Ron Van Valkenburg, hereby certify, according to this drawing since the previous certification are accurate to the best of my knowledge.

INDEX MAP

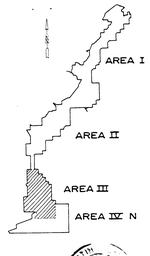


Exhibit 17-25 Sheet 2 of 2

BHP MINERALS INTERNATIONAL

NAVAJO MINE

FRUITLAND, NEW MEXICO

SEAM 6b
THICKNESS MAP
AREA 3

REV. NO.	DATE	REVISIONS	APPROVALS				
			DRAFT.	ENGR.	CHIEF		
	11/1/82		BY				
			CHK.				
	11/1/82						

DRAWN BY L. Dan | SCALE 1" = 500' | EXHIBIT:

APPROVED BY | DATE MAY - 1987

DRAWING NO. | LOCATION NO.

Exhibit 17-25 Sheet 1 of 2

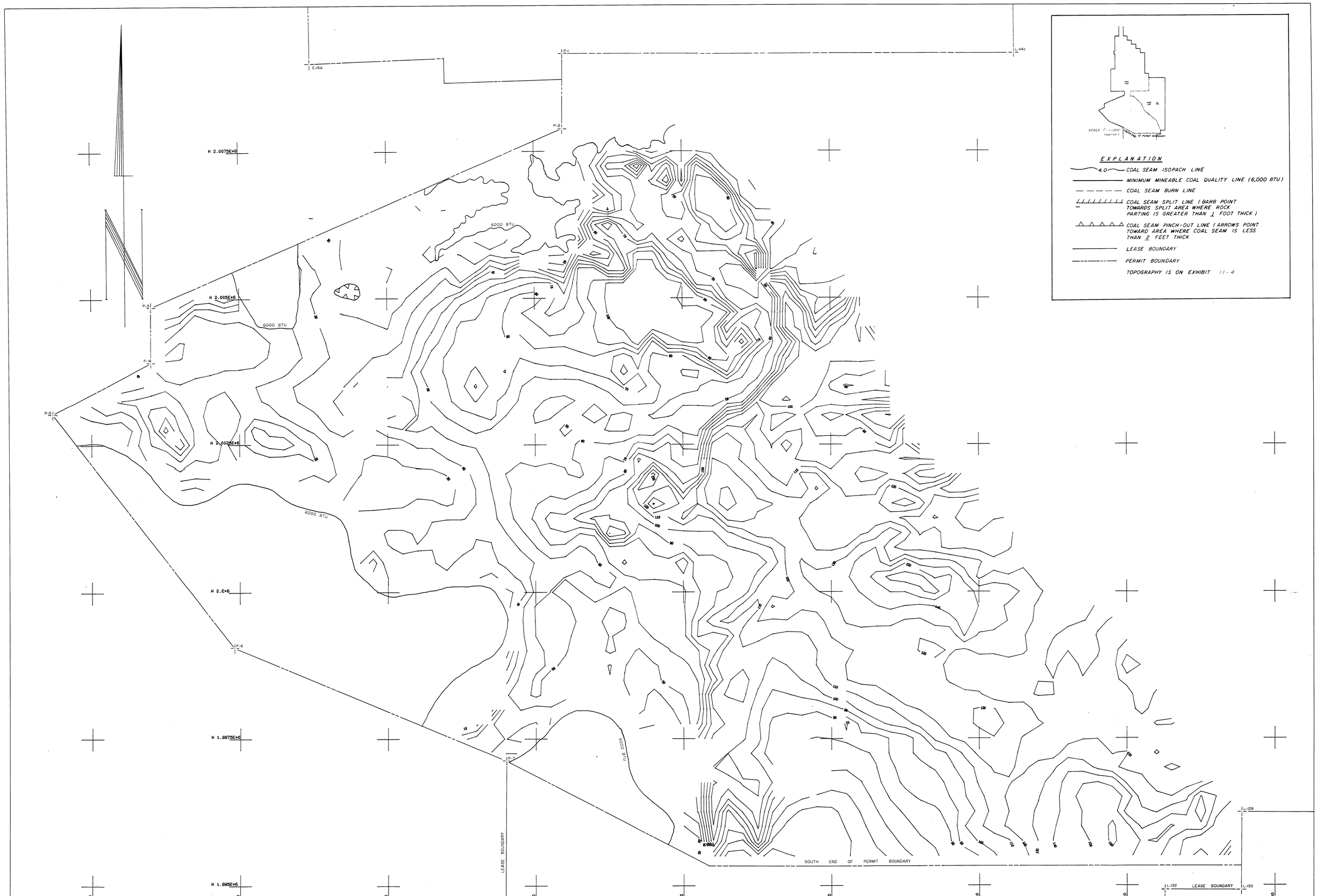


EXHIBIT 17-26

Sheet 3 of 3

BHP-MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861

AREA 4 NORTH
SEAM 6
ISO-OVERBURDEN MAP

Scale: 1 IN.=500FT. | Date: 12/3/87 | Exhibit #:
Contour Interval: 10 FT. | Drawn by: ACE

REV. NO.	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	6-1-88	MOVED TRANSPORTATION AT NORTH PERMIT BOUNDARY AND ADDED A TO EXHIBIT NO.	OG	RRB		
2	3/90	REMOVED PERMIT BOUNDARY LINE FROM L-128 NORTH	JG			
3	2/97	CHANGED CO. NAME				

I, Ron Van Valkenburgh, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.

E-15A
P-1
P-2
P-3
P-4
P-5
P-6
P-7
L-114c
L-128
L-132
L-130
N 2.0075E+6
N 2.005E+6
N 2.0025E+6
N 2.E+6
N 1.9975E+6
N 1.995E+6
E 290000
E 292500
E 295000
E 297500
E 300000
E 302500
E 305000
E 307500
E 310000
6000 BTU
LEASE BOUNDARY
SOUTH END OF PERMIT BOUNDARY
EXPLANATION
4.0 COAL SEAM ISOPACH LINE
MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
COAL SEAM BURN LINE
COAL SEAM SPLIT LINE (BARB POINT TOWARDS SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK
LEASE BOUNDARY
PERMIT BOUNDARY
TOPOGRAPHY IS ON EXHIBIT 11-4
SCALE IN FEET
EXHIBIT 17-26
Sheet 1 of 3
BHP MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861
AREA 4 NORTH
SEAM 6
THICKNESS MAP
Scale: 1 IN.=500FT.
Date: 12/3/87
Exhibit #:
Contour interval: 0.5 FT.
Drawn by: ACE/JG
REV. NO.
DATE
REVISIONS
APPROVALS
DRAFT BY
ENGR.
CHIEF ENGR.
PROJECT MGR.
2/88
WIDEN TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY
GG
RHD
3/93
CHANGE NAME, REFORMATTED, ADDED BLOCK & BOUNDARY.
I, Ron Van Valkenburg, hereby certify that the above drawing since the date indicated on it is accurate to the best of my knowledge.

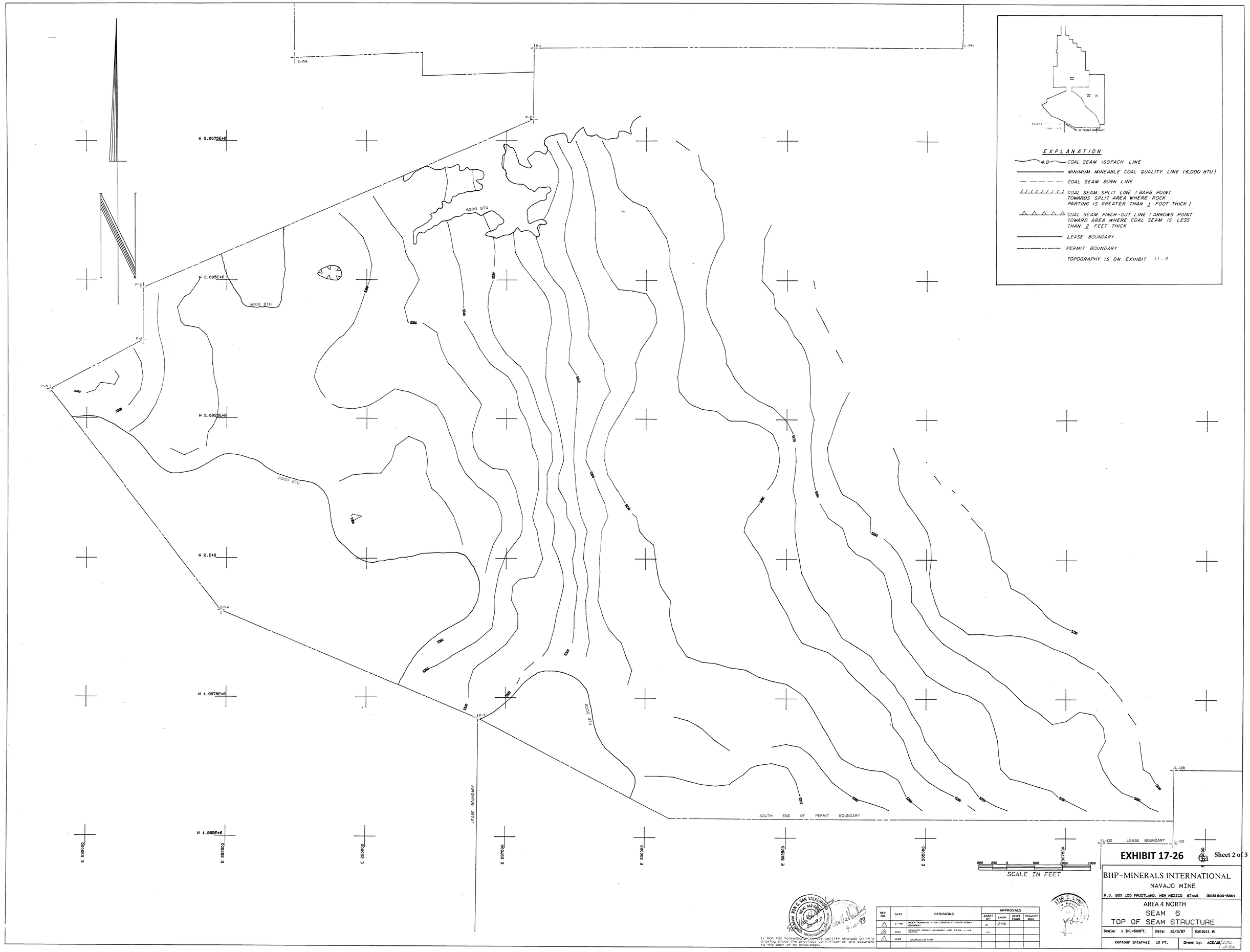


EXHIBIT 17-26

Sheet 2 of 3

BHP-MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861

AREA 4 NORTH
SEAM 6
TOP OF SEAM STRUCTURE

Scale: 1 IN.=500FT. | Date: 12/3/87 | Exhibit #:

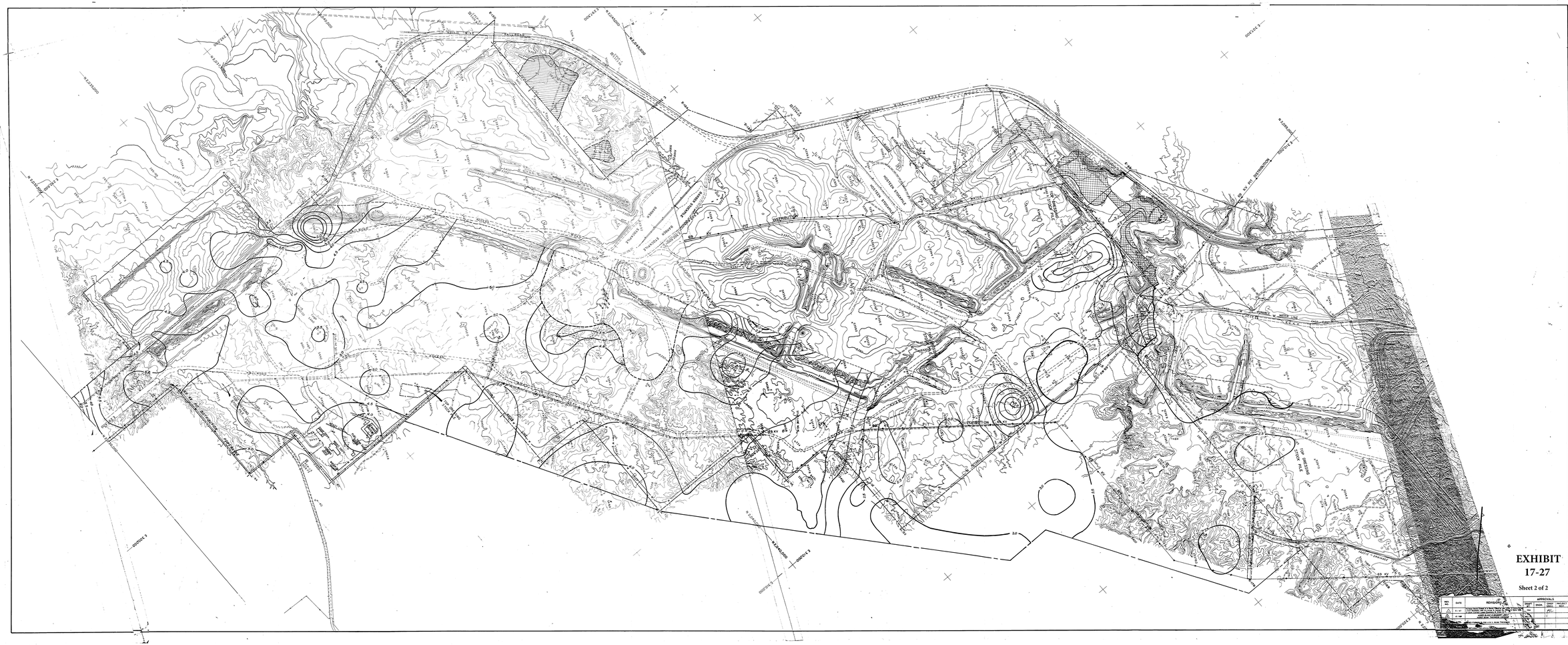
Contour interval: 10 FT. | Drawn by: ACE/JG

I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.

RON C. VAN VALKENBURG NEW MEXICO 9506 REGISTERED PROFESSIONAL ENGINEER

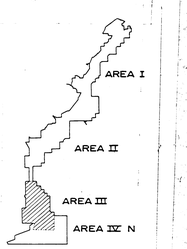
9-10-93

REV. NO.	DATE	REVISIONS	APPROVALS			
			DRAFT BY	ENGR	CHIEF ENGR	PROJECT MGR
1	2/88	MOCK TRANSITION FROM ON NORTH PERMIT BOUNDARY	JS	RHB		
2	5/90	REMOVED PERMIT BOUNDARY LINE FROM L-128 NORTH	JS			
3	9/93	CHANGED CO NAME				


N
500 0 FEET 500 1000 1500
CONTOUR INTERVAL - 10 FEET
DAS JOB NO. 46/9
EXPLANATION
DRILL HOLE LOCATION
8.0 COAL SEAM ISOPACH LINE (ISOPACH INTERVAL: 0.5 FEET)
MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
COAL SEAM BURN LINE
COAL SEAM SPLIT LINE (BARBS POINT TOWARD SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK)
COAL MINED OUT AS OF DECEMBER 16, 1977.
COAL LEASE BOUNDARY
UNMINEABLE
BURN
INDEX MAP
AREA I
AREA II
AREA III
AREA IV N
EXHIBIT 17-27
Sheet 2 of 2
BHP MINERALS INTERNATIONAL
FRUITLAND, NEW MEXICO
SEAM 7
THICKNESS MAP
SAN JUAN COUNTY, NEW MEXICO
DRAWN BY: DAN
SCALE: 1" = 500'
EXHIBIT
DATE:
DRAWING NO.

INDEX MAP
AREA I
AREA II
AREA III
AREA IV
N
LEGEND
DRILL HOLE LOCATION
5280
TOP OF COAL SEAM STRUCTURE CONTOURS (CONTOUR INTERVAL: 10 FEET)
80
OVERBURDEN ISOPACH LINES (ISOPACH INTERVAL: 10 FEET)
MINIMUM MINEABLE COAL QUALITY LINE (9000 BTU)
COAL SEAM BURN LINE
COAL SEAM SPLIT LINE (BARBS POINT TOWARD SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 5 FEET THICK)
COAL MINED OUT AS OF DECEMBER 1977
COAL LEASE BOUNDARY
OVERBURDEN TO TOP OF SEAM
TOP OF SEAM CONTOUR
UNMINEABLE
EXHIBIT 17-27 Sheet 1 of 2
BHP MINERALS INTERNATIONAL
SEAM
TOP OF SEAM STRUCTURE AND ISO-OVERBURDEN MAP
SCALE 1" = 500'
EXHIBIT
DATE AUG. 1987

INDEX MAP



I, Ron Van Valkenburg, hereby certify that no changes or revisions have occurred since the previous certification, to the best of my knowledge.

EXPLANATION

- UNMINEABLE COAL
- DRILL HOLE LOCATION
- 8.0' — COAL SEAM ISOPACH LINE (ISOPACH INTERVAL = 0.5 FEET).
- MINIMUM MINABLE COAL QUALITY LINE (6,000 BTU).
- COAL SEAM BURN LINE.
- COAL SEAM SPLIT LINE. (BARBS POINT TOWARD SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK).
- COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK).
- COAL MINED OUT AS OF DECEMBER 16, 1977.
- COAL LEASE BOUNDARY.
- AREA 3 AREA 4 MINING BOUNDARY.

N

EXHIBIT 17-28 Sheet 2 of 2

BHP MINERALS INTERNATIONAL

NAVAJO MINE

FRUITLAND, NEW MEXICO

SEAM 7

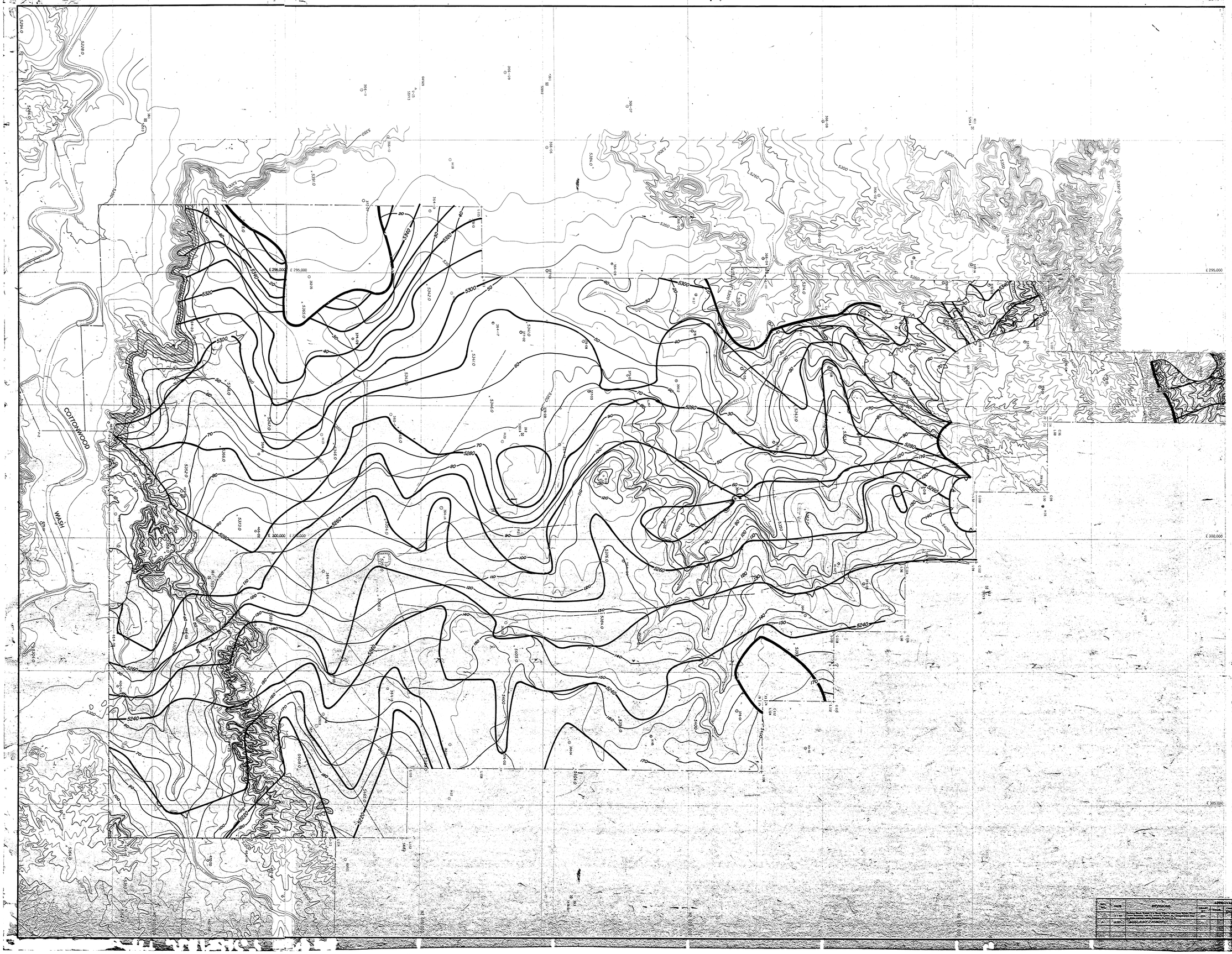
THICKNESS MAP

AREA III

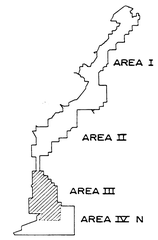
REV. NO.	DATE	REVISIONS	DRAFT BY	ENGR.	CHIEF ENGR.	PROJECT MGR.
2	5-87	Revised Seam Isopach & Burn Lines in the Area S 2000, East 1000 Lease Boundary with U.S. Lease & Added Cottonwood Wash Area	RAA			
1	6-85	ADDED FORMER BLOCK 2 SEAM THICKNESS	PJP			
0	9-195	ADDED AREA & TO TITLE BLOCK. CHANGED SE SEAM. CORRECTED 2 BOUNDARY.				

APPROVALS

DRAWN BY: L. CAN	SCALE: 1" = 500'		CONTINT:
APPROVED BY:	DATE: AUG. 1982		
DRAWING NO:	LOCATION NO:		



INDEX MAP



500 0 FEET 500 1000 1500

CONTOUR INTERVAL = 10 FEET
DAS JOB NO 4619

LEGEND

- DRILL HOLE LOCATION
- 5280 — TOP OF COAL SEAM STRUCTURE CONTOURS (CONTOUR INTERVAL 10 FEET)
- 60 — OVERBURDEN ISOPACH LINES (ISOPACH INTERVAL 10 FEET)
- MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
- COAL SEAM BURN LINE
- COAL SEAM SPLIT LINE (BARBS POINT TOWARD SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
- COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK)
- COAL MINED OUT AS OF DECEMBER 16, 1977
- COAL LEASE BOUNDARY
- AREA 3 AND AREA 4 MINING BOUNDARY
- 50, 60, 5240, 70 — OVERBURDEN TO TOP OF SEAM
- TOP OF SEAM CONTOUR

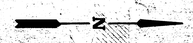


EXHIBIT 17-28 Sheet 1 of 2

BHP MINERALS INTERNATIONAL

NAVAJO MINE
FARMINGTON, NEW MEXICO

SEAM 7
AREA III
TOP OF SEAM STRUCTURE AND ISO-OVERBURDEN MAP

NO.	DATE	REVISIONS	APPROVALS			
			DRAWN	CHECK	CHIEF ENG.	PROJECT ENG.
1	12-1-80	[illegible]	[illegible]			
2	4-2-81	[illegible]	[illegible]			

SCALE: 1" = 500' DATE: [illegible] CORRECT

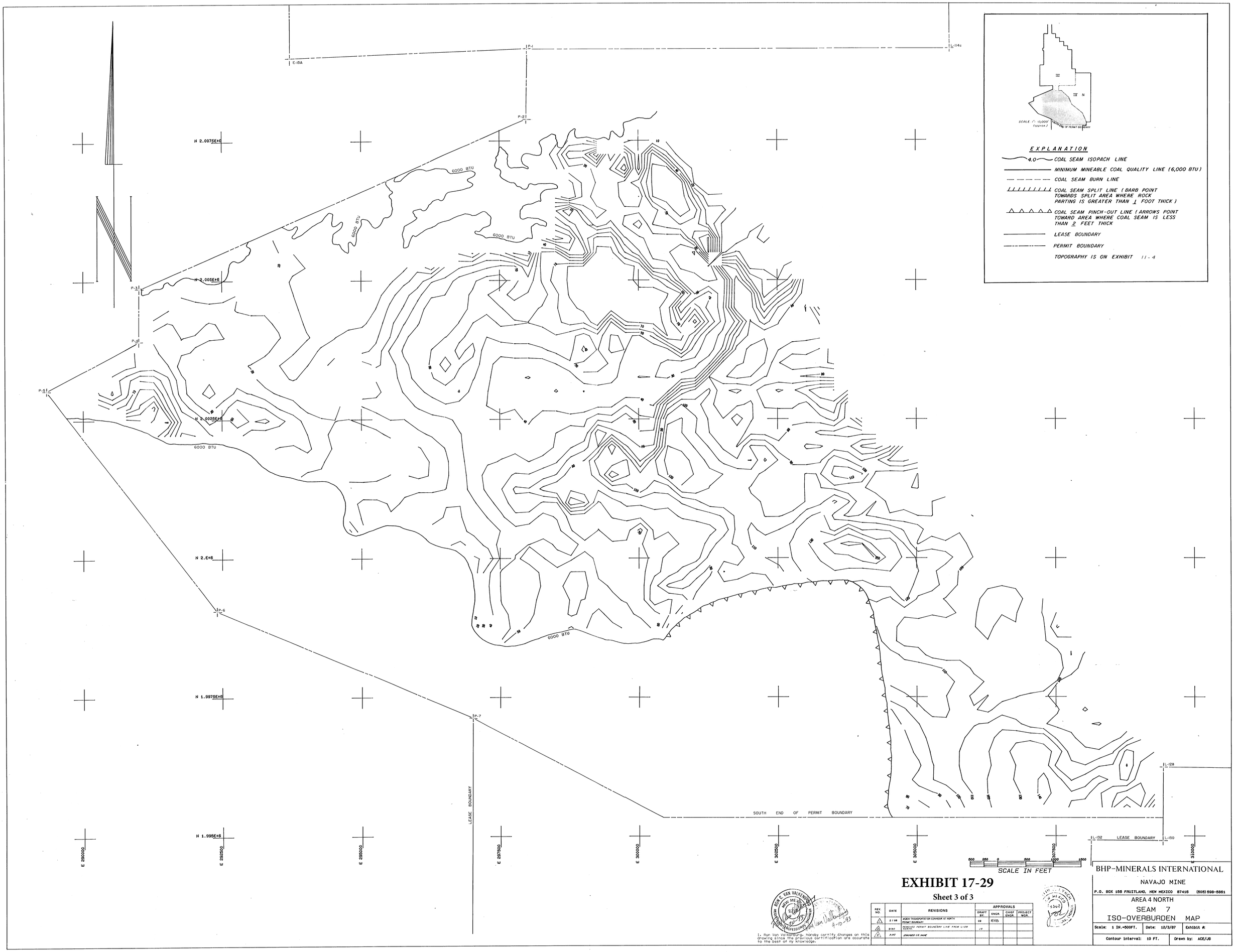


EXHIBIT 17-29

Sheet 3 of 3

I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.

REV. NO.	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	2/88	AVOID TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY	GB	RHB		
2	9/90	REMOVED PERMIT BOUNDARY LINE FROM L-128 NORTH	JB			
3	9/93	CHANGED LEASE				

BHP-MINERALS INTERNATIONAL

NAVAJO MINE

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861

AREA 4 NORTH

SEAM 7

ISO-OVERBURDEN MAP

Scale: 1 IN.=500FT.	Date: 12/3/87	Exhibit #:
Contour interval: 10 FT.		Drawn by: ACE/JB

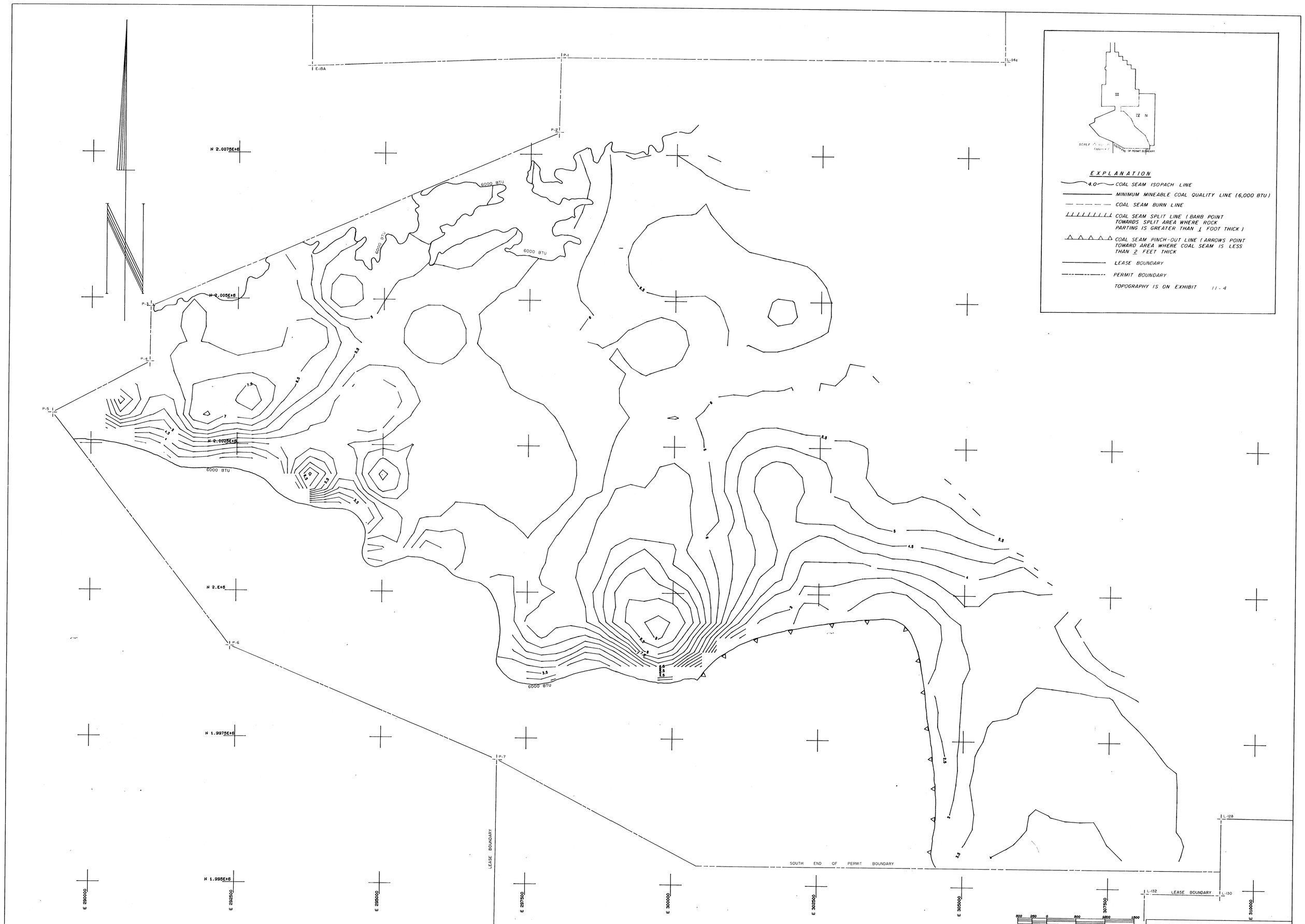


Exhibit 17-29

Sheet 1 of 3

REV NO.	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR	CHIEF ENGR	PROJECT MGR.
1	2/88	ADDED TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY	GB	RHB		
2	5/90	REMOVED PERMIT BOUNDARY LINE FROM LEASE BOUNDARY	JB			
3	9/93	CHANGE NAME, REFORMATTED, ADDED BLOCK & BOUNDARY.				

I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.

RON C. VAN VALKENBURG NEW MEXICO 9263 REGISTERED PROFESSIONAL ENGINEER

JOHN B. LYNCH NEW MEXICO 9102 REGISTERED PROFESSIONAL ENGINEER

BHP MINERALS INTERNATIONAL

NAVAJO MINE

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861

AREA 4 NORTH

SEAM 7

THICKNESS MAP

Scale: 1 IN.=500FT.	Date: 12/3/87	Exhibit #:
Contour interval: 0.5 FT.	Drawn by: ACE/JB	

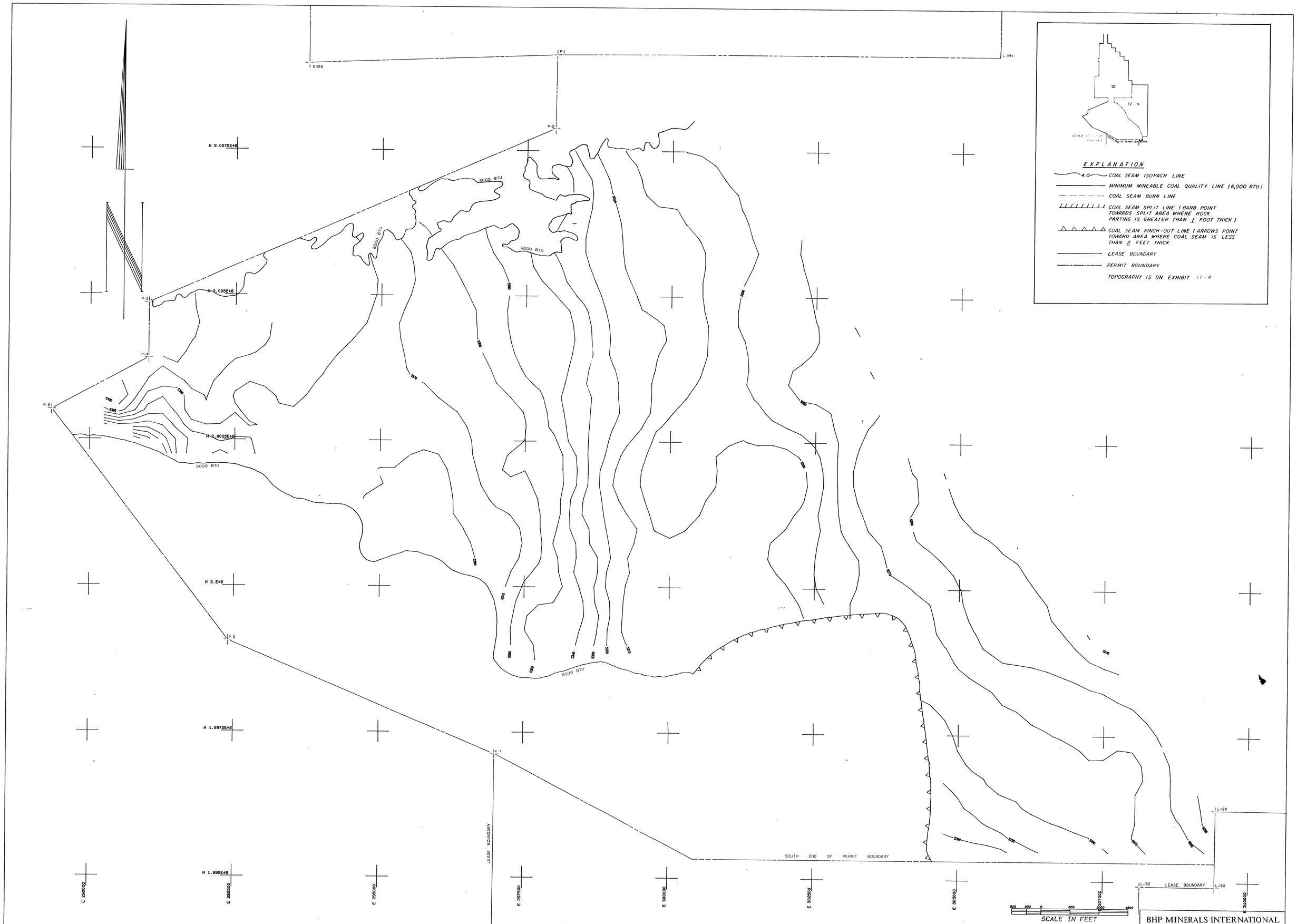


EXHIBIT 17-29

Sheet 2 of 3

I, Ron Van Valkenburg, do hereby certify that the changes on this drawing since the last certification are accurate to the best of my knowledge.

REV NO.	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR	CHIEF ENGR	PROJECT MGR
2	2/88	WIDEN TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY	JB	RVB		
1	11/90	REVISED PERMIT BOUNDARY LINE FROM L-128 TO L-132	JB			
3	3/93	CHANGE NAME, REFORMATTED, ADDED BLOCK & BOUNDARY.				

BHP MINERALS INTERNATIONAL

NAVAJO MINE

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861

AREA 4 NORTH

SEAM 7

TOP OF SEAM STRUCTURE

Scale: 1 IN.=500FT.	Date: 12/3/87	Exhibit #:
Contour interval: 10 FT.		Drawn by: ACE/JB

EXHIBIT 17-30

Sheet 2 of 2

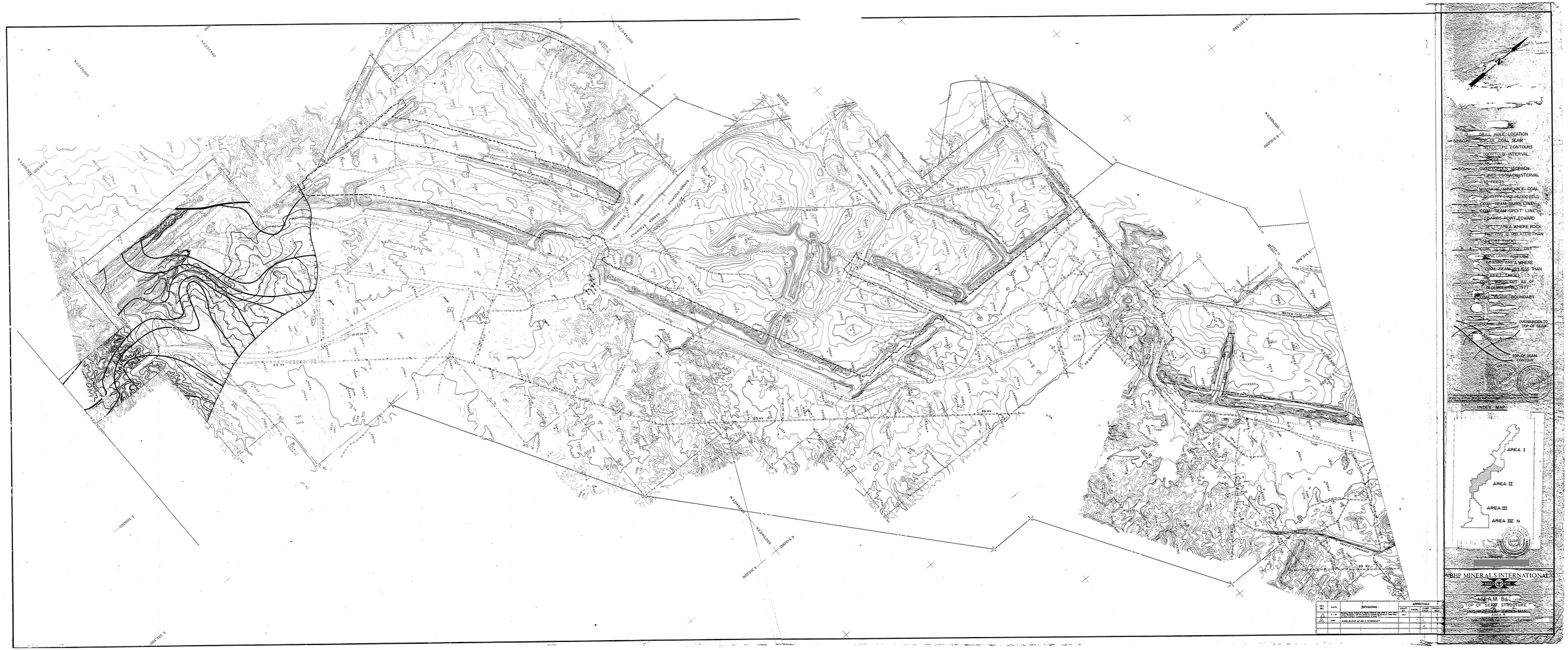
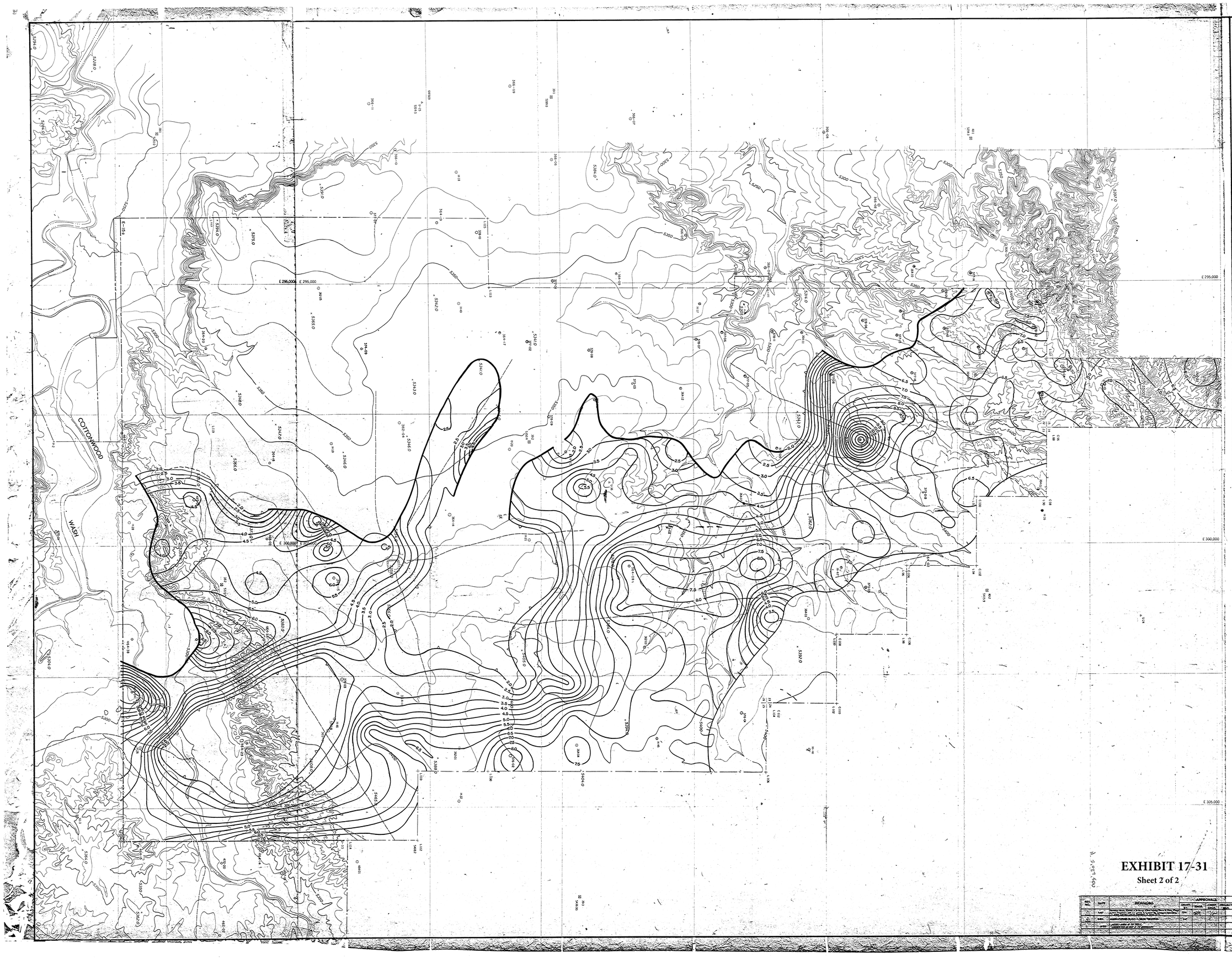
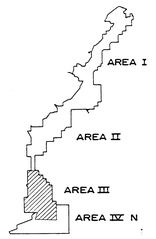


EXHIBIT 17-30

Sheet 1 of 2



INDEX MAP



I, Ron Van Valkenburg, hereby certify that this drawing shows the proposed classification are accurate to the best of my knowledge.

EXPLANATION

- DRILL HOLE LOCATION
- COAL SEAM ISOPACH LINE (ISOPACH INTERVAL = 0.5 FEET).
- MINIMUM MINABLE COAL QUALITY LINE (6,000 BTU).
- COAL SEAM BURN LINE.
- COAL SEAM SPLIT LINE (BARBS POINT TOWARD SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK).
- COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK).
- COAL MINED OUT AS OF DECEMBER 16, 1977
- COAL LEASE BOUNDARY
- AREA 3 AND AREA 4 MINING BOUNDARY.

N

EXHIBIT 17-31

Sheet 2 of 2

REV. NO.	DATE	REVISIONS	APPROVALS: DRAFT. BY	DESIGN	CHECK DESIGN	PROJECT ENG.
1	1977	[illegible]	DSA	[illegible]		
2	5-85	[illegible]	RVV			
3	5-87	[illegible]				

BHP MINERALS INTERNATIONAL

WORLD MINE

FRUITLAND, NEW MEXICO

AREA III

SEAM 8a

THICKNESS MAP

DRAWN BY L. DAN	SCALE 1" = 500'	EXHIBIT:	
APPROVED BY	DATE MAY, 1987		
DRAWING NO.	LOCATION NO.		

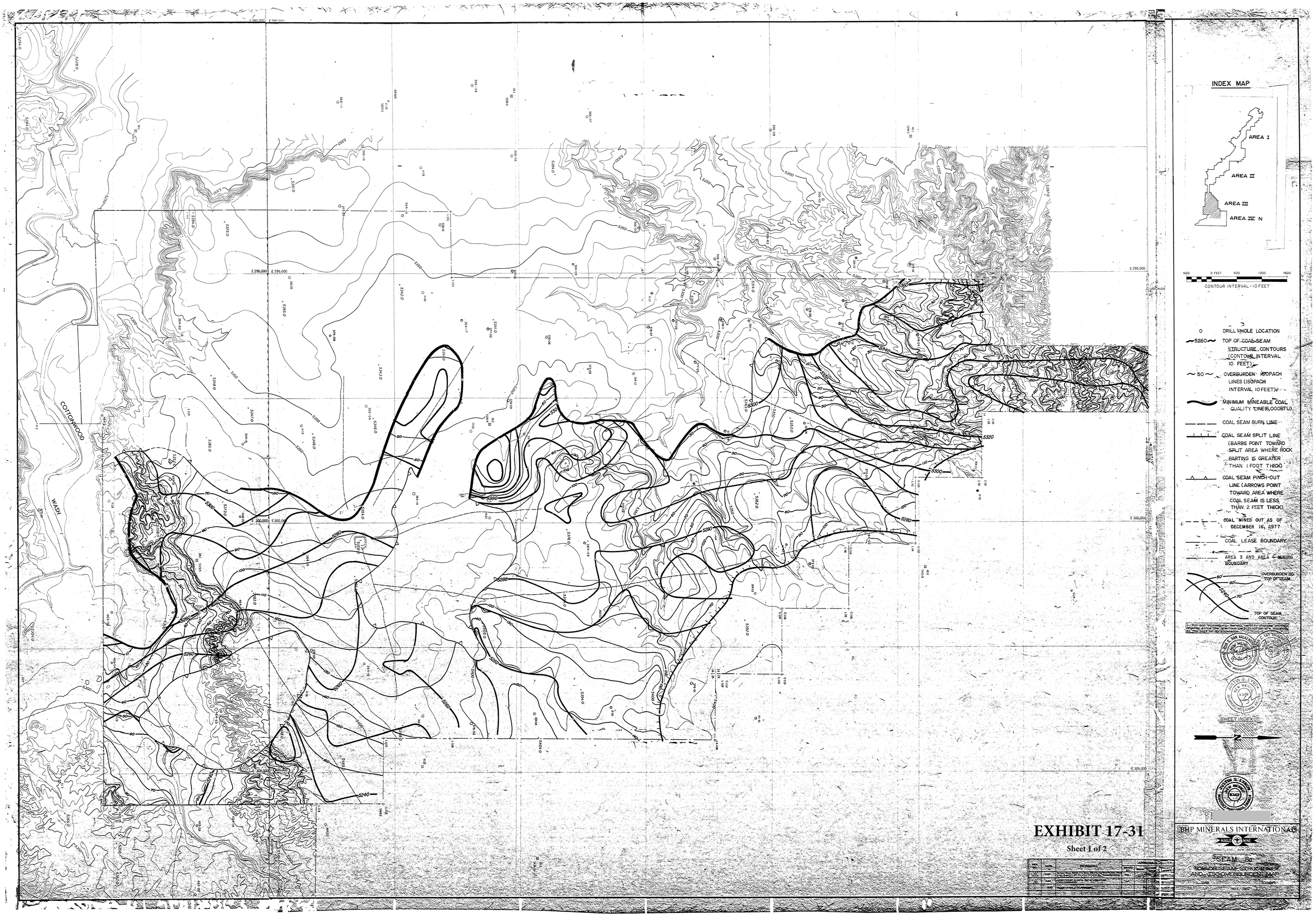


EXHIBIT 17-31

Sheet 1 of 2

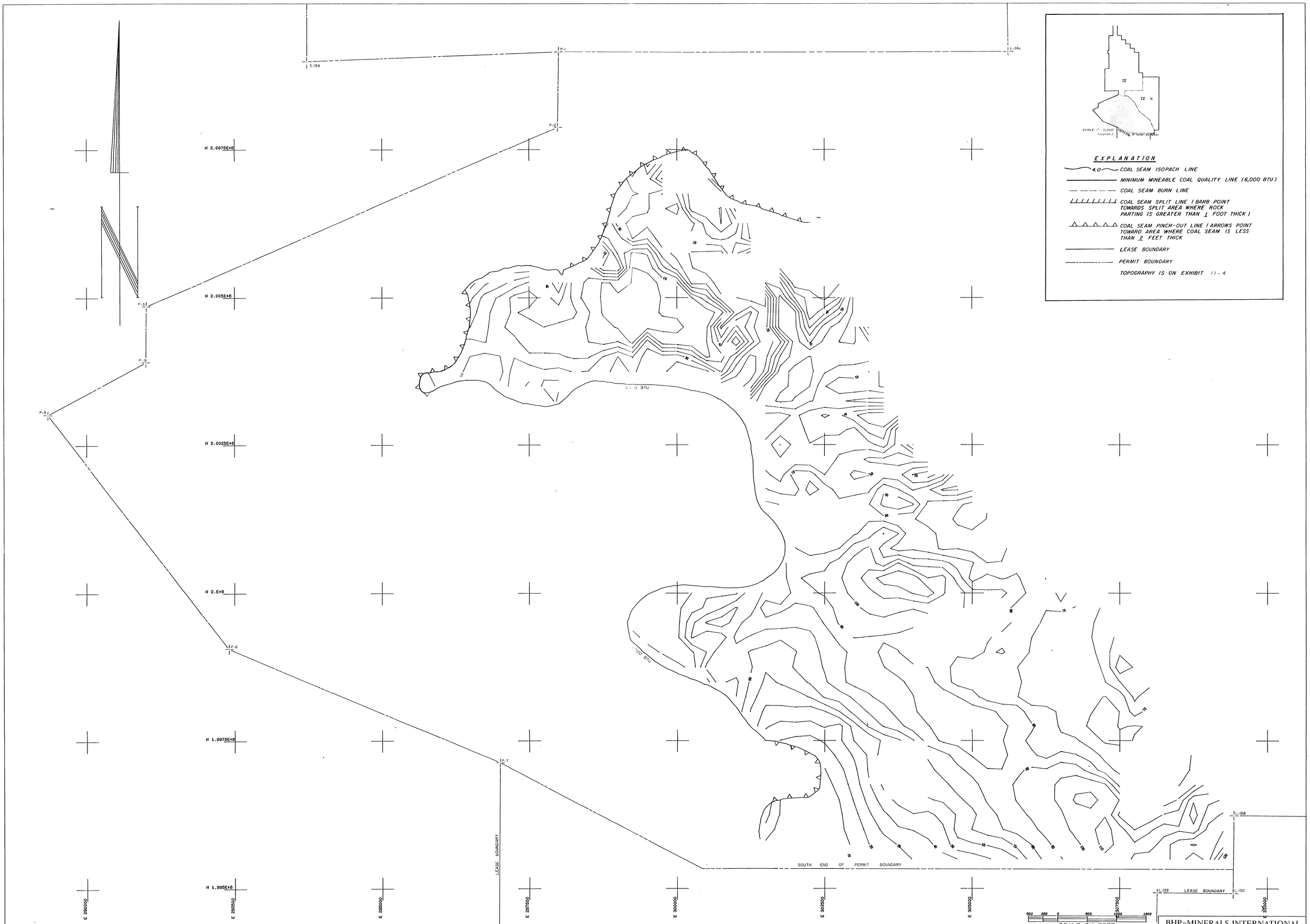


EXHIBIT 17-32

Sheet 3 of 3

I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.

REV NO	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR	CHIEF ENGR	PROJECT MGR
1	2-1-88	ADDED TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY	CG	RVB		
2	7/7/93	REMOVED PERMIT BOUNDARY LINE FROM L-128 TO L-130				
3	9/23	CHANGED CO. NAME				

BHP-MINERALS INTERNATIONAL

NAVAJO MINE

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5881

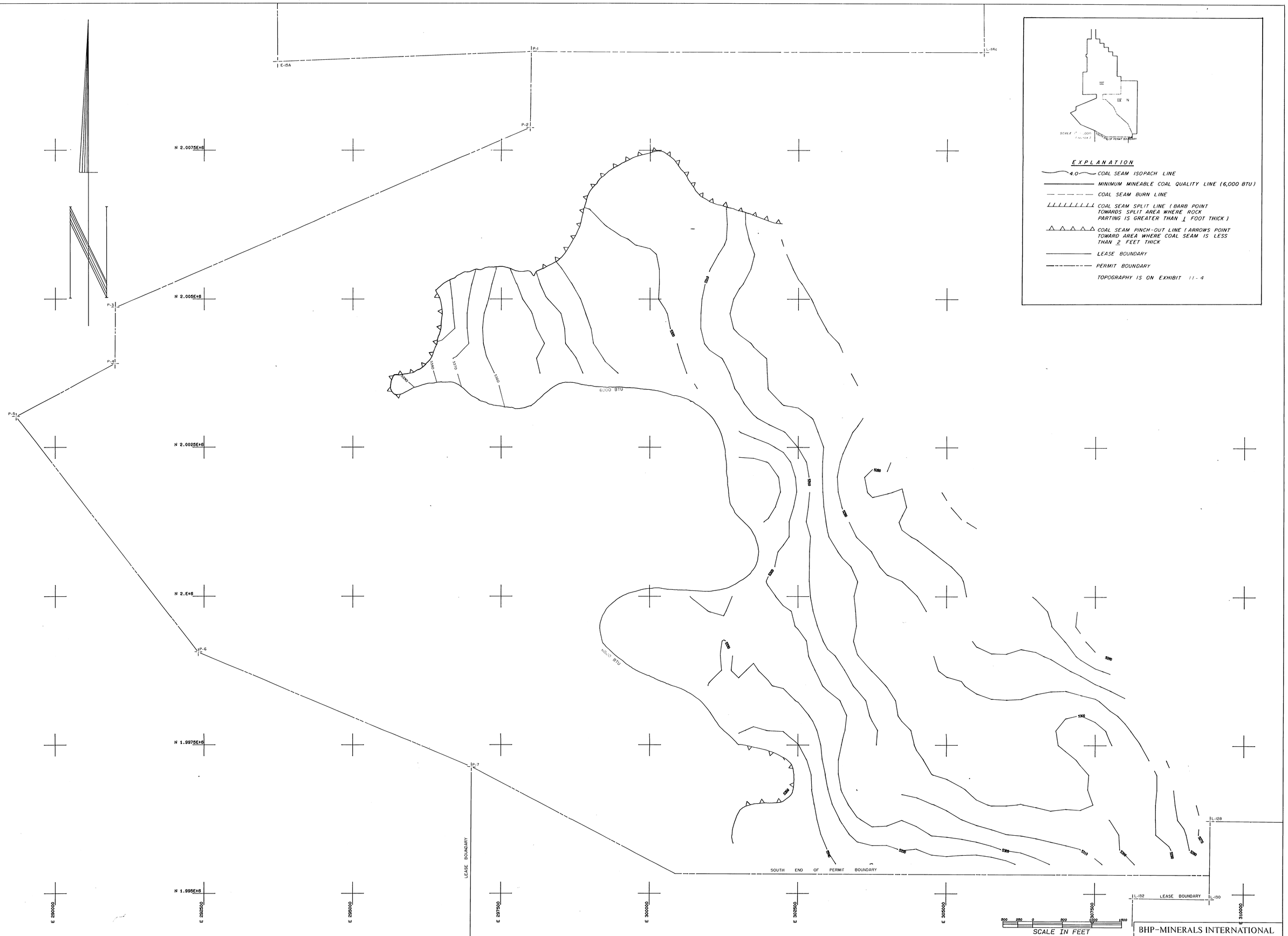
AREA 4 NORTH

SEAM 8A

ISO-OVERBURDEN MAP

Scale: 1 IN.=500FT.	Date: 12/3/87	Exhibit #:
Contour Interval: 10 FT.	Drawn by: ACE/JG	

EXPLANATION
4.0 COAL SEAM ISOPACH LINE
MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
COAL SEAM BURN LINE
COAL SEAM SPLIT LINE (BARB POINT TOWARDS SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK
LEASE BOUNDARY
PERMIT BOUNDARY
TOPOGRAPHY IS ON EXHIBIT 11-4
SOUTH END OF PERMIT BOUNDARY
LEASE BOUNDARY
SCALE IN FEET
N 2.0075E+6
N 2.005E+6
N 2.0025E+6
N 2.E+6
N 1.9975E+6
N 1.995E+6
E 290000
E 292500
E 295000
E 297500
E 300000
E 302500
E 305000
E 307500
E 310000
P-1
P-2
P-3
P-4
P-5
P-6
P-7
E-15A
L-114c
L-128
L-132
L-130
EXHIBIT 17-32
Sheet 1 of 3
BHP-MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861
AREA 4 NORTH
SEAM 8A
THICKNESS MAP
Scale: 1 IN.=500FT.
Date: 12/3/87
Exhibit #:
Contour Interval: 0.5 FT.
Drawn by: ACE/JG
REVISIONS
APPROVALS
DRAFT BY
ENGR
CHIEF ENGR
PROJECT MGR



EXPLANATION

- 4.0 — COAL SEAM ISOPACH LINE
- MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
- COAL SEAM BURN LINE
- COAL SEAM SPLIT LINE (BARB POINT TOWARDS SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
- COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK
- LEASE BOUNDARY
- PERMIT BOUNDARY

TOPOGRAPHY IS ON EXHIBIT 11-4

EXHIBIT 17-32

Sheet 2 of 2

I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.

REV. NO.	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	2/88	ROCK TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY	DB	RHB		
2	5/90	REVISED PERMIT BOUNDARY LINE FROM L-128 NORTH	JE			
3	5/93	CHANGED CE NAME				

BHP-MINERALS INTERNATIONAL

NAVAJO MINE

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861

AREA 4 NORTH

SEAM 8A

TOP OF SEAM STRUCTURE

Scale: 1 IN.=500FT.	Date: 12/3/87	Exhibit #:
Contour Interval: 10 FT.	Drawn by: ACE/JG	

EXHIBIT 17-33

Sheet 2 of 2

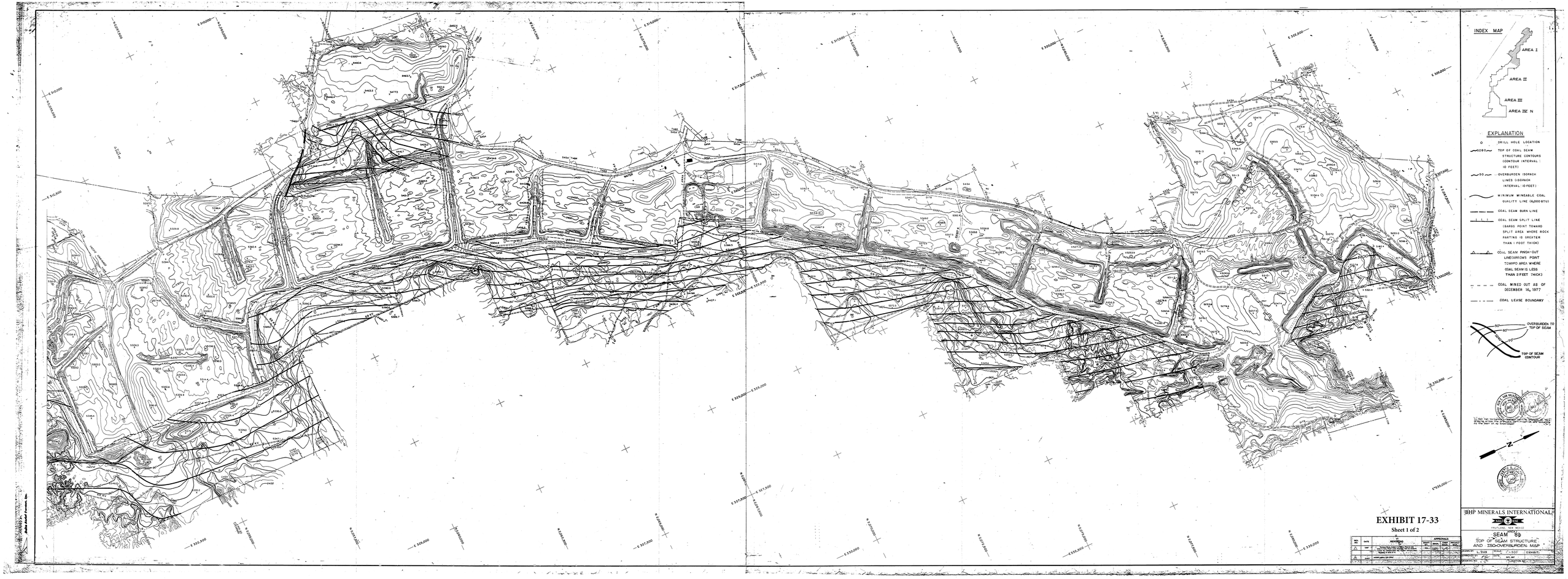
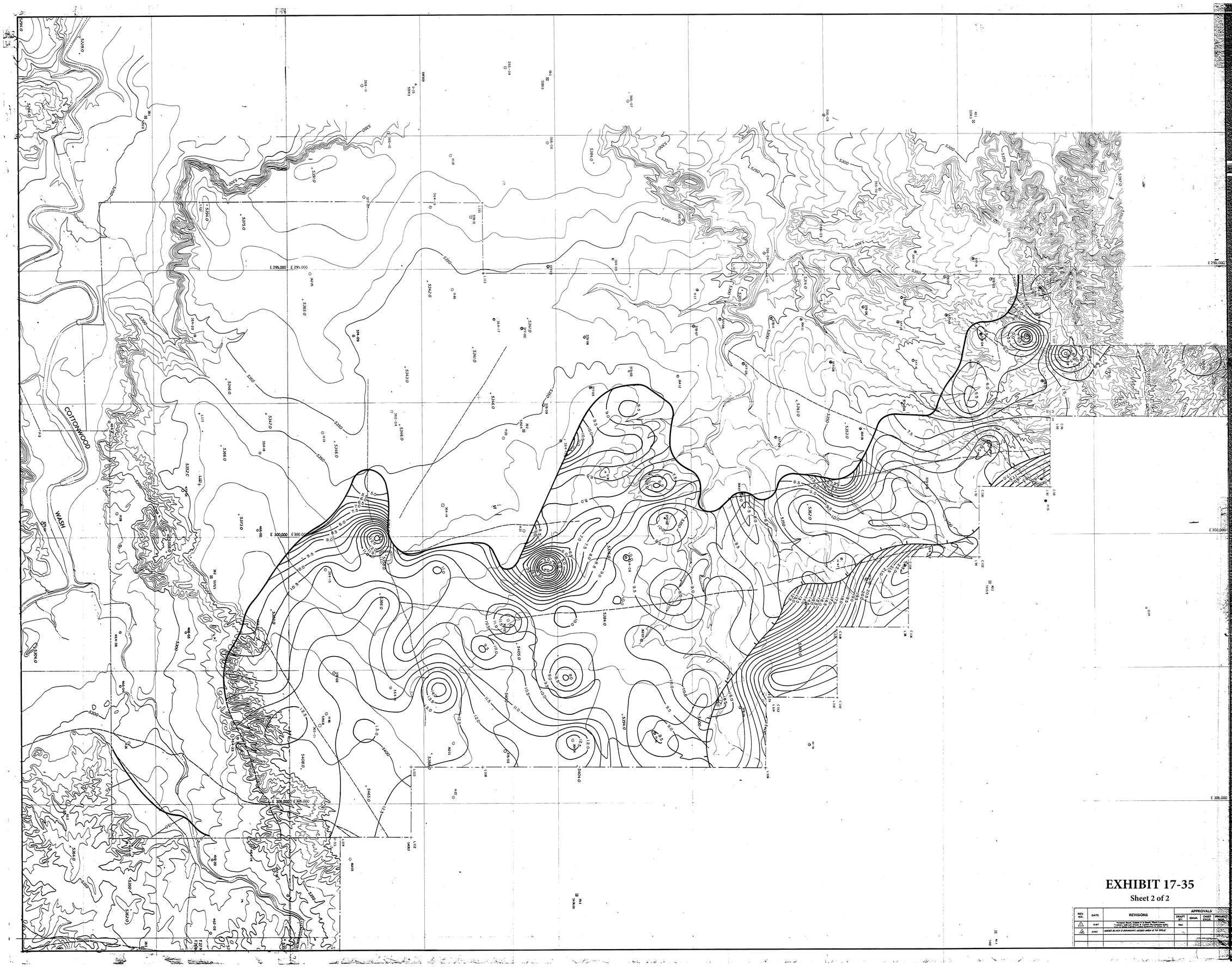

INDEX MAP
AREA I
AREA II
AREA III
AREA IV
N
EXPLANATION
DRILL HOLE LOCATION
TOP OF COAL SEAM STRUCTURE CONTOURS (CONTOUR INTERVAL : 10 FEET)
OVERBURDEN ISOPACH LINES (ISOPACH INTERVAL : 10 FEET)
MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
COAL SEAM BURN LINE
COAL SEAM SPLIT LINE (BARBS POINT TOWARD SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
COAL SEAM PINCH-OUT LINE(ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK)
COAL MINED OUT AS OF DECEMBER 16, 1977
COAL LEASE BOUNDARY
OVERBURDEN TO TOP OF SEAM
TOP OF SEAM CONTOUR
EXHIBIT 17-33
Sheet 1 of 2
BHP MINERALS INTERNATIONAL
CRUZALAND, NEW MEXICO
SEAM "Sb"
TOP OF SEAM STRUCTURE AND ISO-OVERBURDEN MAP
SCALE 1" = 1,000'
EXHIBIT

EXHIBIT 17-34

Sheet 2 of 2

EXHIBIT 17-34

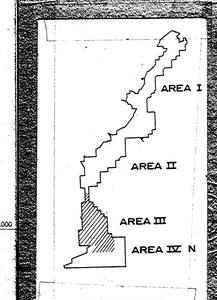
Sheet 1 of 2



EXPLANATION

- DRILL HOLE LOCATION
- COAL SEAM ISOPACH LINES (ISOPACH INTERVAL = 0.5 FEET)
- MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
- COAL SEAM BURN LINE
- COAL SEAM SPLIT LINE (BARBS POINT TOWARD SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
- COAL SEAM "PINCH-OUT" LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 5 FEET THICK)
- COAL MINED OUT AS OF DECEMBER 31, 1977
- COAL LEASE BOUNDARY
- USER SOUNDING LOCATION

INDEX MAP



BHP MINERALS INTERNATIONAL

SEAM 5D THICKNESS MAP

EXHIBIT 17-35

Sheet 2 of 2

REV. NO.	DATE	REVISIONS	APPROVALS DRAFT BY	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	5-87	Pulaski South, Cabin 1 to North Pilot Knob, Pulaski, Mill 3-5, Cabin 4 & Cabin 5 Boundaries Added, Mill 3-5, Cabin 4 & Cabin 5 Burn Boundaries Added, Burn Lines Added, Labels Modified & Other Mod.	MM			
2	8-90	ADDED IN VIA IV DRAINAGE, ADDED AREA IV TO TITLE				

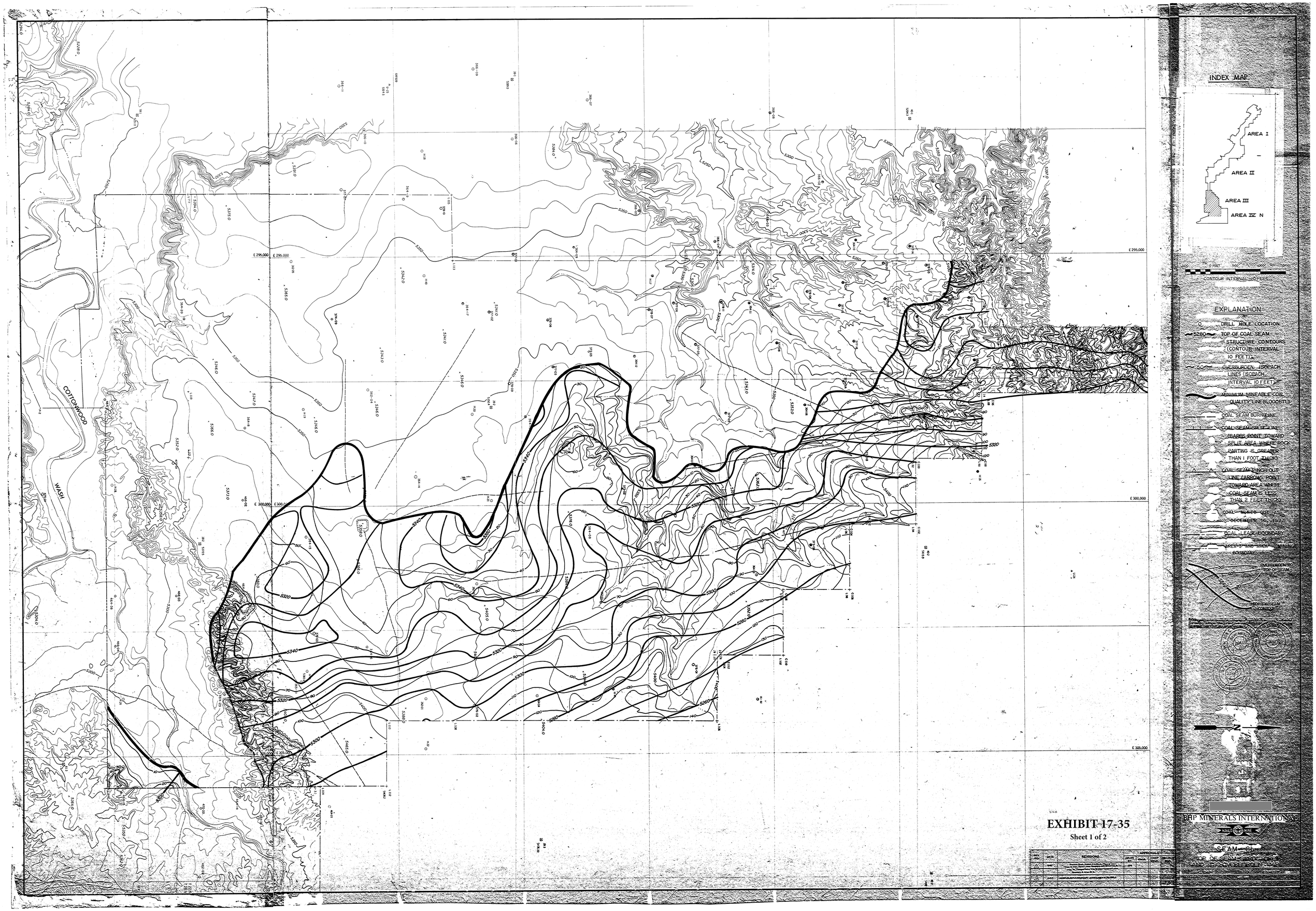


EXHIBIT 17-35

Sheet 1 of 2

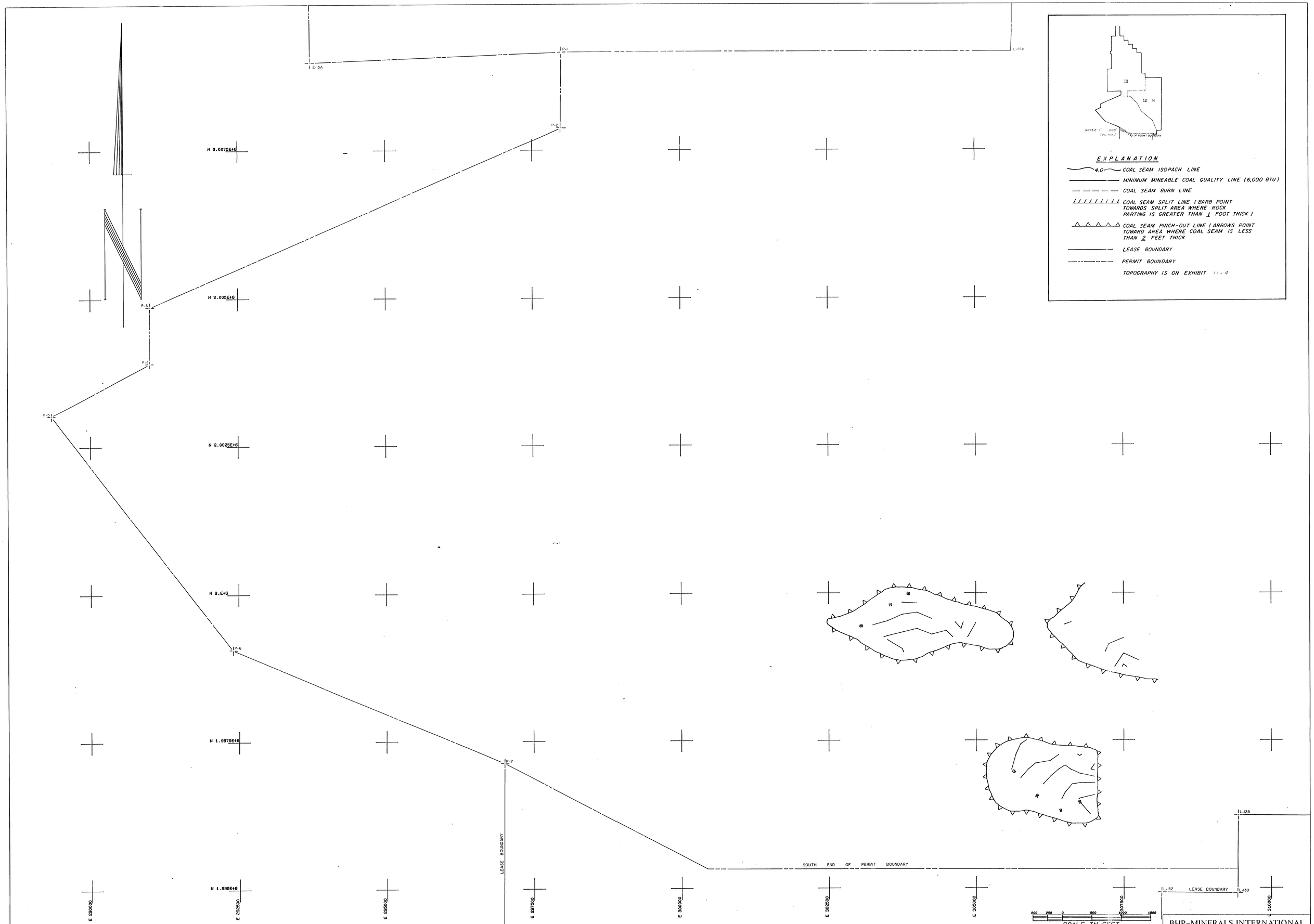


EXHIBIT 17-36

Sheet 3 of 3

I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.

REV. NO.	DATE	REVISIONS	APPROVALS: DRAFT. BY	ENGR.	CHIEF ENGR.	PROJECT MGR.
1	2/88	MOEN TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY	JB	RHB		
2	3/89	REVISED PERMIT BOUNDARY LINE FROM L-128 NORTH	JB			
3	3/89	CHANGED CE NAME, REVISED NORTHERN PERMIT BOUNDARY				

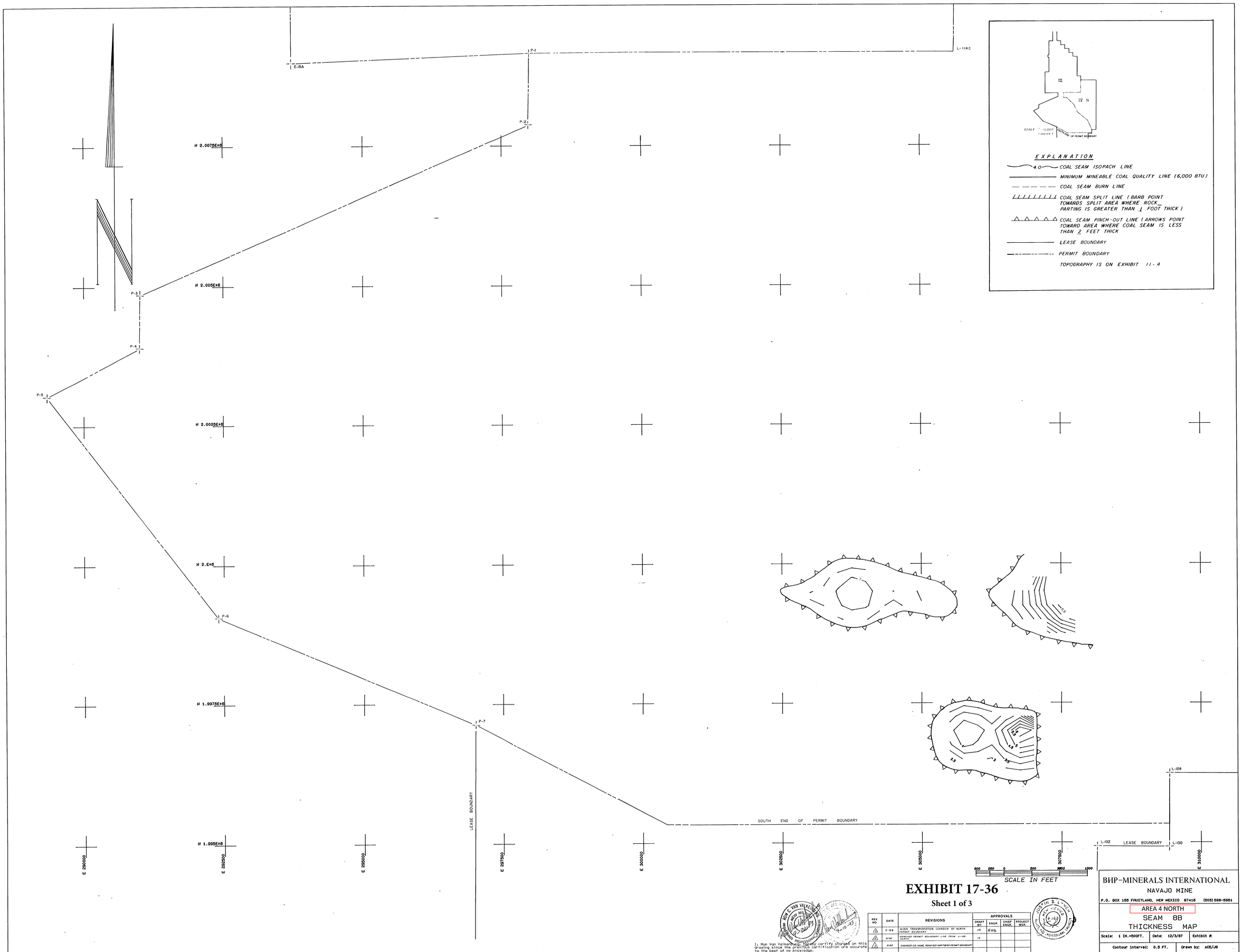
BHP-MINERALS INTERNATIONAL

NAVAJO MINE

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861

AREA 4 NORTH
SEAM 8B
ISO-OVERBURDEN MAP

Scale: 1 IN.=500FT.	Date: 12/3/87	Exhibit #:
Contour Interval: 10 FT.	Drawn by: ACE/JG	


L-114C
E-15A
P-1
P-2
P-3
P-4
P-5
P-6
P-7
N 2.0075E+6
N 2.005E+6
N 2.0025E+6
N 2.E+6
N 1.9975E+6
N 1.995E+6
E 290000
E 292500
E 295000
E 297500
E 300000
E 302500
E 305000
E 307500
E 310000
LEASE BOUNDARY
SOUTH END OF PERMIT BOUNDARY
L-128
L-132
L-130
SCALE IN FEET
EXPLANATION
4.0 COAL SEAM ISOPACH LINE
MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
COAL SEAM BURN LINE
COAL SEAM SPLIT LINE (BARB POINT TOWARDS SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK
LEASE BOUNDARY
PERMIT BOUNDARY
TOPOGRAPHY IS ON EXHIBIT 11-4
III
IV N
SCALE 1" = 10,000' (APPROX.)
SOUTH END OF PERMIT BOUNDARY
EXHIBIT 17-36
Sheet 1 of 3
RON A. VAN VALKENBURG
NEW MEXICO
PROFESSIONAL ENGINEER
9-16-87
JUSTIN S. LUCAS
NEW MEXICO
PROFESSIONAL SURVEYOR
I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.
REV NO. | DATE | REVISIONS | APPROVALS: DRAFT BY | ENGR | CHIEF ENGR. | PROJECT MGR.
1 | 2-88 | WIDEN TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY | JG | RWB
2 | 5/90 | REMOVED PERMIT BOUNDARY LINE FROM L-128 NORTH | JG
3 | 8/93 | CHANGED CO. NAME, REMOVED NORTHERN PERMIT BOUNDARY
BHP-MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5861
AREA 4 NORTH
SEAM 8B
THICKNESS MAP
Scale: 1 IN.=500FT.
Date: 12/3/87
Exhibit #:
Contour Interval: 0.5 FT.
Drawn by: ACE/JG

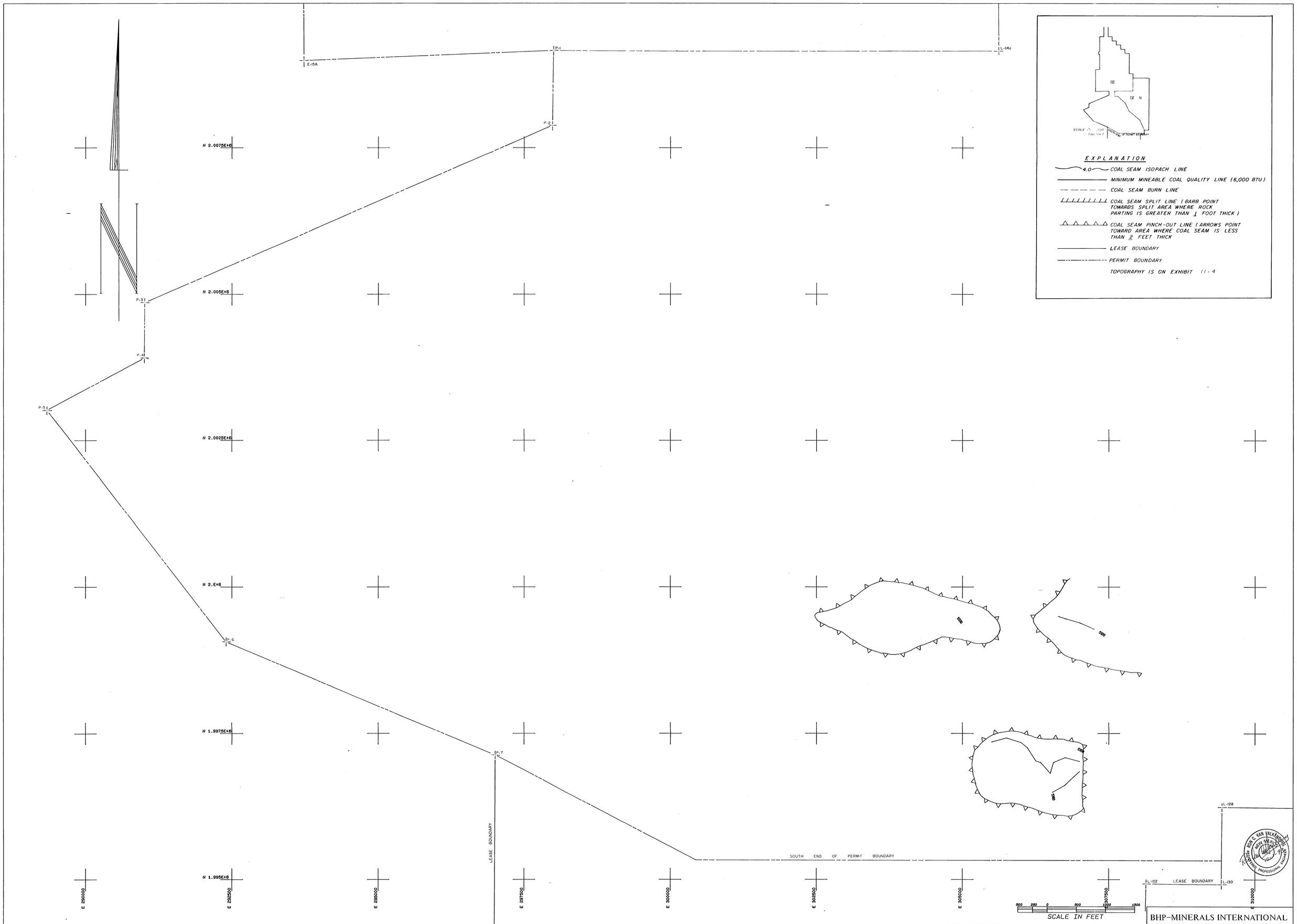


EXHIBIT 17-36

Sheet 2 of 3

I, Ron Van Valkenburg, hereby certify changes on this drawing since the previous certification are accurate to the best of my knowledge.

REV NO	DATE	REVISIONS	APPROVALS: DRAFT BY	ENGR	CHIEF ENGR.	PROJECT MGR.
1	2/88	MOEN TRANSPORTATION CORRIDOR AT NORTH PERMIT BOUNDARY	GG	RHB		
2	5/90	REMOVED PERMIT BOUNDARY LINE FROM L-128 NORTH	JB			
3	3/93	CHANGED CB NAME, REMOVED NORTHERN PERMIT BOUNDARY				

BHP-MINERALS INTERNATIONAL
NAVAJO MINE
P.O. BOX 155 FRUITLAND, NEW MEXICO 87416 (505) 598-5881

AREA 4 NORTH
SEAM 8B
TOP OF SEAM STRUCTURE

Scale: 1 IN.=500FT. | Date: 12/3/87 | Exhibit #: DWG. EOC NE-004

Contour Interval: 10 FT. | Drawn by: ACE/JB

MORGAN LAKE
ACCESS
TOP DRESSING STOCK PILE
TOP DRESSING STOCK PILE
TOP DRESSING STOCK PILE
TOP DRESSING STOCK PILE
TOP DRESSING STOCK PILE
CONTOUR INTERVAL = 10 FEET
EXPLANATION
DRILL HOLE LOCATION
COAL SEAM ISOPACH LINES (ISOPACH INTERVAL = 0.5 FEET)
MINIMUM MINEABLE COAL QUALITY LINE (6,000 BTU)
COAL SEAM BURN LINE
COAL SEAM SPLIT LINE (BARBS POINT TOWARD SPLIT AREA WHERE ROCK PARTING IS GREATER THAN 1 FOOT THICK)
COAL SEAM PINCH-OUT LINE (ARROWS POINT TOWARD AREA WHERE COAL SEAM IS LESS THAN 2 FEET THICK)
COAL MINED OUT AS OF DECEMBER 16, 1977
COAL LEASE BOUNDARY
INDEX MAP
AREA I
AREA II
AREA III
AREA IV N
NOTES
EXHIBIT 17-37
Sheet 2 of 2
EHP MINERALS INTERNATIONAL INC.
SEAM - RIDER ABOVE SEAM B6
COAL THICKNESS
AREA I

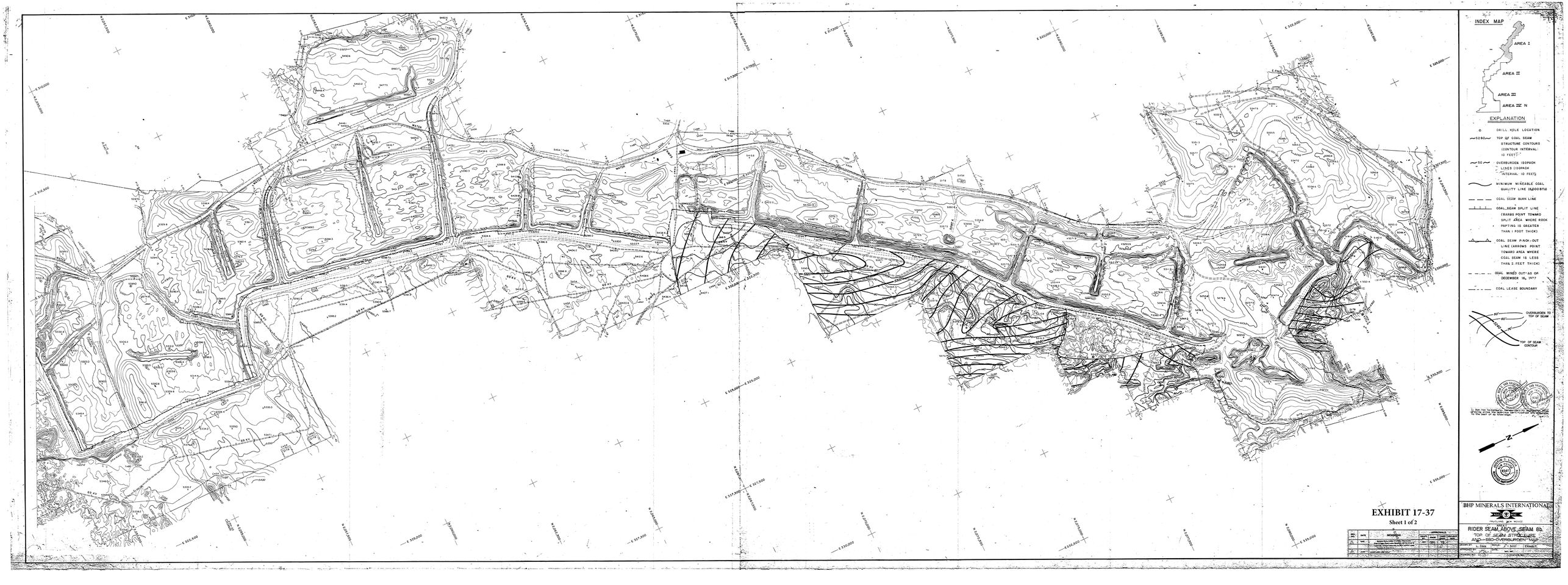


EXHIBIT 17-37

Sheet 1 of 2

Appendix 17.A

Drill Hole Core Logs

BHP-UTAH INTERNATIONAL INC.

DRILL HOLE NO. 487-01, AREA 4N, OVERBURDEN DRILLING PROJECT

COLLAR ELEVATION 5405.3, TOTAL DEPTH 200', DRILLER JACK LEDBETTER

COORDINATES: N= 2,001,943 CONTRACTOR MOTE DRILLING CO.

E= 297,228 DATE COLLARED December 7, 1987

SECTION _____, T _____ N, R _____ W DATE BOTTOMED December 8, 1987

SUMMARY

INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.	INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.
* See Remarks									
TOTALS & AVERAGES									

SEAM NAME	MINABLE COAL HORIZON	THICKNESS COAL	THICKNESS PARTINGS	THICKNESS SEAM	PROXIMATE ANALYSIS MOIST.	ASH	VOL.	F.C.	BTU	% SUL.	B.O.S. ELEV. / A.F. TEMP.
8A	31.0 - 33.7	2.6	1-0.1	2.7	21.06	16.85	31.91	30.18	6772	.61	2210
7	47.0 - 53.4	6.1	1-0.2	6.3	14.74	11.90	33.14	40.22	9970	1.23	2230
6B	60.7 - 64.9	4.2	0-0.0	4.2	14.87	14.30	34.19	36.64	9729	.55	2340
3B	132.4-136.1	3.4	1-0.1	3.5	11.33	24.60	30.75	33.32	8687	.76	2480
3A	140.4-143.2	2.8	0-0.0	2.8	13.27	24.80	27.90	34.03	8416	2.48	2140
2B	156.0-158.5	2.5	0-0.0	2.5	15.36	13.04	32.60	39.00	9763	.79	2250
	158.5-159.9	--	Carbon. Shale	1.4	10.63	48.87	20.35	20.15	5164	2.15	2420
2A	159.9-162.4	2.5	0-0.0	2.5	13.70	10.66	33.74	41.90	10564	.84	2500

REMARKS - * 0.0' to 5.0' Collected rotary chip cuttings.

5.0' to 171' Continuous core

171' to 200' Rotary/ream for geophysical log.

December 22, 1987
DATE

Andy C. Erickson
GEOLOGIST

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
0.0	6.0	6.0	Siltstone	Alluvial weathred (plug drilled).	
6.0	6.8	0.8	Sandstone	Weathered	
6.8	7.0	0.2	Shale	Soft, carbonaceous, W/S.S. bands	
7.0	8.2	1.2	Coal	Oxidized	
8.2	8.4	0.2	Shale	Carbonaceous, weathered	
8.4	16.0	7.6	Mudstone	Weathered, w/ gypsum veinlets	
16.0	17.2	1.2	Claystone	Rust colored, baked	
17.2	17.5	0.3	Siltstone	White, hard	
17.5	30.5	13.0	Mudstone	Weathered, hard	
30.5	31.0	0.5	Shale	Carbonaceous, soft	
31.0	31.7	0.7	Coal	Oxidized	
31.7	31.8	0.1	Bony	Parting, hard	
31.8	33.7	1.9	Coal	Hard, slightly oxidized	
33.7	34.0	0.3	Shale	Carbonaceous	
34.0	35.0	1.0	Shale	Organic	
35.0	36.3	1.3	Shale	Gray	
36.3	36.8	0.5	Shale	Grading to sandstone	
36.8	39.1	2.3	Sandstone	Gray, white,silty, organic laminae	
39.1	40.6	1.5	Siltstone	Sandy, organic lamination	
40.6	41.5	0.9	Siltstone	Sandy	
41.5	43.5	2.0	Mudstone	Gray	
43.5	46.8	3.3	Mudstone	Gray, hard	
46.8	47.0	0.2	Shale	Carbonaceous, dark gray, soft	
47.0	53.2	6.1	Coal	Hard, lustre	
53.2	53.4	0.2	Shale	Carbonaceous, dark gray	
53.4	57.3	3.9	Mudstone	Gray, soft	
57.3	57.4	0.1	Shale	Carbonaceous	
57.4	58.2	0.8	Mudstone	Gray, soft	
58.2	58.4	0.2	Coal	Thin seam, hard	
58.4	60.7	2.3	Mudstone	Gray, soft	
60.7	64.9	4.2	Coal	Broken, friable, resinous, FeS_2	
64.9	65.3	0.4	Shale	Carbonaceous, hard, dull black	

DRILL HOLE NO. 487-01

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
65.3	74.6	9.3	Shale	Light gray, soft to hard, sandy	
74.6	77.9	3.3	Sandstone	Light gray, hard, with soft shale interbedding.	
77.9	84.8	7.8	Shale	Gray, soft	
84.8	93.5	8.7	Shale	Light gray, hard, sandy, calcerous	
93.5	113.5	20.0	Sandstone	Light gray, very hard, fine grained.	
113.5	118.5	5.0	Shale	Gray, soft, broken	
118.5	132.4	13.9	Shale	Gray, soft, friable, intact.	
132.4	133.1	0.7	Coal	Thin lense, hard, lustrous.	
133.1	133.4	0.3	Shale	Tan, hard, parting	
133.4	136.1	2.7	Coal	Resinous, FeS2, calcite, hard, lustre	
136.1	136.2	0.2	Shale	Dark brown, soft	
136.2	140.4	4.2	Shale	Gray, soft	
140.4	143.2	2.8	Coal	Resinous, FeS2, gypsum-calcite flakes	
143.2	149.0	5.8	Shale	Gray, soft, broken, lost 4' in coring.	
149.0	156.0	7.0	Shale	Gray, soft, intact.	
156.0	158.5	2.5	Coal	Lustre, hard, FeS2, resinous	
158.5	159.9	1.4	Shale	Carbonaceous, dark gray, soft, parting	
159.9	162.4	2.5	Coal	Hard, lustre, resinous, FeS2	
162.4	168.0	5.6	Shale	Gray, soft	
168.0	168.0	0.8	Coal	Thin seam, hard, calcite	
168.8	171.0	2.2	Sandstone	Pictured cliffs formation.	
171.0	200.0	29.0	Sandstone	Pictured cliffs formation - "Rotary drilled for geophysical logging."	

DRILL HOLE NO. 487-01

BHP-UTAH INTERNATIONAL INC.

DRILL HOLE NO. 487-02, AREA 4N, Overburden Drilling PROJECT

COLLAR ELEVATION 5426.7, TOTAL DEPTH 160', DRILLER Jack Ledbetter

COORDINATES: N= 2,004,150 CONTRACTOR MOTE Drilling Co.

E= 292,615 DATE COLLARED December 8, 1987

SECTION ____, T ____ N, R ____ W DATE BOTTOMED December 8, 1987

SUMMARY

INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.	INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.
* See remarks.									
TOTALS & AVERAGES									

SEAM NAME	MINABLE COAL HORIZON	THICKNESS COAL	THICKNESS PARTINGS	THICKNESS SEAM	PROXIMATE ANALYSIS MOIST.	ASH	VOL.	F.C.	BTU	% SUL.	B.O.S. ELEV. A.F. TEMP.
7	37.2- 42.9	5.7	0-0.0	5.7	15.78	10.22	34.87	39.13	10096	1.38	2240
6 B	76.4- 82.1	5.7	0-0.0	5.7	16.46	10.32	33.54	39.68	10277	.62	2290
	82.1- 84.1	0.6	Carbon. Shale	2.0	14.66	35.64	25.60	24.10	6490	1.76	2290
4	88.5- 91.5	3.0	0-0.0'	3.0	15.40	19.94	31.66	33.00	8759	.96	2300
3 B	110.8-119.5	8.0	2-0.7'	8.7	14.11	21.10	31.25	33.54	8810	1.37	2280
2 E	135.7-138.8	3.1	0-0.0'	3.1	16.58	23.86	28.89	30.57	8034	1.36	2040
2 A	144.8-146.0	0.9	1-0.3	1.2	13.59	28.22	31.59	26.60	7971	1.74	2430

REMARKS- 0.0' to 5.0' collected rotary chip cuttings.
5.0' to 150.0' continuous core.
150.0' to 160.0' Rotary drilled for geophysical logging.

December 22, 1987
DATE

Leonard Dan
GEOLOGIST

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
0.0	2.0	2.0	Alluv.	Brown sand, tan, fine grained.	
2.0	4.0	2.0	Sandstone	Tan, oxidized, weathered, hard	
4.0	5.0	1.0	Shale	Gray-brown, soft, Fe stained	
5.0	6.4	1.4	Shale	Gray, soft, Fe stained.	
6.4	13.1	6.7	Sandstone	Cap rock, tan, hard, oxidized, organic laminae.	
13.1	13.9	0.8	Shale	Gray, soft, oxidized.	
13.9	15.0	1.1	Sandstone	Tan, hard, fine grained	
15.0	15.7	0.7	Shale	Tan, soft, stained	
15.7	16.0	0.3	Sandstone	Hard, Fe stained	
16.0	16.3	0.3	Shale	Tan, soft, Fe stained.	
16.3	16.5	0.2	Sandstone	Hard, light gray, shale interbedded.	
16.5	18.5	2.0	Shale	Tan, soft, oxidized	
18.5	23.9	5.4	Shale	Hard, gray, osidized, S.S. interbedded.	
23.9	24.7	0.8	Sandstone	Tan, hard, calcareous, fine grained.	
24.7	26.0	1.3	Shale	Gray, soft, Fe stained.	
26.0	27.3	1.3	Sandstone	Light gray, very hard, fine grained.	
27.3	29.4	2.1	Shale	Gray, soft, slightly stained.	
29.4	32.0	2.6	Sandstone	Light gray, hard, to very hard.	
32.0	35.0	3.6	Shale	Gray, soft, with hard s.s. interbedding.	
35.0	37.2	1.6	Shale	Gray, soft	
37.2	42.9	5.7	Coal	Hard, FeS2, calcite, lustre, 2 shale lense.	
42.9	45.0	2.1	Shale	Gray, soft	
45.0	47.7	2.7	Shale	Gray, soft, with minor sandstone streaks.	
47.7	60.0	12.3	Shale	Hard, fine grained, silty streaks.	
60.0	74.8	14.8	Siltstone	Fine grained, hard, calcareous.	
74.8	76.4	1.6	Shale	Gray, soft.	
76.4	82.1	5.7	Coal	Resinous, FeS2, calcite, hard, glossy black.	
82.1	83.5	1.4	Shale	Carbonaceous, coal streaks, hard, mostly shaley.	
83.5	84.1	0.6	Coal	Thin lense, hard, FeS2	
84.1	88.5	4.4	Shale	Gray, soft	
88.5	91.5	3.0	Coal	Hard, brittle, broken, FeS2, lustre	
91.5	98.9	7.4	Shale	Gray, soft, slight silty steaks.	

DRILL HOLE NO. 487-02

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
98.9	99.3	0.4	Shale	White, clayey, greasy, volcanic ash.	
99.3	110.8	11.5	Shale	Gray, soft	
110.8	112.0	1.2	Coal	Hard, lustre, resinous, FeS2.	
112.0	112.5	0.5	Shale	Tan, hard, coal streaks.	
112.5	118.8	6.3	Coal	Hard, lustre, FeS2, calcite, resinous.	
118.8	119.0	0.2	Shale	Soft, gray, parting.	
119.0	119.5	0.5	Coal	Hard, FeS2, lustre.	
119.5	126.2	6.7	Shale	Gray, soft.	
126.2	127.8	1.6	Shale	Light gray, clayish, soft.	
127.8	132.2	4.4	Shale	Gray, soft, dark gray shale bands.	
132.2	132.7	0.5	Coal	Bony, dull black, hard.	
132.7	133.7	1.0	Sh.	Gray, soft.	
133.7	133.9	0.2	Coal	Bony, dark gray, hard, dull texture.	
133.9	135.0	1.1	Shale	Gray, soft.	
135.0	135.7	0.7	Shale	Dark Gray, soft, non-carbonaceous.	
135.7	138.8	3.1	Coal	Hard, lustre, FeS2, resinous.	
138.8	144.8	6.0	Shale	Gray, soft, with s.s. streaks.	
144.8	145.7	0.9	Coal	FeS2, calcite, hard, lustre.	
145.7	146.0	0.3	Shale	Carbonaceous, dark gray, soft.	
146.0	147.0	1.0	Sandstone	Dark gray, hard, fine grained.	
147.0	150.0	3.0	Sandstone	Pictured cliffs formation.	
150.0	160.0	10.0	Sandstone	Pictured cliffs formation - Rotary plug for	
				electric logging.	

DRILL HOLE NO. 487-02

BHP-UTAH INTERNATIONAL INC.

DRILL HOLE NO. 487-03, AREA 4N, Overburden Drilling PROJECT

COLLAR ELEVATION 5392.1, TOTAL DEPTH 205', DRILLER Jack Ledbetter

COORDINATES: N= 1,998,023 CONTRACTOR Mote Drilling Co.

E= 300,508 DATE COLLARED December 09, 1987

SECTION ____, T ____ N, R ____ W DATE BOTTOMED December 10, 1987

SUMMARY

INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.	INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.
*See remarks									
on page 2.									
TOTALS & AVERAGES									

SEAM NAME	MINABLE COAL HORIZON	THICKNESS COAL	THICKNESS PARTINGS	THICKNESS SEAM	PROXIMATE ANALYSIS MOIST.	ASH	VOL.	F.C.	BTU	% SUL.	B.O.S. ELEV. / A.F. TEMP.
8 A	31.9- 33.9	2.0	--	2.0	16.74	8.03	34.92	40.31	10486	.61	2520
7	57.3- 61.0	3.5	1-0.2'	3.7	15.70	22.97	30.69	30.64	8300	.79	2380
	72.2- 73.3	1.1	0-0.0	1.1	14.00	22.92	29.97	33.11	8376	2.21	+ 2700
6 B	106.4-113.2	6.8	--	6.8	15.58	12.96	32.45	39.01	9889	.51	2470
4	134.6-138.0	2.4	1-1.0'	3.4	15.09	28.72	27.14	29.05	7627	1.13	2300
3 B	154.2-159.0	4.3	1-0.5'	4.8	12.99	28.42	28.89	29.70	7886	.64	2500
	159.0-161.2	--	Carbon. Shale	1.2	13.62	66.06	12.03	8.29	2135	.14	2270
3 A	161.2-165.4	4.0	1-0.2	4.2	15.31	23.35	28.18	33.16	8385	2.32	2130

REMARKS - → CONTINUED ON PAGE 2.

December 23, 1987
DATE

Andy Erickson
GEOLOGIST

DRILL HOLE NO. 487-03

BHP-UTAH INTERNATIONAL INC.

DRILL HOLE NO. 487-03, AREA _____, _____ PROJECT

COLLAR ELEVATION _____, TOTAL DEPTH _____, DRILLER _____

COORDINATES: N= _____ CONTRACTOR _____

E= _____ DATE COLLARED _____

SECTION _____, T _____ N, R _____ W DATE BOTTOMED _____

SUMMARY

INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.	INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.
TOTALS & AVERAGES									

SEAM NAME	MINABLE COAL HORIZON	THICKNESS COAL	THICKNESS PARTINGS	THICKNESS SEAM	PROXIMATE ANALYSIS MOIST.	ASH	VOL.	F.C.	BTU	% SUL.	B.O.S. ELEV. / A.F. TEMP.
2 B	175.6-177.7	1.9	1-0.2	2.1	15.78	9.72	33.89	40.61	10369	.76	------ / 2310
	177.7-178.4	--	Shale Parting	0.7	10.90	51.52	21.67	15.91	4873	4.48	------ / 2100
2 A	178.4-181.1	2.3	1-0.4	2.7	15.60	16.70	31.03	36.67	9384	.73	------ / 2340
1	187.4-188.5	1.1	0-0.0'	1.1	16.66	21.92	30.03	31.39	8411	1.69	------ / 2110

REMARKS - 0.0' to 5.0' - Collected rotary chips cuttings.
5.0' to 205.0 - Continuous core.

DATE _____ GEOLOGIST _____

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
0.0	5.0	5.0	Sandstone	Fine-medium grained, brown-tan, (rotary drilled).	
5.0	5.6	0.6	Sandstone	Tan, fine-medium grained.	
5.6	5.7	0.1	Sandstone	Fe stained, hard.	
5.7	6.0	0.3	Sandstone	Fine grained, tan, soft.	
6.0	6.1	0.1	Mudstone	Brown, very hard.	
6.1	7.2	1.1	Sandstone	Very fine grained, tan/brown.	
7.2	7.7	0.5	Mudstone	Gray, laminated, soft	
7.7	8.3	0.6	Sandstone	Very fine grained, gray, soft.	
8.3	8.9	0.6	Sandstone	Fine/medium grained, hard.	
8.9	9.0	0.1	Mudstone	Fe stained, hard.	
9.0	10.0	1.0	Shale	Gray, soft, S.S. interbedded.	
10.0	11.7	1.7	Sandstone	Fine grained, shale laminated, minor staining.	
11.7	12.2	0.5	Shale	Gray, soft.	
12.2	12.4	0.2	Sandstone	Medium Grained.	
12.4	14.0	1.6	Sandstone	Very fine grained.	
14.0	15.0	1.0	Shale	Gray, soft, S.S. interbedded.	
~~15.0~~	~~17.7~~	~~2.7~~	~~Sandstone~~	~~Fine/very fine grained, hard, gray~~	
17.7	18.1	0.4	Shale	Light gray.	
18.1	21.0	2.9	Shale	Light gray, soft.	
21.0	21.2	0.2	Sandstone	Light gray, hard, calcareous.	
21.2	21.4	0.2	Shale	Gray, soft.	
21.4	23.1	1.7	Limestone	Very fine grained, very hard.	
23.1	23.9	0.8	Shale	Sandstone streaks, light gray, hard.	
23.9	24.8	0.9	Shale	Light to dark gray.	
24.8	27.0	2.2	Shale	Dark gray.	
27.0	29.8	2.8	Shale	Gray, sofo (not recovered).	
29.8	30.0	0.2	Limestone	Very hard, medium gray.	
30.0	30.6	0.6	Shale	Light gray, hard, calcareous.	
30.6	31.4	0.8	Shale	Gray, soft.	
31.4	31.6	0.2	Sandstone	Fine grained, light gray.	
31.6	31.9	0.3	Shale	Gray, soft.	
31.9	33.9	2.0	Coal	Hard, lusterous, FeS_2, calcite.	

DRILL HOLE NO. 487-03

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
33.9	34.2	0.3	Shale	Carbonaceous, dark gray, soft.	
34.2	37.0	2.8	Shale	Dark gray, soft.	
37.0	39.0	2.0	Shale	Dark gray, very soft.	
39.0	45.0	6.0	Shale	Gray, soft, (not recovered).	
45.0	48.3	2.7	Shale	Gray, soft	
48.3	52.9	4.6	Shale	Gray, soft.	
52.9	56.9	4.0	Shale	Graditional gray - dark gray.	
56.9	57.3	0.4	Shale	Carbonaceous, minor coal lenses.	
57.3	58.4	1.1	Coal	Calcite, FeS2, hard, lustre.	
58.4	58.6	0.2	Shale	Gray, soft.	
58.6	61.0	2.4	Coal	Hard, FeS2, lustre, calcite, resinous.	
61.0	61.6	0.6	Shale	Carbonaceous, dark gray, soft.	
61.6	63.3	1.7	Shale	Soft, dark gray, organic.	
63.3	65.9	2.6	Sandstone	Hard, fine grained, shale interbedded.	
65.9	66.3	0.4	Sandstone	Fine grained, light gray, hard, calcite.	
66.3	68.5	2.2	Sandstone	Extra hard, calcareous, fine grained.	
68.5	69.3	0.8	Limestone	Calcareous, hard, very fine grained.	
69.3	71.7	2.4	Shale	Dark gray, soft.	
71.7	72.2	0.5	Shale	Carbonaceous, soft.	
72.2	73.3	1.1	Coal	Hard, lustreous, calcite.	
73.3	73.5	0.2	Shale	Carbonaceous, soft.	
73.5	79.8	6.3	Shale	Gray, soft.	
79.8	80.0	0.2	Shale	Carbonaceous.	
80.0	80.7	0.7	Shale	Dark gray, soft.	
80.7	82.3	1.6	Shale	Gray, soft.	
82.3	82.5	0.2	Shale	Carbonaceous.	
82.5	82.9	0.4	Coal	Thin seam, hard, with carbonaceous bands.	
82.9	83.1	0.2	Shale	Carbonaceous.	
83.1	84.9	1.8	Shale	Gray, soft, grading to dark gray.	
84.9	85.3	0.4	Shale	Carbonaceous.	
85.3	86.0	0.7	Shale	Dark gray, soft	
86.0	86.9	0.9	Coal	Thin seam, hard.	

DRILL HOLE NO. 487-03

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
86.9	87.1	0.2	Shale	Carbonaceous.	
87.1	92.0	4.9	Shale	Gray, soft, dark gray streaks.	
92.0	94.5	2.5	Shale	Dark gray, very soft, clayey.	
94.5	94.7	0.2	Sandstone	Light gray.	
94.7	96.8	2.1	Shale	Dark gray, very soft.	
96.8	97.0	0.2	Sandstone	Medium grained, hard.	
97.0	97.1	0.1	Shale	Gray.	
97.1	97.5	0.4	Sandstone	Light gray, medium grained, very hard, fossil shells.	
97.5	97.7	0.2	Limestone	Tan, very hard.	
97.7	98.1	0.4	Sandstone	Light gray, medium grained, very hard, fossil shells.	
98.1	106.4	8.3	Shale	Dark gray, soft, fossil shells.	
106.4	113.2	6.8	Coal	Hard, FeS2, calcite, lustre.	
113.2	114.3	1.1	Shale	Carbonaceous.	
114.3	118.3	4.0	Shale	Dark gray, soft with coal stringers - Carbonaceous shale.	
118.3	119.5	1.2	Shale	Dark gray, soft.	
119.5	124.2	4.7	Shale	Dark gray, soft, fossil shells, (0.5' lost).	
124.2	125.5	1.3	Shale	Sandstone interbedding, hard.	
125.5	127.5	2.0	Sandstone	Light gray, very hard, flaser bedding, fossil shells.	
127.5	127.7	0.2	Sandstone	Tan, shells, very hard, calcareous.	
127.7	129.4	1.7	Sandstone	Light gray, hard, shale interbedded.	
129.4	130.5	1.1	Sandstone	Hard, grading into shale.	
130.5	132.3	1.8	Shale	Dark gray, soft.	
132.3	132.7	0.4	Shale	Carbonaceous, dark gray.	
132.7	132.8	0.1	Coal	Bone, dull black, hard.	
132.8	132.9	0.1	Shale	Carbonaceous.	
132.9	133.9	1.0	Shale	Carbonaceous, soft.	
133.9	134.6	0.7	Shale	Gray, soft, some carbonaceous.	
134.6	137.0	2.4	Coal	FeS2, lustre, hard.	
137.0	137.4	0.4	Shale	Carbonaceous.	
137.4	138.0	0.6	Coal	Hard, with carbonaceous shale interbedding.	
138.0	139.7	1.7	Shale	Gray, soft.	
139.7	141.6	1.9	Shale	Dark gray, fossil shells, soft, minor carbonation.	

DRILL HOLE NO. 487-03

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
141.6	142.2	0.6	Sandstone	Light gray, with shale interbedding.	
142.2	145.1	2.9	Shale	Dark gray, soft, fossil shells.	
145.1	145.5	0.4	Claystone	Light gray, plastic, soft.	
145.5	153.6	8.1	Shale	Darker gray, soft.	
153.6	154.2	0.6	Shale	Carbonaceous.	
154.2	155.7	1.5	Coal	Hard, FeS2, calcite, lustre.	
155.7	156.2	0.5	Sandstone	Gray, with coal interbedding.	
156.2	159.0	2.8	Coal	Hard, FeS2, lustre.	
159.0	159.4	0.4	Shale	Carbonaceous.	
159.4	161.0	0.6	Shale	Dark gray, soft.	
161.0	161.2	0.2	Shale	Carbonaceous.	
161.2	165.4	4.2	Coal	FeS2, hard, lustre with carbonaceous shale streaks.	
165.4	167.0	1.6	Shale	Dark gray, soft.	
167.0	167.4	0.4	Shale	Carbonaceous.	
167.4	168.3	0.9	Shale	Darx gray, soft.	
168.3	168.6	0.3	Shale	Carbonaceous.	
168.6	169.0	0.4	Coal	Hard, lustre, thin seam.	
169.0	169.8	0.8	Shale	Carbonaceous.	
169.8	171.5	1.7	Shale	Gray, soft.	
171.5	172.1	0.6	Limestone	Tan, very hard	
172.1	173.8	1.7	Sandstone	Shale interbedding.	
173.8	175.6	1.8	Shale	Gray, soft, non carbonation.	
175.6	175.8	0.2	Shale	Carbonaceous, hard, dull black.	
175.8	177.7	1.9	Coal	Resinous, calcite, FeS2, hard, lustre.	
177.7	178.4	0.7	Shale	Dark gray, soft.	
178.4	179.3	0.9	Coal	FeS2, calcite, hard, lustre.	
179.3	179.7	0.4	Shale	Dark gray, soft, clayey.	
179.7	181.1	1.4	Coal	Resinous, FeS2, hard.	
181.1	181.2	0.1	Shale	Dark gray, soft, carbonaceous.	
181.2	182.0	0.8	Shale	Gray, soft.	
182.0	184.0	2.0	Sandstone	Light gray, soft, hard, silty, fine grained.	
184.0	187.4	3.4	Shale	Gray, soft.	

DRILL HOLE NO. 487-03

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
187.4	188.4	1.1	Coal	Calcite, hard, resinous.	
188.4	189.4	0.9	Shale	Gray, soft.	
189.4	205.0	15.6	Sandstone	Pictured cliffs formation.	

DRILL HOLE NO. 487-03

BHP-UTAH INTERNATIONAL INC.

DRILL HOLE NO. 487-04, AREA IV N, OVERBURDEN SAMPLING PROJECT

COLLAR ELEVATION 5408.6, TOTAL DEPTH 240', DRILLER JACK LEDBETTER

COORDINATES: N= 1,995,716 CONTRACTOR MO-TE DRILLING CO.

E= 306,666 DATE COLLARED DECEMBER 10, 1987

SECTION ____, T ____ N, R ____ W DATE BOTTOMED DECEMBER 11, 1987

SUMMARY

INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.	INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.

SEAM NAME	MINABLE COAL HORIZON	THICKNESS COAL	THICKNESS PARTINGS	THICKNESS SEAM	PROXIMATE ANALYSIS MOIST.	ASH	VOL.	F.C.	BTU	% S.	B.O.S. ELEV. A.F. TEMP.*
8A	66.7- 73.8	6.8	1- 0.3	7.1'	14.56	15.21	32.54	37.69	9697	1.08	2450
	75.0- 76.1	1.1	0 - 0.0	1.1	15.36	30.60	26.92	27.12	7256	3.05	2100
	76.1 -77.6	---	CARBN.	1.5	15.04	49.39	19.32	16.25	4128	1.38	+ 2700
7 RIDER	94.0- 96.1	1.2	3- 0.9	2.1	13.28	31.50	29.25	25.97	7272	1.32	+2700
	96.1-97.2	----	SHALE PARTING	1.1'	12.96	65.90	13.82	7.32	1891	.92	+2700
7	97.2- 101.1	3.2	2- 0.7'	3.9	14.28	19.65	31.47	34.60	9121	1.10	+2700
7R	105.4- 110.6	5.1	1. 0.1	5.2	15.22	13.95	33.74	37.09	9806	.67	+2700
6B	127.6- 130.8	3.0	1. 0.2	3.2	14.47	19.10	32.53	33.90	9074	1.68	2550

REMARKS - 0.0'- 4.0 COLLECTED CHIP CUTTINGS.

4.0'-240.0 CONTINOUS CORE SAMPLES

* FUSION TEMPERATURE OF ASH = INITIAL DEFORMATION @ REDUCING

DECEMBER 28, 1987
DATE

LEONARD DAN
GEOLOGIST

DRILL HOLE NO. 487- 04

BHP-UTAH INTERNATIONAL INC.

DRILL HOLE NO. 487- 04, AREA _____, _____ PROJECT

COLLAR ELEVATION _____, TOTAL DEPTH _____, DRILLER _____

COORDINATES: N= _____ CONTRACTOR _____

E= _____ DATE COLLARED _____

SECTION _____, T _____ N, R _____ W DATE BOTTOMED _____

SUMMARY

INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	%, REC'D.	INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	%, REC'D.

SEAM NAME	MINABLE COAL HORIZON	THICKNESS COAL	THICKNESS PARTINGS	THICKNESS SEAM	PROXIMATE ANALYSIS MOIST.	ASH	VOL.	F.C.	BTU	% S.	B.O.S. ELEV. / A.F. TEMP.
6A	134.1- 141.7	7.6	0-0.0'	7.6'	15.11'	11.60	33.35	39.94	10059	.46	------ / +2700
4	189.4- 193.1	3.6'	1.01'	3.7'	13.70	26.27	28.13	31.90	8189	.58	------ / 2550
3	209.5- 216.5	6.5	1-0.5	7.0'	14.37	24.81	27.71	33.11	8421	.44	------ / 2270
	216.5- 217.6	----	SHALE PARTING	1.1	12.29	76.11	7.86	3.74	924	.13	------ / 2350
2	217.6- 223.3	5.7	0 0.0	5.7	14.52	17.85	30.85	36.78	9347	.47	------ / +2700

REMARKS - _____

_____ DATE

_____ GEOLOGIST

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
0.0	4.0	4.0	Alluvial	Blown sand, with hard sandstone cappint (rotary drilling).	
4.0	8.0	4.0	Sandstone	Light tan, hard, oxidized.	
8.0	10.2	2.2	Shale	Gray, soft, oxidized.	
10.2	11.1	0.9	Claystone	Very hard, calcareous, gypsum flakes.	
11.1	15.0	3.9	Shale	Gray, soft, slightly oxidized.	
15.0	21.4	6.4	Shale	Gray, soft, gypsum, calcite, oxidized.	
21.4	23.9	2.5	Shale	Gray, hard, calcite, alkali flakes.	
23.9	25.9	2.0	Shale	Gray, soft, oxidized.	
25.9	28.3	2.4	Claystone	Gray, hard, calcareous.	
28.3	34.9	6.6	Shale	Gray, soft.	
34.9	36.0	1.1	Claystone	Light gray, very hard, calcareous.	
36.0	42.9	6.9	Shale	Gray, soft.	
42.9	44.2	1.3	Shale	Carbonaaceous, dark gray, soft.	
44.2	46.5	2.3	Shale	Gray, soft.	
46.5	46.7	0.2	Siltstone	Light gray, very hard.	
46.7	56.0	9.3	Shale	Gray, soft, numerous slickensides.	
56.0	56.5	0.5	Claystone	LIght gray, hard.	
56.5	66.6	10.1	Shale	Gray, soft, slicken side at top.	
66.6	66.7	0.1	Shale	Carbonaceous, dark gray, soft.	
66.7	69.7	3.0	Coal	Calcite, resinous, hard, lustre, calcareous.	
69.7	70.0	0.3	Shale	Clayey, soft, white, volcanic ash.	
70.0	73.8	3.8	Coal	Calcite, resinous, hard, lustre, calcareous.	
73.8	74.0	0.2	Shale	Non-carbonaceous, dark gray, soft.	
74.0	75.0	1.0	Shale	Gray, soft.	
75.0	76.1	1.1	Coal	Hard, FeS2, calcite, lustre.	
76.1	77.6	1.5	Shale	Dark gray, carbonaceous, hard.	
77.6	78.9	1.3	Shale	Dark gray, non-carbonaceous, soft.	
78.9	90.0	11.1	Claystone	Light gray, hard.	
90.0	94.0	4.0	Shale	Gray, soft with carbonaceous bands.	
94.0	94.3	0.3	Shale	Carbonaceous, dark gray, hard.	
94.3	95.1	0.8	Coal	Resinous, calcite, hard, FeS2.	
95.1	95.3	0.2	Shale	Parting, gray, soft.	

DRILL HOLE NO. 487-04

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
95.3	95.7	0.4	Coal	FeS2, calcite, lustre, hard.	
95.7	96.1	0.4	Shale	Slightly carbonaceous, dark gray.	
96.1	97.2	1.1	Shale	Gray, soft, parting.	
97.2	98.2	1.0	Coal	Hard, calcite, FeS2, lustre, resinous.	
98.2	98.5	0.3	Shale	Parting, soft, gray.	
98.5	100.7	2.2	Coal	Hard, lustre, calcite, FeS2.	
100.7	101.1	0.4	Shale	Carbonaceous, dark gray.	
101.1	102.1	1.0	Shale	Gray, soft.	
102.1	103.5	1.4	Siltstone	Light gray, very hard, very fine grained.	
103.5	105.4	1.9	Shale	Gray, soft.	
105.4	108.0	2.6	Coal	Resinous, FeS2, hard, lustre.	
108.0	108.1	0.1	Shale	Parting, white, volcanic ash.	
108.1	110.6	2.5	Coal	Resinous, FeS2, hard, calcite, lustre.	
110.6	111.0	0.4	Shale	Gray, soft.	
111.0	112.6	1.6	Sandstone	Light gray, very hard, fine grained.	
112.6	114.3	1.7	Claystone	Light gray, very hard, silty interbedding.	
114.3	117.8	3.5	Siltstone	Light gray, very hard, fine grained.	
117.8	123.8	6.0	Sandstone	Light gray, very hard.	
123.8	127.0	3.2	Shale	Gray, soft, silty.	
127.0	127.6	0.6	Shale	Slightly carbonaceous, soft, gray.	
127.6	130.6	3.0	Coal	Resinous, FeS2, calcite, lustre.	
130.6	130.8	0.2	Shale	Carbonaceous, dark gray, soft.	
130.8	134.1	3.3	Claystone	Light gray, hard, very fine grained.	
134.1	141.7	7.6	Coal	Resinous, FeS2, lustre, hard.	
141.7	150.9	9.2	Shale	Gray, soft, slicken sides.	
150.9	151.5	0.6	Sandstone	Light gray, hard, calcareous.	
151.5	159.2	7.7	Siltstone	Light gray, very hard.	
159.2	165.0	5.8	Sandstone	Light gray, hard, very fine grained.	
165.0	169.3	4.3	Shale	Gray, soft.	
169.3	170.3	1.0	Siltstone	Light gray, hard.	
170.3	174.4	4.1	Claystone	Light gray, hard.	
174.4	175.1	0.7	Sandstone	Gray, very hard.	

DRILL HOLE NO. 487-04

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
175.1	175.9	0.8	Shale	Gray, soft.	
175.9	177.0	1.1	Claystone	Light gray, very hard.	
177.0	178.0	1.0	Sandstone	Light gray, very hard.	
178.0	179.1	1.1	Claystone	Gray, hard.	
179.1	179.4	0.3	Shale	Gray, hard.	
179.4	183.0	3.6	Claystone	Light gray, hard.	
183.0	187.5	4.5	Shale	Gray, soft, fossil shells.	
187.5	189.4	1.9	Shale	Gray, soft.	
189.4	193.0	3.6	Coal	Resinous, FeS2, calcite, hard, lustre.	
193.0	193.1	0.1	Shale	Carbonaceous, dark gray, hard.	
193.1	196.5	3.4	Claystone	Light gray, hard, very fine grained.	
196.5	198.1	1.6	Siltstone	Light gray, hard, fine grained.	
198.1	201.9	3.8	Shale	Gray, soft.	
201.9	202.5	0.6	Claystone	Light gray, hard.	
202.5	206.3	3.8	Shale	Gray, soft, fossil shells.	
206.3	209.5	3.2	Shale	Dark gray, soft, non-cargbonaceous.	
209.5	210.2	0.7	Coal	Hard, lustre, nonchoidal fracture.	
210.2	210.7	0.5	Shale	Dark gray, soft, carbonaceous, bony streaks.	
210.7	216.5	5.8	Coal	Resinous, FeS2, hard lustre	
216.5	217.6	1.1	Shale	Gray, soft, parting	
217.6	223.3	5.7	Coal	Resinous, FeS2, hard lustre	
223.3	225.0	1.7	Shale	Gray, soft.	
225.0	225.2	0.2	Coal	Thin seam, hard, lustre.	
225.2	229.3	4.1	Shale	Gray, hard, silty	
229.3	237.7	8.4	Sandstone	Pictured cliffs formation with siltstone streaks.	
237.7	238.8	1.1	Claystone	Light gray, very hard.	
238.8	240.0	1.2	Sandstone	Pictured cliffs formation	

DRILL HOLE NO. 487-04

APPENDIX 5-A

BHP-UTAH INTERNATIONAL INC.

DRILL HOLE NO. 487-05, AREA 4N, OVERBURDEN DRILLING PROJECT

COLLAR ELEVATION 5,372.1, TOTAL DEPTH 200', DRILLER JACK LEDBETTER

COORDINATES: N= 2,006,336 CONTRACTOR MOTE DRILLING CO

E= 300,869 DATE COLLARED DECEMBER 11, 1987

SECTION ____, T ____ N, R ____ W DATE BOTTOMED DECEMBER 14, 1987

SUMMARY

INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.	INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.
*See Remarks.									

SEAM NAME	MINABLE COAL HORIZON	THICKNESS COAL	THICKNESS PARTINGS	THICKNESS SEAM	PROXIMATE ANALYSIS MOIST.	ASH	VOL.	F.C.	BTU	% S.	B.O.S. ELEV. / A.F. TEMP.
8B	36.9-39.1	2.2	0=0.0'	2.2	23.11	12.53	30.35	34.01	7183	..71	2140
8A	67.5-70.4	2.8	1-0.1	2.9	15.64	12.15	33.12	39.09	9975	.62	2250
7	86.3-92.5	6.1	1-0.1	6.2	14.39	10.79	35.01	39.81	10417	1.00	2340
6B	105.8-110.9	5.1	0-0.0	5.1	15.04	10.27	35.11	39.58	10432	.57	2380
4	134.3-136.5	2.2	0-0.0	2.2	15.35	18.17	31.59	34.89	9107	.61	2500
3B	153.5-157.6	4.0	1-0.1	4.1	14.33	19.25	31.22	35.20	9160	.76	2510
2B	169.2-177.5	8.1	1-0.2	8.3	15.92	12.80	32.35	38.93	9872	.55	2410
	190.7-191.6	0.9	0-0.0	0.9	13.49	17.25	33.41	35.85	9787	.79	2300

REMARKS- 0.0' to 4.0' - Collected rotary chip cuttings.
4.0' to 200' - Continuous core.

December 23, 1987
DATE

Leonard Dan
GEOLOGIST

DRILL HOLE NO. 487-05

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
0.0	4.0	4.0	Sandstone	Cap rock, tan, extra hard.	
4.0	7.8	3.8	Sandstone	Tan, hard, stained.	
7.8	8.1	0.3	Siltstone	Pink, oxidized, very hard.	
8.1	12.0	3.9	Sandstone	Tan, hard, stained.	
12.0	19.6	7.6	Shale	Gray, soft, Fe stained.	
19.6	20.2	0.6	Coal	Badly weathered, soft, friable.	
20.2	21.8	1.6	Shale	Light brown, soft, clayey.	
21.8	22.1	0.3	Coal	Thin seam, soft, friable.	
22.1	29.0	6.9	Shale	Light brown, soft, weathered, (Lost 6.4')	
29.0	36.9	7.9	Shale	Light brown, soft, calcite, gypsum.	
36.9	39.1	2.2	Coal	Intact, soft, oxidized.	
39.1	39.4	0.3	Shale	Carbonaceous, dark gray, soft.	
39.4	44.0	4.6	Shale	Gray, soft.	
44.0	50.0	6.0	Claystone	Light gray, hard, angular fractures.	
50.0	52.6	2.6	Sandstone	Light gray, hard, shale interbedded.	
52.6	53.9	1.3	Shale	Gray, soft.	
53.9	54.2	.3	Sandstone	Light gray, hard.	
54.2	57.6	3.4	Sandstone	Light gray, hard, shale interbedded.	
57.6	58.6	1.0	Shale	Gray, soft, angular fractures.	
58.6	65.8	7.2	Shale	Gray, soft, with sandstone interbedding.	
65.8	66.3	0.5	Sandstone	Silty, hard, fine grained.	
66.3	67.0	0.7	Shale	Gray, soft.	
67.0	67.5	0.5	Sandstone	Gray, hard.	
67.5	67.6	0.1	Coal	Hard, FeS2, calcite, lustre.	
67.6	67.7	0.1	Shale	Grey, Soft, calcite, alkalai.	
67.7	70.4	2.7	Coal	Resinous, FeS2, Hard, lustre.	
70.4	76.0	5.6	Shale	Grey, Soft	
76.0	78.1	1.5	Shale	Gray, soft.	
78.1	81.3	3.2	Sandstone	Light gray, hard	
81.3	86.3	5.0	Shale	Grey, Soft	
86.9	92.4	6.1	Coal	Resinous, FeS2, Calcite, Hard, Lustre	
92.4	92.5	0.1	Shale	Carbonaceous, Dark Grey, Soft	

DRILL HOLE NO. 487-05

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
92.5	95.3	2.8	Shale	Grey, Soft	
95.3	95.9	0.6	Claystone	Light gray,very hard.	
95.9	105.8	9.9	Shale	Grey, Soft	
105.8	110.9	5.1	Coal	Resinous, FeS2, calcite, hard, lustre.	
110.9	112.9	2.0	Shale	Dark gray, soft.	
112.9	118.1	5.2	Shale	Gray, soft.	
118.1	119.1	1.0	Sandstone	Light gray, hard.	
119.1	122.8	3.7	Shale	Gray, soft.	
122.8	124.0	2.2	Sandstone	Light gray, hard.	
124.0	125.7	1.7	Shale	Gray, soft.	
125.7	134.3	8.6	Sandstone	Silty, hard, light gray, shale streak.	
134.3	136.5	2.2	Coal	Resinous, FeS2, hard, lustre.	
136.5	139.3	2.8	Shale	Grey, Soft	
139.3	140.3	1.0	Sandstone	Light gray, very hard.	
140.3	145.7	5.4	Shale	Grey, Soft	
145.7	146.0	0.3	Shale	White, clayey, volcanic ash.	
146.0	153.4	7.4	Shale	Grey, Soft	
153.4	153.5	0.1	Shale	Carbonaceous, dark gray.	
153.5	154.0	0.5	Coal	FeS2, hard, calcite, lustre.	
154.0	154.1	0.1	Sandstone	Thin parting, hard, light gray.	
154.1	157.6	3.5	Coal	Resinous, FeS2, calcite, hard, lustre.	
157.6	159.2	1.6	Shale	Grey, Soft	
159.2	160.0	0.8	Sandstone	Light gray, hard	
160.0	164.7	4.7	Shale	Grey, Soft	
164.7	165.3	0.6	Claystone	Light gray, very hard.	
165.3	165.9	0.6	Shale	Gray, soft, sandstone streaks.	
165.9	166.4	0.5	Siltstone	Light gray, very hard, calcareous.	
166.4	167.1	0.7	Shale	Grey, Soft	
167.1	167.9	0.8	Sandstone	Light gray, hard.	
167.9	169.2	1.3	Shale	Grey, Soft	
169.2	169.4	0.2	Coal	Bony, hard, dull black.	
169.4	177.5	8.1	Coal	Resinous, FeS2, Calcite, Hard, Lustre	

DRILL HOLE NO. 487-05

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
177.5	181.1	3.6	Shale	Grey, Soft	
181.1	185.1	4.0	Claystone	Fine grained, hard, light gray.	
185.1	190.0	4.0	Sandstone	Light gray, hard.	
190.0	190.7	0.7	Shale	Grey, Soft	
190.7	191.6	0.9	Coal	Thin seam, hard, lustre, FeS2.	
191.6	191.9	0.3	Sandstone	Brown, hard, stained.	
191.9	199.0	8.1	Sandstone	Pictured cliffs formation	

DRILL HOLE NO. 487-05

APPENDIX 5-A

BHP-UTAH INTERNATIONAL INC.

DRILL HOLE NO. 289-01, AREA Block B Overburden, PROJECT

COLLAR ELEVATION 5456, TOTAL DEPTH 266, DRILLER Jack Ledbetter

COORDINATES: N= 2048940 CONTRACTOR MO-TE

E= 311850 DATE COLLARED 7/18/89

SECTION ____, T ____ N, R ____ W DATE BOTTOMED 7/19/89

SUMMARY

INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.	INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.

SEAM NAME	MINABLE COAL HORIZON	THICKNESS COAL	THICKNESS PARTINGS	THICKNESS SEAM	PROXIMATE ANALYSIS MOIST.	ASH	VOL.	F.C.	BTU	% S.	INIT / SOFT
8	177.0 - 191.9				12.36	21.70			9081	0.62	2694 / 2700
7B	201.1 - 203.6				11.58	29.19			8141	1.65	2431 / 2606
6	238.3 - 246.2				12.95	23.41			8656	0.87	2375 / 2523

REMARKS - No water table encountered.

07/19/89 DATE

Dave Hoag GEOLOGIST

DRILL HOLE NO. 289-01

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
0.0	5.0		SS	QTZ SS, HARD, MESA CAPROCK, CUTTINGS	
5.0	5.4		"	QTZ SS, HARD, MESA CAPROCK, CORE.	
5.40	34.0		SS	BROWN, MD GR., MD. HARD, LAMINATED	
34	35.6		CLAYSTONE	BROWN	
35.6	38.2		CLAYSTONE	DARK BROWN, CARBONACEOUS	
38.2	46.0		SILTSTONE	GRAY W/BROWN STAINS, SOME VFG SS	
46.0	72.2		SS	GARY, LAMINATED	
72.2	73.7		SH	D. GY.	
73.7	75.2		SH	CARBONACEOUS	
75.2	81.2		CLAYSTONE	D-MD GY, SILTY	
81.2	81.8		SHALE	CARBONACEOUS	
81.8	83.0		CLAYSTONE	DK.-MD GY, SILTY	
83.0	86.0		LOST		
86.0	93.2		CLAYSTON	DK. MD GY, SILTY	
93.2	113.0		SS	LT GY. MD HARD LAMINATED, F-M. GRAIN	
113.0	114.8		SH	M. GY, SOFT	
114.8	119.2		SS	LT. GY. F-M GR, CARB. LAMINAE	
119.2	120.4		SH	CARBONACEOUS, SOFT	
120.4	135.3		CLAYSTONE	LT.-M. GY, SILTY, MED HARD	
135.3	177.0		SANDSTONE	LIGHT GRAY, MEDIUM HARD, FAIR-MEDIUM GRAY, CARB	LAMS
177.0	178.0		COAL	BONY	
178.0	178.3		PARTING	TAN SHALE & BONY COAL	
178.3	178.8		COAL	BONY	
178.8	178.9		SANDSTONE	TAN, FAIR GRAY, SOFT	
178.9	180.6		COAL	LUSTROUS	
180.6	180.9		COAL	BONY	
180.9	181.0		SHALE	TAN. SOFT	
181.0	181.5		COAL	LUSTROUS	
181.5	181.7		PARTING	TAN, SHALE	
181.7	183.5		COAL	HARD, LUSTROUS	
183.5	183.6		PARTING	TAN, SANDY SHALE	
183.7	187.6		COAL	HARD, LUSTROUS	

DRILL HOLE NO. 289-01

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
187.6	187.7		SH	TAN, SOFT	
187.7	189.4		COAL	HARD, LUSTROUS, RESINOUS	
189.4	189.5		SH	TAN, SOFT	
189.5	191.7		COAL	HARD, LUSTROUS RESINOUS	
191.7	191.9		SH	CARBONACEOUS	
191.9	200.8		CLAYSTONE	DK-MD GY, SILTY, MED HARD	
200.8	201.1		SH	CARBONACEOUS	
201.1	203.4		COAL	HARD, LUSTROUS, RESIN	
203.4	203.6		SH	CARB	
203.6	209.1		CLAYSTONE	GRAY, SILTY, MED HARD	
209.1	209.2		SH	CARB	
209.2	209.9		COAL	HARD, LUSTROUS	
209.9	211.1		SH	CARB	
211.1	214.2		CLAYSTONE	M GRAY, SILTY, MED HARD	
214.2	215.9		SS	LT GRAY, FGR, SOME CARB LAMS	
215.9	216.4		CLAYSTONE	M GRY, MED HARD	
216.4	217.0		COAL	HARD, BONY	
217.0	218.0		SH	CARB	
218.0	221.8		CLAYSTONE	M-DK GY, MED HARD	
221.8	229.6		SS	LAMINATED LT AND DK GRAY, F. GR.	
229.6	238.3		SH	DK GRY, SOME SS LAMS	
238.3	239.0		COAL	BONY	
239.0	244.9		COAL	HARD, LUSTROUS, DISSENIMATED FeS_2, GYPSUM	
244.9	245.0		SH	TAN PARTING	
245.0	245.9		COAL	HARD, LUSTROUS, FeS_2, GYPSUM	
245.9	246.2		SH	CARB	
246.2	256.0		SANDSTONE	LIGHT-DARK GRAY, LAMINATED, FAIR GRAY	
256.0	266.0		SHALE	MEDIUM GRAY, 70% OYSTERS, SOME SAND	

DRILL HOLE NO. 289-01

APPENDIX 5-A

BHP-UTAH INTERNATIONAL INC.

DRILL HOLE NO. 289-02, AREA Block B, Overburden PROJECT

COLLAR ELEVATION 5381, TOTAL DEPTH 256, DRILLER Jack Ledbetter

COORDINATES: N= 2047826 CONTRACTOR MO-TE

E= 316995 DATE COLLARED 08/01/89

SECTION _____, T _____ N, R _____ W DATE BOTTOMED 08/02/89

SUMMARY

INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.	INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.

SEAM NAME	MINABLE COAL HORIZON	THICKNESS COAL	THICKNESS PARTINGS	THICKNESS SEAM	PROXIMATE ANALYSIS MOIST.	ASH	VOL.	F.C.	BTU	% S.	INIT / SOFT
8	172.3 - 186.1				11.62	32.33			7440	0.64	2700 / 2700
7B	207.3 - 210.1				11.45	33.07			7516	1.80	2590 / 2700
6	234.6 - 243.0				11.37	27.09			8487	1.05	2377 / 2449

REMARKS - Water Table encounter at 180.0 ft.

08/02/89
DATE

Dave Hoag
GEOLOGIST

DRILL HOLE NO. 289-02

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
0.0	5.0		CLAY	BROWN, SOFT DRILL CUTINGS	
5.0	6.8		CLAYSTONE	TAN, SILTY, SOFT	
6.8	14.2		CLAYSTONE	BROWN, SOFT, SILTY	
14.2	19.8		CLAYSTONE	TAN, BROWN STAINS, SANDY, MED HARD	
19.8	23.2		SHALE	CARBONACEOUS, SOFT	
23.2	26.7		SHALE	MED GRAY, SLIGHTLY CARBONACEOUS	
26.7	32.8		CLAYSTONE	TAN TO GRAY, SILTY TO SANDY, SOFT	
32.8	35.5		SANDSTONE	LT GRAY, MOTTLED, FG, HARD	
35.5	36.0		SHALE	CARBONACEOUS	
36.0	42.2		CLAYSTONE	MED GRAY, SILTY, SOFT	
42.2	44.2		SHALE	CARBONACEOUS	
44.2	68.2		SANDSTONE	LT-MED GRAY, FG, MED HARD	
68.2	73.3		CLAYSTONE	MED GRAY, SANDY, HARD	
73.3	76.8		SANDSTONE	LT GRAY, FG, HARD	
76.8	96.0		CLAYSTONE	MED GRAY, SILTY, HARD	
96.0	136.5		SANDSTONE	LT GRAY, FG, HARD, LAMINATED	
136.5	162.8		CLAYSTONE	MED-DK GRAY, SILTY, HARD	
162.8	170.0		SANDSTONE	LT GRAY, FG, LAMINATED, HARD	
170.0	172.3		CLAYSTONE	MED-DK GRAY, SILTY, HARD	
172.3	172.5		SHALE	CARBONACEOUS	
172.5	175.8		COAL	HARD, FRESH	
175.8	176.1		SHALE	CARBONACEOUS, SANDY	
176.1	176.3		COAL	HARD, FRESH	
176.3	176.5		SHALE	CARBONACEOUS, SANDY	
176.5	177.2		COAL	HARD, FRESH	
177.2	177.7		SHALE	CARBONACEOUS, SANDY	
177.7	179.6		COAL	HARD, FRESH	
179.6	180.5		SHALE	CARBONACEOUS, SANDY	
180.5	186.0		COAL	HARD, FRESH	
186.0	186.1		SHALE	CARBONACEOUS	
186.1	190.7		CLAYSTONE	MED GRAY, SILTY	
190.7	191.0		COAL	HARD, FRESH	

DRILL HOLE NO. 289-02

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
191.0	191.1		SHALE	CARBONACEOUS	
191.1	199.4		CLAYSTONE	MED-LT GRAY, SANDY, HARD	
199.4	203.7		SANDSTONE	LT GRAY, LAMINATED, HARD	
203.7	207.3		CLAYSTONE	MED-LT GRAY, SANDY, HARD	
207.3	208.0		SHALE	CARBONACEOUS	
208.0	210.1		COAL	HARD, FRESH	
210.1	215.5		SANDSTONE	LT-MED GRAY, CONVOLUTED LAMINAE	
215.5	216.0		COAL	HARD, FRESH	
216.0	217.6		SANDSTONE	LT GRAY, FG, LAMINATED, HARD	
217.6	218.3		CLAYSTONE	MED GRAY, SANDY, HARD	
218.3	219.2		COAL	HARD, FRESH	
219.2	219.3		SHALE	CARBONACEOUS	
219.3	221.5		CLAYSTONE	MED-DK GRAY, SANDY, HARD	
221.5	225.7		SANDSTONE	LT GRAY, FG, LAMINATED, HARD	
225.7	234.6		CLAYSTONE	MED-DK GRAY, SANDY, HARD	
234.6	234.7		SHALE	CARBONACEOUS	
234.7	235.4		COAL	HARD, FRESH	
235.4	235.7		SHALE	CARBONACEOUS	
235.7	239.7		COAL	HARD, FRESH	
239.7	239.8		SHALE	TAN, SANDY	
239.8	242.6		COAL	HARD, FRESH	
242.6	243.0		SHALE	CARBONACEOUS	
243.0	250.2		CLAYSTONE	MED-DK GRAY, SANDY	
250.2	256.0		SANDSTONE	LT GRAY, LAMINATED, HARD	

DRILL HOLE NO. 289-02

APPENDIX 5-A

BHP-UTAH INTERNATIONAL INC.

DRILL HOLE NO. 289-03, AREA _____, Block B Overburden PROJECT

COLLAR ELEVATION 5446, TOTAL DEPTH 276, DRILLER Jack Ledbetter

COORDINATES: N= 2043470 CONTRACTOR MO-TE

E= 311610 DATE COLLARED 07/19/89

SECTION _____, T _____ N, R _____ W DATE BOTTOMED _____

SUMMARY

INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.	INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.

SEAM NAME	MINABLE COAL HORIZON	THICKNESS COAL	THICKNESS PARTINGS	THICKNESS SEAM	PROXIMATE ANALYSIS MOIST.	ASH	VOL.	F.C.	BTU	% S.	INIT / SOFT
8	196.1 - 215.0				11.72	25.71			8539	0.69	2700 / 2700
7B	223.8 - 227.0				12.64	40.38			6243	1.73	2490 / 2705
6	255.6 - 263.7				12.91	19.43			9316	0.56	2640 / 2700

REMARKS - Water Table encountered at 196 feet depth.

07/18/89
DATE

Dave Hoag
GEOLOGIST

DRILL HOLE NO. 289-03

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
0.0	5.0			CUTTING	
5.0	9.4		SS	LT BRN, VFG - FG, SILTY, FRIABLE	
9.4	17.8		CLAY	DARK BRN, SOFT	
17.8	19.6		SS	BROWN, FG-VFG, SOFT, FRIABLE	
19.6	37.0		CLAYSTONE	BROWN, SILTY, SOFT, CARBONACEOUS, LAMINAE	
37.0	39.4		SS	BROWN, LAMINATED, FRIABLE	
39.4	43.0		CLAYSTONE	BROWN, SILTY, CARBONACEOUS LAM SOFT	
43.0	55.0		CLAYSTONE	GRAY, SILTY, SOFT	
55.0	56.4		CLAYSTONE	CARBONACEOUS	
56.4	66.3		CLAYSTONE	M. GRAY, SILTY, MED HARD	
66.3	79.0		SS	LT GRAY, FG, MED HARD	
79.0	80.6		CLAYSTONE	CARBONACEOUS	
80.6	84.0		CLAYSTONE	M-D GY, SILTY	
84.0	97.2		CLAYSTONE	CARBONACEOUS	
97.2	98.5		SLTST	LT GRY, MD HARD	
98.5	105.9		CLAYSTONE	DARK GRAY, SOFT	
105.9	109.8		SLTST	LT GRY, HARD	
109.8	112.1		CLAYSTONE	DARK GRAY, SOFT	
112.1	113.6		CLAYSTONE	CARBONACEOUS	
113.6	114.1		COAL	SHALEY, HARD LUSTROUS	
114.1	118.0		CLAYSTONE	DARK GRAY, MED HARD	
118.0	118.3		SH	CARBONACEOUS	
118.3	126.1		CLAYSTONE	DARK-MED GRAY, HARD	
126.1	126.2		COAL	HARD, CALCITE VEINS	
126.2	128.6		CLAYSTONE	DARK-MED GRAY HARD	
128.6	129.2		SILTSTONE	LT GRAY, HARD	
129.2	136.7		CLAYSTONE	DARK-MED GRAY, MED HARD	
136.7	137.7		SS	LT. GRAY, FGR, HARD	
137.7	138.4		CLAYSTONE	DARK-MED GRAY, MED HARD	
138.4	139.8		SS	LT GRAY, FGR, HARD	
139.8	171.2		SILTSTONE	DARK-MED GRAY, SOME CARB LAMS	
				MED HARD	

DRILL HOLE NO. 289-03

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
171.2	176.9		CLAYSTONE	LT GY, SLIGHTLY SILTY, HARD	
176.9	180.9		CLAYSTONE	M. GY, HARD	
180.9	184.6		SILTSTONE	LT GY, HARD	
184.6	196.1		CLAYSTONE	LT MED GRAY, HARD, SILTY	
196.1	197.0		SHALE	CARBONACEOUS	
197.0	197.6		COAL	HARD, LUSTROUS	
197.6	197.7		CLAYSTONE	LT GRAY, SILTY	
197.7	200.0		COAL	HARD LUSTROUS	
200.0	200.1		CLAYSTONE	LT GRAY, SILTY	
200.1	200.6		COAL	HARD, LUSTROUS	
200.6	200.7		CLAYTONE	LT GRAY, SILTY	
200.7	206.6		COAL	HARD, LUSTROUS	
206.6	206.8		SH	CARBONACEOUS	
206.8	207.3		SILTSTONE	LT GRAY, HARD	
207.3	210.9		COAL	HARD, LUSTROUS	
210.9	211.0		SHALE	TAN, HARD	
211.0	213.0		COAL	HARD, LUSTROUS	
213.0	213.2		SHALE	TAN, HARD	
213.2	214.9		COAL	HARD, LUSTROUS	
214.9	215.6		COAL	BONY	
215.6	216.0		SHALE	CARBONACEOUS	
216.0	219.6		SANDSTONE	LT GRAY, FG, HARD	
219.6	223.8		CLAYSTONE	M GRAY, SILTY, HARD	
223.8	224.2		SHALE	CARBONACEOUS	
224.2	226.8		COAL	HARD LUSTROUS (7B SEAM)	
226.8	227.0		SHALE	CARBONACEOUS	
227.0	230.5		SILTSTONE	M GRAY, HARD	
230.5	231.3		COAL	HARD, LUSTROUS (7A SEAM)	
231.3	231.7		SHALE	CARBONACEOUS	
231.7	232.4		CLAYSTONE	MED GRAY, HARD	
232.4	232.9		SHALE	CARBONACEOUS	
232.9	235.3		CLAYSTONE	MED GRAY, SILTY, HARD	

DRILL HOLE NO. 289-03

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
235.3	235.9		COAL	HARD, LUSTROUS	
235.9	236.4		SHALE	CARBONACEOUS	
236.4	246.5		SANDSTONE	LT GRAY, VFG-FG, HARD	
246.5	255.6		CLAYSTONE	DK GRAY, SILTY, HARD	
255.6	255.9		SHALE	CARBONACEOUS	
255.9	260.3		COAL	HARD, LUSTROUS	
260.3	260.4		CLAYSTONE	TAN, SANDY	
260.4	263.4		COAL	HARD, LUSTROUS	
263.4	263.7		SHALE	CARBONACEOUS	
263.7	266.5		SS	LT GRAY, FG, HARD	
266.5	268.8		CLAYSTONE	MED GRAY, SILTY, HARD	
268.8	276.0		SS	LT GRAY, FG, HARD	

DRILL HOLE NO. 289-03

APPENDIX 5-A

BHP-UTAH INTERNATIONAL INC.

DRILL HOLE NO. 289-04, AREA BLOCK B, OVERBURDEN PROJECT

COLLAR ELEVATION 5453, TOTAL DEPTH 260, DRILLER Jack Ledbetter

COORDINATES: N= 2039963 CONTRACTOR MO-TE

E= 308515 DATE COLLARED 08/02/89

SECTION ____, T ____ N, R ____ W DATE BOTTOMED 08/03/89

SUMMARY

INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.	INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.

SEAM NAME	MINABLE COAL HORIZON	THICKNESS COAL	THICKNESS PARTINGS	THICKNESS SEAM	PROXIMATE ANALYSIS MOIST.	ASH	VOL.	F.C.	BTU	% S.	INIT / SOFT
8	181.7 201.8				12.15	23.37			8817	0.49	2700 / 2700
7	210.4 - 215.0				12.90	25.52			8444	1.17	2462 / 2600
6	242.4 - 250.0				13.14	21.06			9054	0.54	2636 / 2700

REMARKS - No water table encountered.

08/03/89 — DATE

David Hoag — GEOLOGIST

DRILL HOLE NO. 289-04

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
0.0	5.0		SANDSTONE	LT GRAY, VFG-FG MED HARD/DRILL CUTTINGS	
5.0	13.8		SANDSTONE	LT GRAY, VFG-FG MED HARD	
13.8	15.0		SHALE	CARBONACEOUS	
15.0	43.0		CLAYSTONE	LT DK GRAY, SAND, STAINED BROWN	
43.0	44.2		SHALE	CARBONACEOUS	
44.2	48.0		CLAYSTONE	MED-DK GRAY, SILTY.	
48.0	48.2		SHALE	CARBONACEOUS, SOFT	
48.2	48.9		COAL	SHALEY, SOFT	
48.9	60.0		CLAYSTONE	LT-DK GRAY, SILTY, MED HARD	
60.0	61.8		SHALE	CARBONACEOUS	
61.8	78.2		CLAYSTONE	MED-DK GRAY, SILTY, MED HARD	
78.2	83.0		SANDSTONE	LT GRY, VFG, HARD	
83.0	95.0		CLAYSTONE	MED-DARK GRAY, SILTY, MED HARD	
95.0	95.4		COAL	SHALEY	
95.4	105.8		CLAYSTONE	MED-DARK GRAY, SILTY, MED HARD	
105.8	106.2		SHALE	CARBONACEOUS	
106.2	113.8		CLAYSTONE	MED-DARK GRAY, SILTY, MED HARD	
113.8	115.4		SHALE	CARBONACEOUS	
115.4	119.6		CLAYSTONE	MED-DARK GRAY, SILTY, MED HARD	
119.6	119.8		SHALE	CARBONACEOUS	
119.8	119.9		COAL	SHALEY	
119.9	120.0		SHALE	CARBONACEOUS	
120.0	128.6		CLAYSTONE	MED-DARK GRAY, SILTY, MED HARD	
128.6	181.7		CLAYSTONE	MED-LT GRAY, SANDY HARD	
181.7	181.9		SHALE	CARBONACEOUS	
181.9	182.0		SHALE	TAN, SOFT	
182.0	182.1		SHALE	CARBONACEOUS	
182.1	182.2		SHALE	TAN, SOFT	
182.2	192.4		COAL	HARD, FRESH	
192.4	192.6		SHALE	TAN, SANDY	
192.6	198.6		COAL	HARD, FRESH	
198.6	198.8		SHALE	TAN, SANDY	

DRILL HOLE NO. 289-04

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
198.8	201.8		COAL	HARD, FRESH, MINOR PARTINGS	
201.8	207.2		SANDSTONE	LT-MED GRAY, FG, LAMINATED, HARD	
207.2	210.4		CLAYSTONE	MED GRAY, SANDY, HARD	
210.4	210.8		SHALE	CARBONACEOUS	
210.8	214.7		COAL	HARD, FRESH	
214.7	215.0		SHALE	CARBONACEOUS	
215.0	217.6		SHALE	CARBONACEOUS	
217.6	220.3		CLAYSTONE	MED-DARK GRAY, SANDY, HARD	
220.3	223.6		SHALE	CARBONACEOUS	
223.6	233.7		SANDSTONE	LT-MED GRAY, LAMINATED, FG, HARD.	
233.7	242.4		CLAYSTONE	MED-DARK GRAY, SANDY, HARD	
242.4	242.7		SHALE	CARBONACEOUS	
242.7	246.6		COAL	HARD, FRESH	
246.6	246.7		SHALE	TAN, SANDY	
246.7	244.8		COAL	HARD, FRESH	
244.8	250.3		SHALE	CARBONACEOUS	
250.3	256.4		CLAYSTONE	MED-LT GRAY, SANDY, HARD	
256.4	260.0		SANDSTONE	LT GRAY, FG, HARD	

DRILL HOLE NO. 289-04

APPENDIX 5-A

BHP-UTAH INTERNATIONAL INC.

DRILL HOLE NO. 289-05, AREA Block B, Overburden PROJECT

COLLAR ELEVATION 5419, TOTAL DEPTH 212, DRILLER Jack Ledbetter

COORDINATES: N= 2037300 CONTRACTOR MO-TE

E= 304350 DATE COLLARED 08/04/89

SECTION _____, T _____ N, R _____ W DATE BOTTOMED _____

SUMMARY

INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.	INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.

SEAM NAME	MINABLE COAL HORIZON	THICKNESS COAL	THICKNESS PARTINGS	THICKNESS SEAM	PROXIMATE ANALYSIS MOIST.	ASH	VOL.	F.C.	BTU	% S.	INIT / SOFT
8	120.0 - 140.2				12.36	26.84			8227	0.76	2505 / 2599
7B	148.5 - 153.6				13.63	23.35			8565	1.28	2640 / 2700
6	179.6 - 187.4				12.91	20.61			9106	0.49	2700 / 2700
3	204.6 - 206.4				12.90	35.75			6712	1.12	2700 / 2700

REMARKS - No water table encountered.

DATE

David Hoag
GEOLOGIST

DRILL HOLE NO. 289-05

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
0.0	5.0		SAND, CLAY	TAN, SOFT DRILL CUTTINGS.	
5.0	15.3		CLAYSTONE	GRAY, BROWN STAINS, SOFT	
15.3	16.8		SILTSTONE	LT GRAY, VERY HARD	
16.8	32.2		CLAYSTONE	MED GRAY, SILTY TO SANDY, SOFT	
32.2	33.5		SHALE	CARBONACEOUS	
33.5	35.7		CLAYSTONE	MED-LT GRAY, SANDY, GYPSUM	
35.7	36.7		SILTSTONE	LT GRAY, VERY HARD	
36.7	40.3		CLAYSTONE	MED GRAY, SILTY, SOFT	
40.3	40.8		SHALE	CARBONACEOUS	
40.8	55.2		CLAYSTONE	MED-DARK GRAY, SILTY, SOFT	
55.2	68.0		SHALE	CARBONACEOUS	
68.0	76.0		CLAYSTONE	MED-DARK GRAY, SILTY, SOFT	
76.0	91.0		CLAYSTONE	MED-LT GRAY, SANDY, HARD	
91.0	93.8		SANDSTONE	LT GRAY, FG, SHELLS, HARD	
93.8	119.2		CLAYSTONE	LT-DARK GRAY, SITLY, MED HARD	
119.2	120.0		CLAYSTONE	DARK GRAY, SLIGHTLY CARBONACEOUS	
120.01	120.7		SHALE	CARBONACEOUS	
120.7	125.2		COAL	HARD, FRESH	
125.2	125.4		SHALE	TAN, SANDY	
125.4	131.2		COAL	HARD, FRESH	
131.2	131.4		SHALE	TAN, SANDY	
131.4	139.7		COAL	HARD, FRESH	
139.7	140.2		SHALE	CARBONACEOUS	
140.2	144.6		SANDSTONE	LT GRAY, FG, LAMINATED HARD	
144.6	148.5		CLAYSTONE	MED-DARK GRAY, SILTY, MED HARD	
148.5	148.8		SHALE	CARONACEOUS	
148.8	153.6		COAL	HARD, FRESH	
153.6	155.3		SHALE	SLIGHTLY CARBONACEOUS	
155.3	158.9		CLAYSTONE	LT-MED GRAY, SANDY, HARD	
158.9	161.6		SHALE	CARBONACEOUS	
161.6	168.2		CLAYSTONE	LT-MED GRAY, SANDY, HARD	
168.2	179.6		CLAYSTONE	DARK-MED GRAY, SILTY, HARD	

DRILL HOLE NO. 289-05

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
179.6	179.7		SHALE	CARBONACEOUS	
179.7	187.1		COAL	HARD, FRESH	
187.1	187.4		SHALE	CARBONACEOUS	
187.4	195.0		CLAYSTONE	MED-LT GRAY, SANDY, HARD	
195.0	199.8		SANDSTONE	LT GRAY, FG, HARD	
199.8	204.6		CLAYSTONE	MED GRAY, SANDY, HARD	
204.6	206.4		COAL	HARD, FRESH	
206.4	211.3		SANDSTONE	LT GRAY, FG, HARD, LAMINATED	

DRILL HOLE NO. 289-05

APPENDIX 5-A

BHP-UTAH INTERNATIONAL INC.

DRILL HOLE NO. 389-48, AREA LOWE, ASH FUSION PROJECT

COLLAR ELEVATION 5378, TOTAL DEPTH 217, DRILLER JACK LEDBETTER

COORDINATES: N= 2023481 CONTRACTOR MO-TE

E= 300393 DATE COLLARED 7/28/89

SECTION _____, T _____ N, R _____ W DATE BOTTOMED 7/31/89

SUMMARY

INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.	INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.
0.0 - 217.0		217.0							
TOTALS & AVERAGES									

SEAM NAME	MINABLE COAL HORIZON	THICKNESS COAL	THICKNESS PARTINGS	THICKNESS SEAM	PROXIMATE ANALYSIS MOIST.	ASH	VOL.	F.C.	BTU	% SUL.	
8	96.0 - 105.3				13.09	32.62	26.56	27.73	7283	0.70	2484/2700
7B	128.3 - 131.4				11.68	49.13	20.90	18.29	5187	1.76	2234/2495
6	154.5 - 163.3				13.58	23.06	29.90	33.46	8757	0.91	2447/2700
3	178.3 - 181.7				10.92	37.26	27.09	24.73	6970	1.24	2523/2700
2	198.9 - 202.4				13.76	14.48	33.23	38.53	10017	0.74	2215/2298

REMARKS -

DATE

DAVID HOAG
GEOLOGIST

DRILL HOLE NO. 389-48

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
0.0	5.0		CLAY & SAND	BROWN, DRILL CUTTINGS	
5.0	9.0		CLAYSTONE	BROWN, SOFT, SANDY	
9.0	22.0		CLAYSTONE	GRAY, BROWN STAINED, SILTY, SOFT	
22.0	24.2		SHALE	CARBONACEOUS	
24.2	36.9		CLAYSTONE	GRAY, BROWN STAINED, GYPSUM VEINS, SOFT	
36.9	37.4		SANDSTONE	LT. GRAY, FG, HARD	
37.4	55.8		CLAYSTONE	GRAY, BROWN STAINED, GYPSUM VEINS, MED HARD	
55.8	79.2		SILTSTONE	LT. GRAY, SANDY, HARD	
79.2	86.0		CLAYSTONE	MED. GRAY, SANDY, HARD	
86.0	88.8		COAL	HARD, FRESH	
88.8	88.9		CLAYSTONE	TAN, SANDY	
88.9	89.6		COAL	HARD, FRESH	
89.6	89.7		CLAYSTONE	TAN, SANDY	
89.7	97.2		COAL	HARD FRESH	
97.2	97.5		CLAYSTONE	TAN, SANDY	
97.5	102.5		COAL	HARD, FRESH	
102.5	102.6		CLAYSTONE	TAN, SANDY	
102.6	105.1		COAL	HARD, FRESH	
105.1	105.3		SHALE	CARBONACEOUS	
105.3	107.4		SANDSTONE	LT. GRAY, FG, HARD, LAMINATED	
107.4	109.2		SHALE	LT. GRAY, FG, HARD	
109.2	118.1		SANDSTONE	LT. GRAY, FG, HARD	
118.1	121.4		CLAYSTONE	MED GRAD, SILTY, HARD	
121.4	122.6		SHALE	CARBONACEOUS	
122.6	124.5		CLAYSTONE	MED GRAY, SILTY, MED. HARD	
124.5	128.3		SHALE	CARBONACEOUS, TO SHALEY COAL	
128.3	130.4		COAL	FRESH, HARD, RESIN	
130.4	131.4		SHALE	CARBONACEOUS	
131.4	138.8		SANDSTONE	LT. GRAY, LAMINATED, HARD	
138.8	140.8		SHALE	CARBONACEOUS, SANDY	
140.8	147.2		SANDSTONE	LT. GRAY, FG, HARD, LAMINATED	
147.2	154.5		CLAYSTONE	MED. GRAY, SANDY, HARD	

DRILL HOLE NO. 389-48

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
154.5	162.5		COAL	HARD, FRESH	
162.5	163.3		SHALE	CARBONACEOUS	
163.3	172.0		SANDSTONE	LT. GRAY, FG, CONVOLUTED LAMS, HARD	
172.0	175.0			MISSING	
175.0	178.3		CLAYSTONE	MED.-DARK GRAY, SILTY, HARD	
178.3	178.5		SHALE	CARBONACEOUS	
178.5	180.1		COAL	HARD, FRESH	
180.1	180.6		SHALE	SANDY, CARBONACEOUS	
180.6	181.4		COAL	HARD, FRESH	
181.4	181.7		SHALE	CARBONACEOUS	
181.7	189.7		SANDSTONE	LT. GRAY, FG, CONVOLUTED LAMS, HARD	
189.7	194.2		CLAYSTONE	MED. GRAY, HARD, SANDY	
194.2	196.9		SANDSTONE	LT. GRAY, FG, HARD	
196.9	198.9		CLAYSTONE	MED. GRAY, SILTY, HARD	
198.9	199.0		SHALE	CARBONACEOUS	
199.0	202.3		COAL	HARD, FRESH	
202.3	202.4		SHALE	CARBONACEOUS	
202.4	203.0		SANDSTONE	CARBONACEOUS	
203.0	217.0		SANDSTONE	LT. GRAY, SALT & PEPPER, HARD	
				PICTURED CLIFFS	

DRILL HOLE NO. 389-48

APPENDIX 5-A

BHP-UTAH INTERNATIONAL INC.

DRILL HOLE NO. 389-49, AREA LOWE, ASH FUSION PROJECT

COLLAR ELEVATION 5373, TOTAL DEPTH 205, DRILLER JACK LEDBETTER

COORDINATES: N= 2018130 CONTRACTOR MO-TE

E= 300206 DATE COLLARED 7/27/89

SECTION _____, T _____ N, R _____ W DATE BOTTOMED 7/28/89

SUMMARY

INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.	INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.
0.0 - 205.0		205.0							
TOTALS & AVERAGES									

SEAM NAME	MINABLE COAL HORIZON	THICKNESS COAL	THICKNESS PARTINGS	THICKNESS SEAM	PROXIMATE ANALYSIS MOIST.	ASH	VOL.	F.C.	BTU	% SUL.	Init. Sulf.
8B	53.3 - 63.3				13.61	28.53	28.21	29.65	7785	1.13	2224 / 2535
8A	96.0 - 101.0				14.76	28.32	27.52	29.40	7775	0.84	2297 / 2514
7B	114.9 - 120.2				13.31	22.21	30.90	33.58	8874	1.44	2315 / 2432
6	138.7 - 148.0				13.96	22.14	30.45	33.45	8786	0.69	2594 / 2700
3	162.2 - 166.6				10.83	44.16	23.94	21.07	6074	0.82	2401 / 2557
2	181.7 - 186.2				13.36	20.19	30.64	35.81	9109	0.75	2632 / 2700

REMARKS- Water table encountered at 90 feet.

DATE

David Hoag
GEOLOGIST

DRILL HOLE NO. 389-49

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
0.0	5.0		SAND	BROWN, ALLUVIUM, SOME CLAY	
5.0	10.0		CLAYSTONE	TAN, SOFT, SOME GYPSUM, FOSSIL LEAFS	
10.0	17.0		CLAYSTONE	GRAY, BROWN STAIN, LIVE ROOTS	
17.0	18.0		SHALE	CARBONACEOUS	
18.0	20.9		CLAYSTONE	GRAY, BROWN STAIN, SILTY, GYPSUM	
20.9	21.4		SHALE	CARBONACEOUS	
21.4	23.3		CLAYSTONE	MED.-DARK GRAY, SANDY	
23.3	30.0		SANDSTONE	TAN, FG, SOFT	
30.0	41.0		CLAYSTONE	BROWN GRAY, SOFT, WET, WON'T CORE WELL	
41.0	42.1		CLAYSTONE	MED. GRAY, SILTY, HARD	
42.1	52.4		SANDSTONE	LT. GRAY, FG, HARD, PELECYPODS	
52.4	53.2		CLAYSTONE	MED. GRAY, HARD, GASTROPODS	
53.2	57.5		COAL	HARD, FRESH	
57.5	57.6		CLAYSTONE	TAN, SANDY	
57.6	62.1		COAL	HARD, FRESH	
62.1	62.2		CLAYSTONE	TAN, SANDY	
62.2	62.3		COAL	HARD, FRESH	
62.3	62.4		CLAYSTONE	TAN, SANDY	
62.4	62.9		COAL	HARD, FRESH	
62.9	63.3		SHALE	CARBONACEOUS	
63.3	76.5		CLAYSTONE	MED.-LT. GRAY, SANDY	
76.5	78.9		SANDSTONE	LT. GRAY, FG, LAMINATED, HARD	
78.9	82.2		SHALE	CARBONACEOUS	
82.2	92.6		CLAYSTONE	MED.-DARK GRAY, SILTY	
92.6	94.3		SHALE	CARBONACEOUS	
94.3	94.6		COAL		
94.6	94.8		SHALE	CARBONACEOUS	
94.8	95.0		COAL		
95.0	95.1		SHALE	CARBONACEOUS	
95.1	96.0		COAL		
96.0	97.0		SHALE	CARBONACEOUS	
97.0	101.0		COAL		

DRILL HOLE NO. 389-49

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
101.0	102.1		CLAYSTONE	MED.-DARK GRAY, SILTY	
102.1	113.1		SANDSTONE	MED.-LT. GRAY, VFG.-FG., HARD	
113.1	114.9		CLAYSTONE	MED. GRAY, SILTY, HARD	
114.9	115.4		SHALE	CARBONACEOUS	
115.4	120.1		COAL	HARD, FRESH	
120.1	120.2		SHALE	CARBONACEOUS	
120.2	123.8		SANDSTONE	MED. LT. GRAY, HARD, FG.-VFG.	
123.8	124.9		COAL	HARD, FRESH	
124.9	125.5		SHALE	CARBONACEOUS	
125.5	130.8		SANDSTONE	LT. GRAY, FG, HARD	
130.8	138.7		CLAYSTONE	MED.- DARK GRAY, SANDY, HARD	
138.7	147.0		COAL	HARD, FRESH	
147.0	148.0		SHALE	CARBONACEOUS	
148.0	151.4		CLAYSTONE	MED. GRAY, SANDY, HARD	
151.4	153.0		SANDSTONE	LT. GRAY, FG, HARD	
153.0	155.0			MISSING	
155.0	157.6		SANDSTONE	LT.- MED. GRAY, FG.-VFG., HARD	
157.6	162.2		CLAYSTONE	DARK-MED. GRAY, SILTY, HARD	
162.2	162.4		SHALE	CARBONACEOUS	
162.4	163.6		COAL	HARD, FRESH	
163.6	163.9		CLAYSTONE	TAN, SANDY	
163.9	165.7		COAL	HARD, FRESH	
165.7	166.6		SHALE	CARBONACEOUS	
166.6	177.2		SANDSTONE	LT. GRAY, FG, CONVOLUTED LAMINATIONS	
177.2	177.3		COAL	HARD, FRESH	
177.3	177.5		SHALE	CARBONACEOUS	
177.5	181.7		SANDSTONE	LT. GRAY, FG, HARD	
181.7	181.9		SHALE	CARBONACEOUS	
181.9	186.2		COAL		
186.2	205.0		SANDSTONE	LT. GRAY, FG, HARD	

DRILL HOLE NO. 389-49

APPENDIX 5-A

BHP-UTAH INTERNATIONAL INC.

DRILL HOLE NO. 389-50, AREA DIXON, ASH FUSION PROJECT

COLLAR ELEVATION 5337, TOTAL DEPTH 164, DRILLER JACK LEDBETTER

COORDINATES: N= 2015229 CONTRACTOR MO-TE

E= 296626 DATE COLLARED 7/26/89

SECTION _____, T _____ N, R _____ W DATE BOTTOMED 7/27/89

SUMMARY

INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.	INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.
0.0 - 164.0		164.0							
TOTALS & AVERAGES									

SEAM NAME	MINABLE COAL HORIZON	THICKNESS COAL	THICKNESS PARTINGS	THICKNESS SEAM	PROXIMATE ANALYSIS MOIST.	ASH	VOL.	F.C.	BTU	% SUL.	Init. Soft
8A	26.4 - 28.4				17.83	5.07	33.34	43.76	10492	0.72	2054/2170
7B	42.0 - 47.0				14.58	22.17	28.36	34.89	8737	1,14	2404/2572
7A	49.4 - 51.3				16.01	6.45	34.55	42.99	10748	0.70	2128/2366
6B	64.7 - 67.0				14.24	8.11	35.73	41.92	10824	0.61	2239/2351
6A	69.5 - 76.4				13.23	23.11	30.60	33.06	8762	0.73	2700/2700
3	93.9 - 97.6				12.73	30.70	28.98	28.22	7715	1.06	2508/2700
2B	122.6 - 123.3				14.83	24.47	27.40 ~~24.40~~	33.30	8267	1.46	2199/2414
2A	142.3 - 144.8				11.86	9.10	37.56	41.48	11196	0.91	2277/2412

REMARKS - Water Table at 85'.

DATE

David Hoag
GEOLOGIST

DRILL HOLE NO. 389-50

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
0.0	5.0		SAND & CLAY	BROWN, ALLUVIUM, CUTTINGS	
5.0	16.9		SAND & CLAY	BROWN, ALLUVIUM	
16.9	26.2		SHALE	CARBONACEOUS, WEATHERED, SOME GYPSUM, SOME GREEN STAINS	
26.2	26.4		CLAYSTONE	TAN, SANDY, MED HARD	
26.4	28.2		COAL		
28.2	28.4		SHALE	CARBONACEOUS	
28.4	33.4		CLAYSTONE	MED. GRAY, SILTY	
33.4	37.7		SANDSTONE	LT. GRAY, FG, HARD	
37.7	42.0		CLAYSTONE	MED. - DARK GRAY, SILTY	
42.0	42.5		SHALE	CARBONACEOUS	
42.5	47.0		COAL	HARD, FRESH	
47.0	49.4		CLAYSTONE	LT.- MED. GRAY, SANDY	
49.4	51.0		COAL	HARD, FRESH	
51.0	51.3		SHALE	CARBONACEOUS	
51.3	52.8		CLAYSTONE	MED. GRAY, SILTY	
52.8	55.3		SANDSTONE	LT. GRAY, FG, LAMINATED HARD	
55.3	64.7		CLAYSTONE	MED.-DARK GRAY, SILTY	
64.7	64.9		SHALE	CARBONACEOUS	
64.9	67.0		COAL	HARD, FRESH	
67.0	69.5		CLAYSTONE	DARK GRAY	
69.5	69.7		SHALE	CARBONACEOUS	
69.7	76.0		COAL	HARD, FRESH	
76.0	76.4		SHALE	CARBONACEOUS	
76.4	83.7		CLAYSTONE	MED.- DARK GRAY, SILTY	
83.7	87.5		SANDSTONE	LT. GRAY, FG, LAMINATED	
87.5	93.9		CLAYSTONE	MED. - DARK GRAY, SILTY	
93.9	94.2		SHALE	CARBONACEOUS	
94.2	97.6		COAL	FRESH, HARD	
97.6	120.0		SANDSTONE	LT. GRAY, SANDY, HARD, CONVOLUTED LAMINATIONS	
120.0	120.3		COAL	HARD, FRESH, CALCITE VEINS, DIS. PY.	
120.3	122.6		CLAYSTONE	MED. GRAY, SANDY	

DRILL HOLE NO. 389-50

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
122.6	123.3		SHALE	CARBONACEOUS	
123.3	125.4		COAL	HARD, FRESH, DIS. PY.	
125.4	125.6		CLAYSTONE	TAN, SANDY	
125.6	128.4		COAL	HARD, FRESH, DIS. PY.	
128.4	129.0		CLAYSTONE	MED. GRAY, SANDY	
129.0	142.3		SANDSTONE	LT. GRAY, FG., LAMINATED	
142.3	144.8		COAL	HARD, FRESH	
144.8	155.8		SANDSTONE	LT. TAN-GRAY, FG, HARD	
155.8	157.1		SHALE	CARBONACEOUS	
157.1	164.0		SANDSTONE	LT. GRAY, FG, HARD, CONVOLUTED LAMS	
				CORE TO 154.6	

DRILL HOLE NO. 389-50

APPENDIX 5-A

BHP-UTAH INTERNATIONAL INC.

DRILL HOLE NO. 389-51, AREA DIXON, ASH FUSION PROJECT

COLLAR ELEVATION 5350, TOTAL DEPTH 165, DRILLER JACK LEDBETTER

COORDINATES: N= 2011839 CONTRACTOR MO-TE

E= 296785 DATE COLLARED 7/25/89

SECTION _____, T _____ N, R _____ W DATE BOTTOMED 7/26/89

SUMMARY

INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.	INTERVAL	FOOTAGE PLUG	FOOTAGE CORE	AMT. REC'D.	% REC'D.
0.0 - 165.0		165.0							
TOTALS & AVERAGES									

SEAM NAME	MINABLE COAL HORIZON	THICKNESS COAL	THICKNESS PARTINGS	THICKNESS SEAM	PROXIMATE ANALYSIS MOIST.	ASH	VOL.	F.C.	BTU	% SUL.	Init / Soft
7	47.3 - 54.0				13.55	16.74	31.77	37.94	9599	1.12	2269 / 2365
6	63.9 - 70.6				13.85	33.34	25.19	27.62	7118	0.72	2230 / 2482
3	114.6 - 120.0				13.06	22.47	31.32	33.15	8770	1.10	2385 / 2528
2B	130.0 - 136.0				14.30	18.04	30.90	36.76	9285	1.46	2429 / 2565
2A	140.6 - 143.5				13.76	13.64	34.44	38.16	10120	1.42	2122 / 2270

REMARKS -

DATE

David Hoag
GEOLOGIST

DRILL HOLE NO. 389-51

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
0.0	5.5		SAND	TAN, ALLUVIUM	
5.5	6.3		SANDSTONE	TAN, VFG. - FG, FRIABLE	
6.3	8.8		SANDSTONE	TAN, FG, SOFT	
8.8	14.8		SANDSTONE	GRAY-TAN, FG, HARD	
14.8	27.7		CLAYSTONE	GRAY BROWN, VERY SOFT	
27.7	28.5		SANDSTONE	LT. GRAY, FG, HARD	
28.5	29.7		CLAYSTONE	MED. GRAY, SILTY, HARD	
29.7	30.6		SANDSTONE	LT. GRAY, FG, HARD	
30.6	31.2		CLAYSTONE	MED. GRAY, SILTY HARD	
31.2	31.6		SANDSTONE		
31.6	31.7		CLAYSTONE		
31.7	32.1		SANDSTONE		
32.1	32.6		CLAYSTONE		
32.6	40.3		SANDSTONE	LT. GRAY, FG., HARD	
40.3	41.1		CLAYSTONE	MED. GRAY, SANDY	
41.1	43.4		SANDSTONE	LT. GRAY; FG.	
43.4	47.3		CLAYSTONE	MED. GRAY, SANDY	
47.3	47.6		SHALE	CARBONACEOUS	
47.6	53.8		COAL	HARD, FRESH	
53.8	54.0		SHALE	CARBONACEOUS	
54.0	63.9		CLAYSTONE	MED. GRAY, HARD, SANDY	
63.9	64.1		SHALE	CARBONACEOUS	
64.1	66.6		COAL	HARD, FRESH	
66.6	67.8		CLAYSTONE	DARK GRAY - BLACK	
67.8	68.3		SHALE	CARBONACEOUS	
68.3	70.1		COAL	HARD, FRESH	
70.1	70.6		SHALE	CARBONACEOUS	
70.6	72.4		CLAYSTONE		
72.4	73.0		SHALE	CARBONACEOUS	
73.0	76.8		CLAYSTONE	MED. GRAY, SOFT	
76.8	94.2		CLAYSTONE	LT.-MED GRAY, SANDY HARD	
94.2	94.7		COAL	HARD, FRESH	

DRILL HOLE NO. 389-51

APPENDIX 5-A

FORMATION RECORD

DEPTH FROM	DEPTH TO	THICK. OF STRATUM	FORMATION (KIND ROCK)	DESCRIPTION AND REMARKS	STRIP LOG
94.7	96.2		SHALE	CARBONACEOUS	
96.2	114.6		CLAYSTONE	MED. DARK GRAY, SANDY, SOME OYSTERS	
114.6	114.8		SHALE	CARBONACEOUS	
114.8	115.7		COAL	HARD, FRESH, SLIGHTLY SHALEY	
115.7	116.1		CLAYSTONE	TAN, SANDY, LAMINATED	
116.1	120.0		COAL	HARD, FRESH, RESIN	
120.0	121.5		CLAYSTONE	MED.- DARK GRAY, SANDY, HARD	
121.5	126.7		SANDSTONE		
126.7	127.2		COAL	SHALEY	
127.2	130.0		CLAYSTONE	MED. GRAY, SILTY	
130.0	131.2		COAL	BONY	
131.2	133.2		COAL	HARD, FRESH	
133.2	133.9		COAL	SHALEY	
133.9	135.6		COAL	BONY, DISEMINATED PYRITE	
135.6	136.0		SHALE	CARBONACEOUS	
136.0	140.6		CLAYSTONE	MED. GRAY, SANDY	
140.6	140.8		SHALE	CARBONACEOUS	
140.8	143.3		COAL	HARD, FRESH, SHALEY IN PART	
143.3	143.5		SHALE	CARBONACEOUS	
143.5	145.1		CLAYSTONE	MED. GRAY, SANDY	
145.1	165.0		SANDSTONE	LT. GRAY, FG., HARD, SOME CARBONACEOUS, LAMINAE	

DRILL HOLE NO. 389-51

Appendix 17.B

Overburden Chemical and Physical Analyses

APPENDIX 5–B. Drill Hole 289–01 Overburden Analysis

Interval (ft) Top- Bot	pH	EC (mmhos/cm @ 25 C)	SAR	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	Boron (ppm)	Total Selenium (ppm)	H2O Sol. Selenium (ppm)	Tot. Org. Carbon (%)	Total Sulfur (%)	Neut. Pot. (t/1000t)	Sulfate Sulfur (%)	Pyritic Sulfur (%)	Organic Sulfur (%)	Pyr S AB (t/1000t)	Pyr S ABP (t/1000t)	Sand (%)	Silt (%)	Clay (%)	Texture	Sat. (%)
0.0 - 5.0	8.5	1.12	15.4	0.65	0.39	11.10	0.21	0.02	0.01	1.8	0.07	164.00	0.01	0.06	0.01	1.87	162.00	74	18	8	SL	29.2
5.0 - 10.0	8.6	2.60	27.5	0.86	0.76	24.90	0.35		0.01	1.7	0.11	92.50	0.10	0.01	0.01	-0.01	92.50	80	13	7	LS	34.9
10.0 - 15.0	8.1	1.98	17.3	1.25	0.95	18.10	0.20		0.01	2.0	0.08	74.40	0.07	0.01	0.01	-0.01	74.40	80	12	8	LS	38.2
15.0 - 20.0	8.0	1.81	15.5	1.27	0.83	15.90	0.26	0.05	0.03	2.8	0.11	25.90	0.10	0.01	0.01	-0.01	25.90	72	16	12	SL	51.4
20.0 - 25.0	8.0	2.09	15.3	1.86	1.21	19.00	0.20		0.03	3.1	0.08	35.10	0.07	0.01	0.01	-0.01	35.10	72	17	12	SL	49.4
25.0 - 30.0	8.0	2.05	15.7	1.67	1.11	18.50	0.14		0.01	2.7	0.08	75.20	0.01	0.07	0.01	2.19	73.00	72	16	12	SL	43.6
30.0 - 34.0	7.9	2.12	23.1	1.07	0.61	21.20	0.12		0.02	2.4	0.09	49.70	0.01	0.06	0.01	2.50	47.20	72	14	14	SL	47.6
34.0 - 35.6	5.1	4.19	29.6	1.90	1.97	41.20	0.40	1.20	0.04	5.1	0.11	4.12	0.01	0.01	0.09	0.31	3.81	33	19	48	C	79.2
35.6 - 38.2	4.3	9.66	20.9	20.70	18.30	92.10	0.43	0.95	0.02	6.2	0.53	-0.43	0.42	0.01	0.11	-0.01	-0.43	53	14	33	SCL	89.0
38.2 - 43.2	5.3	9.51	20.9	20.60	17.10	90.70	0.31	0.50	0.02	6.7	0.33	5.21	0.23	0.01	0.09	0.31	4.90	33	47	21	L	95.8
43.2 - 46.0	7.0	8.26	20.2	17.60	11.90	77.70	0.39		0.03	3.6	0.28	7.24	0.18	0.01	0.10	-0.01	7.24	43	39	18	L	93.7
46.0 - 51.0	9.0	1.45	24.8	0.63	0.21	16.10	0.38		0.03	2.1	0.10	22.50	0.01	0.01	0.08	0.31	22.20	60	24	16	SL	125.0
51.0 - 56.0	9.1	1.27	32.3	0.20	0.12	12.90	0.57		0.03	1.9	0.09	72.70	0.01	0.01	0.08	-0.01	72.70	69	17	14	SL	140.0
56.0 - 61.0	9.1	1.15	24.6	0.39	0.15	12.80	0.79	0.05	0.07	2.6	0.10	32.90	0.01	0.01	0.09	0.31	32.60	65	22	14	SL	124.0
61.0 - 66.0	9.2	1.39	32.8	0.27	0.11	14.30	0.36		0.01	2.9	0.10	20.70	0.01	0.01	0.09	0.31	20.40	46	35	18	L	148.0
66.0 - 71.0	9.1	1.32	30.1	0.28	0.10	13.10	0.40		0.04	2.8	0.13	75.80	0.02	0.03	0.08	0.94	74.80	51	30	19	L	123.0
71.0 - 72.2	9.0	1.50	27.1	0.44	0.15	14.70	0.40		0.04	2.9	0.12	26.50	0.01	0.05	0.07	1.56	24.90	46	34	18	L	114.0
72.2 - 73.7	7.9	6.39	34.5	5.14	1.59	63.20	0.52	0.50	0.05	3.7	0.45	9.81	0.05	0.27	0.13	8.43	1.38	35	25	39	CL	93.8
73.7 - 75.2	6.0	10.90	32.7	17.30	6.15	112.00	1.04	2.15	0.15	16.6	1.30	7.06	0.16	0.67	0.47	20.90	-13.90	58	12	30	SCL	61.9
75.2 - 80.2	7.9	6.24	42.1	3.49	0.96	62.60	0.62	0.85	0.05	5.4	0.53	12.60	0.02	0.33	0.16	10.30	2.27	31	26	43	C	96.8
80.2 - 81.2	8.0	7.98	43.7	5.80	1.40	82.90	0.40		0.04	4.0	0.63	8.62	0.06	0.44	0.13	13.70	-5.12	37	22	41	C	94.5
81.2 - 81.8	5.6	11.80	35.2	18.30	6.55	124.00	0.90	1.25	0.09	8.6	1.36	3.62	0.15	0.90	0.33	26.10	-24.50	53	18	29	SCL	62.0
81.8 - 86.0	8.5	4.39	51.8	1.59	0.16	48.50	0.52	0.15	0.02	3.3	0.49	8.18	0.01	0.35	0.13	10.90	-2.75	28	43	28	CL	83.1
86.0 - 91.0	8.9	2.04	42.1	0.54	0.10	23.80	0.55	0.35	0.04	3.2	0.19	9.91	0.03	0.06	0.10	1.87	8.04	31	41	28	CL	92.5
91.0 - 93.2	9.1	1.25	33.1	0.33	0.06	14.60	1.46		0.04	3.6	0.12	13.60	0.01	0.03	0.09	0.94	12.70	25	55	20	SIL	142.0
93.2 - 98.2	9.3	1.27	26.0	0.32	0.09	12.70	0.36		0.01	2.0	0.09	42.60	0.01	0.02	0.07	0.62	42.00	58	25	18	SL	142.0
98.2 - 103.2	9.1	1.41	35.3	0.34	0.03	15.20	0.30	0.15	0.01	2.1	0.09	114.00	0.01	0.08	0.01	2.50	111.00	72	16	12	SL	82.1
103.2 - 108.2	8.3	3.63	40.0	1.28	0.19	34.30	0.26		0.01	3.6	0.11	14.70	0.01	0.01	0.09	0.31	14.40	80	11	9	LS	35.7
108.2 - 113.0	8.8	2.21	48.4	0.43	0.03	23.20	0.24		0.01	2.2	0.09	125.00	0.01	0.01	0.08	0.31	125.00	79	12	9	SL	40.5
113.0 - 114.8	8.7	1.74	27.3	0.53	0.30	17.60	0.37	0.02	0.02	3.4	0.11	72.30	0.01	0.01	0.10	0.31	72.00	55	21	24	SCL	56.2
114.8 - 119.2	8.3	5.70	51.0	1.98	0.49	56.70	0.35	0.60	0.03	3.8	0.51	76.70	0.01	0.35	0.15	10.90	65.80	43	22	36	CL	76.2
119.2 - 120.4	7.4	11.40	39.7	13.50	2.69	113.00	0.62	1.20	0.05	9.3	1.12	11.00	0.12	0.70	0.30	21.90	-10.90	52	14	35	SCL	77.7
120.4 - 125.4	8.3	5.99	44.9	2.37	0.55	54.20	0.36		0.01	3.7	0.57	25.00	0.01	0.43	0.14	13.40	11.60	30	27	43	C	84.7
125.4 - 130.4	8.6	4.13	50.1	0.96	0.33	40.20	0.36	0.25	0.01	3.2	0.45	38.50	0.01	0.37	0.12	11.60	26.90	24	45	30	CL	86.0
130.4 - 135.3	9.0	1.50	24.7	0.73	0.23	17.10	0.60		0.02	2.9	0.16	44.90	0.01	0.05	0.11	1.56	43.30	31	43	26	L	91.9
135.3 - 140.3	9.1	1.33	20.7	0.72	0.23	14.30	0.40		0.01	2.1	0.08	100.00	0.01	0.01	0.08	-0.01	100.00	67	19	15	SL	78.6
140.5 - 145.3	9.0	2.03	31.4	0.62	0.23	20.50	0.37		0.01	2.4	0.08	117.00	0.01	0.01	0.07	0.31	117.00	72	15	14	SL	57.5
145.3 - 150.3	8.9	1.93	29.5	0.55	0.22	18.30	0.36		0.01	2.4	0.08	107.00	0.01	0.01	0.07	0.31	107.00	72	16	13	SL	59.2
150.3 - 155.3	9.0	1.59	23.5	0.56	0.17	14.20	0.43		0.01	2.1	0.14	165.00	0.05	0.01	0.08	0.31	165.00	68	18	15	SL	80.4
155.3 - 160.3	9.1	1.58	26.2	0.49	0.15	14.80	0.42		0.01	2.5	0.08	81.90	0.01	0.01	0.08	-0.01	81.90	65	19	16	SL	93.8
160.3 - 165.3	9.2	1.23	25.9	0.33	0.12	12.30	0.28		0.01	2.8	0.09	78.90	0.01	0.01	0.08	0.31	78.60	67	15	18	SL	126.0
165.3 - 170.3	8.8	1.49	26.0	0.59	0.17	16.00	0.27		0.01	2.8	0.10	80.20	0.01	0.01	0.09	0.31	79.90	70	15	15	SL	60.8
170.3 - 175.3	9.1	1.35	25.5	0.36	0.13	12.60	0.39		0.01	3.1	0.16	92.30	0.03	0.04	0.11	1.25	91.10	65	15	20	SCL	119.0
175.3 - 177.0	9.0	1.18	22.2	0.61	0.15	13.70	0.30	0.20	0.03	4.5	0.16	74.60	0.03	0.04	0.11	1.25	73.50	47	31	22	L	126.0
191.9 - 196.9	8.8	1.54	30.7	0.51	0.25	18.90	0.98	0.35	0.04	4.9	0.44	56.60	0.01	0.32	0.16	10.00	46.60	18	58	24	SIL	70.7
196.9 - 201.1	8.9	1.37	25.1	0.57	0.22	15.80	0.68		0.03	5.5	0.44	145.00	0.01	0.29	0.15	9.06	136.00	25	32	43	C	87.2
203.6 - 209.1	8.2	3.27	41.4	1.19	0.25	35.10	0.36	0.10	0.03	4.2	0.31	10.60	0.02	0.17	0.12	5.31	5.34	42	42	16	L	34.0
209.1 - 209.9	8.4	8.33	24.9	14.30	3.73	74.90	3.14	1.40	0.04	61.7	1.98	8.06	0.23	1.07	0.68	33.40	-25.40	62	14	5	LS	49.8
209.9 - 211.1	8.1	4.25	52.3	0.91	0.29	40.50	0.75	0.75	0.04	12.5	0.44	8.75	0.03	0.16	0.25	5.00	3.75	30	32	38	CL	106.0
211.1 - 214.2	9.2	1.87	30.2	0.52	0.10	16.80	0.32	0.25	0.03	4.4	0.18	7.76	0.01	0.05	0.12	1.56	6.20	23	55	23	SIL	98.0
214.2 - 215.9	9.0	1.51	25.1	0.51	0.12	14.10	0.46	0.25	0.02	2.9	0.16	40.40	0.03	0.01	0.13	-0.01	40.40	62	21	18	SL	88.6
215.9 - 217.0	8.6	2.31	37.7	0.58	0.17	23.10	0.69	1.20	0.01	32.7	0.60	9.09	0.01	0.35	0.45	10.90	-1.64	50	26	25	SCL	80.9
217.0 - 218.0	7.6	7.17	60.5	2.21	0.88	74.90	0.72	0.95	0.04	16.6	1.11	6.94	0.16	0.51	0.44	15.90	-8.99	59	13	28	SCL	94.7
218.0 - 221.8	8.2	3.74	46.5	0.97	0.27	36.60	0.98	0.40	0.04	4.1	1.03	6.94	0.05	0.74	0.24	23.10	-16.20	24	42	34	CL	104.0
221.8 - 226.8	9.2	1.57	22.9	0.72	0.20	15.50	0.79	0.20	0.02	8.2	0.14	97.10	0.01	0.01	0.13	0.31	96.60	53	28	19	SL	56.2
226.8 - 229.6	9.2	1.90	29.7	0.62	0.17	20.90	0.80		0.02	3.6	0.42	12.40	0.01	0.24	0.18	7.50	4.93	35	42	23	L	73.5
229.6 - 234.6	9.1	1.88	27.7	0.93	0.20	20.80	0.80		0.04	5.4	1.62	14.00	0.04	1.29	0.29	40.30	-26.30	35	35	30	CL	109.0
234.6 - 238.3	9.2	1.73	34.2	0.52	0.13	19.50	0.69	0.75	0.03	5.2	1.56	21.10	0.04	1.24	0.28	38.70	-17.70	24	45	30	CL	101.0
246.2 - 251.2	8.7	2.64	46.7	0.56	0.15	27.80	0.29	0.25	0.01	3.6	0.56	5.57	0.06	0.25	0.25	7.81	-2.24	52	23	25	SCL	93.3
251.2 - 256.0	8.4	3.54	44.3	0.95	0.22	33.90	0.25	0.25	0.01	3.0	0.63	29.80	0.01	0.42	0.20	13.10	16.70	67	19	15	SL	62.3
256.0 - 258.0	8.6	5.07	43.0	2.59	0.63	54.50	0.55	0.02	0.01	3.1	1.30	408.00	0.27	0.79	0.24	24.70	383.00	60	19	20	SCL	56.2

APPENDIX 5–B. Drill Hole 289–02 Overburden Analysis

Interval (ft) Top– Bot	pH	EC (mmhos/cm @ 25 C)	SAR	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	Boron (ppm)	Total Selenium (ppm)	H2O Sol. Selenium (ppm)	Tot. Org. Carbon (%)	Total Sulfur (%)	Neut. Pot. (t/1000t)	Sulfate Sulfur (%)	Pyritic Sulfur (%)	Organic Sulfur (%)	Pyr S AB (t/1000t)	Pyr S ABP (t/1000t)	Sand (%)	Silt (%)	Clay (%)	Texture	Sat. (%)
0.0 – 5.0	5.8	9.15	33.5	9.82	5.43	92.60	0.72	0.65	0.15	5.8	0.24	7.17	0.10	0.01	0.13	0.31	6.86	57	16	27	SCL	89.5
5.0 – 6.8	7.2	10.10	33.1	15.90	5.77	109.00	0.34	0.35	0.05	3.4	0.23	10.10	0.06	0.01	0.14	0.31	9.78	52	34	15	L	79.9
6.8 – 11.8	6.5	12.90	37.6	23.40	9.24	152.00	0.48	0.45	0.06	4.8	0.28	8.81	0.15	0.01	0.13	–0.01	8.81	55	23	22	SCL	74.9
11.8 – 14.2	6.9	8.39	29.1	11.90	3.81	81.60	0.38		0.05	3.7	0.22	6.05	0.10	0.01	0.12	–0.01	6.05	36	44	20	L	86.4
14.2 – 19.8	6.6	2.18	26.7	1.04	0.20	21.00	0.26	0.20	0.05	3.1	0.14	23.20	0.01	0.12	0.01	3.75	19.50	40	37	23	L	173.0
19.8 – 23.2	5.9	14.10	41.8	21.20	8.54	161.00	0.56	1.10	0.21	8.1	0.33	11.30	0.18	0.01	0.14	0.31	11.00	64	12	24	SCL	88.9
23.2 – 26.7	7.8	7.72	45.1	5.31	1.55	93.50	0.30	0.65	0.10	5.6	0.18	12.60	0.05	0.01	0.12	0.31	12.30	61	15	25	SCL	85.0
26.7 – 31.7	7.6	7.85	37.9	6.86	2.36	81.40	0.40	0.15	0.02	4.0	0.17	9.24	0.04	0.12	0.01	3.75	5.49	46	34	19	L	62.2
31.7 – 32.8	7.6	5.66	36.1	3.52	1.00	54.30	0.32		0.02	4.9	0.20	10.50	0.07	0.01	0.13	–0.01	10.50	35	41	25	L	102.0
32.8 – 35.5	6.6	1.70	24.5	0.78	0.17	16.90	0.18	0.20	0.04	3.5	0.15	35.30	0.01	0.03	0.11	0.94	34.40	50	28	22	L	213.0
35.5 – 36.0	6.2	3.11	31.3	1.20	0.27	26.80	0.62	0.60	0.08	12.6	0.21	9.24	0.05	0.01	0.16	–0.01	9.24	48	23	28	SCL	91.9
36.0 – 41.0	8.0	4.99	40.6	2.38	0.63	50.10	0.32	0.15	0.03	4.6	0.16	13.10	0.01	0.02	0.13	0.62	12.50	53	15	32	SCL	105.0
41.0 – 42.2	5.9	9.09	33.4	9.97	4.28	89.20	0.66		0.09	4.6	0.26	8.10	0.11	0.04	0.11	1.25	6.66	44	15	41	C	105.0
42.2 – 44.2	3.7	15.40	34.9	21.10	24.20	166.00	1.52	1.10	0.12	9.0	0.85	–3.05	0.66	0.01	0.19	–0.01	–3.05	52	26	23	SCL	66.7
44.2 – 49.2	8.6	2.88	34.2	0.89	0.26	25.90	0.30		0.03	3.2	0.16	12.20	0.01	0.03	0.13	0.94	11.30	42	38	20	L	104.0
49.2 – 54.2	9.4	0.89	17.6	0.38	0.11	8.73	0.46		0.01	2.3	0.13	47.30	0.01	0.01	0.12	0.31	47.00	58	23	18	SL	187.0
54.2 – 59.2	9.3	1.03	19.5	0.42	0.14	10.30	0.66	0.10	0.01	2.2	0.13	41.10	0.01	0.01	0.12	0.31	40.80	58	23	18	SL	181.0
59.2 – 64.2	9.2	1.10	23.7	0.36	0.13	11.60	0.28		0.01	2.7	0.12	105.00	0.01	0.01	0.11	0.31	104.00	70	17	13	SL	102.0
64.2 – 68.2	9.1	1.18	23.5	0.43	0.12	12.30	0.24		0.01	2.3	0.14	21.80	0.02	0.01	0.12	–0.01	21.80	68	18	14	SL	128.0
68.2 – 73.3	9.0	1.28	23.7	0.47	0.17	13.40	0.42	0.30	0.03	3.5	0.35	38.20	0.04	0.16	0.15	5.00	33.20	35	38	28	CL	120.0
73.3 – 76.8	8.7	1.16	20.6	0.47	0.10	11.00	0.44	0.05	0.01	3.4	0.14	173.00	0.01	0.01	0.14	–0.01	173.00	66	21	13	SL	81.8
76.8 – 81.8	9.0	1.74	36.5	0.37	0.15	18.60	0.82		0.06	4.4	0.39	20.50	0.15	0.09	0.15	2.81	17.60	30	28	42	C	96.3
81.8 – 86.8	8.4	3.79	41.0	1.24	0.22	35.00	1.02	1.00	0.16	7.2	0.60	12.10	0.01	0.35	0.25	10.90	1.19	32	25	43	C	88.1
86.8 – 91.8	8.7	2.74	35.8	0.73	0.16	23.90	0.82		0.07	4.3	0.44	39.60	0.01	0.27	0.17	8.43	31.10	22	42	36	CL	91.0
91.8 – 96.0	9.0	1.92	34.4	0.51	0.14	19.60	0.50		0.04	3.9	0.26	13.40	0.01	0.11	0.15	3.44	9.99	39	33	28	CL	102.0
96.0 – 101.0	9.1	1.02	25.0	0.33	0.07	11.20	0.52		0.02	2.7	0.12	26.40	0.01	0.01	0.12	–0.01	26.40	39	42	18	L	129.0
101.0 – 106.0	9.3	1.02	20.5	0.34	0.08	9.40	0.82		0.01	2.4	0.14	70.10	0.03	0.01	0.11	–0.01	70.10	36	47	15	L	145.0
106.0 – 111.0	9.2	1.07	22.2	0.37	0.08	10.30	0.42		0.01	2.8	0.11	86.40	0.01	0.01	0.11	–0.01	86.40	60	26	15	SL	128.0
111.0 – 116.0	9.1	0.99	19.4	0.39	0.08	9.39	0.34	0.10	0.01	2.6	0.11	110.00	0.01	0.01	0.11	–0.01	110.00	64	22	14	SL	131.0
116.0 – 121.0	9.1	1.00	22.0	0.34	0.06	9.62	1.24		0.01	2.6	0.13	34.60	0.02	0.01	0.11	–0.01	34.60	43	38	19	L	170.0
121.0 – 126.0	9.3	1.00	19.6	0.41	0.08	9.72	1.02		0.01	2.2	0.11	47.50	0.01	0.01	0.11	–0.01	47.50	52	31	17	SL	185.0
126.0 – 131.0	8.6	1.46	25.0	0.52	0.08	13.70	0.30		0.01	2.7	0.12	65.50	0.01	0.01	0.12	–0.01	65.50	64	23	13	SL	92.0
131.0 – 136.5	8.6	2.01	36.7	0.46	0.06	18.70	0.22		0.01	2.2	0.11	175.00	0.01	0.01	0.11	–0.01	175.00	71	20	9	SL	51.6
136.5 – 141.5	8.7	1.70	30.6	0.61	0.16	19.00	0.64		0.05	4.0	0.46	48.00	0.01	0.28	0.18	8.75	39.40	30	31	39	CL	97.0
141.5 – 146.5	8.8	1.27	24.2	0.53	0.13	13.90	0.56		0.02	4.5	0.25	96.70	0.01	0.06	0.17	2.50	96.20	14	52	35	SICL	94.2
146.5 – 151.5	8.7	1.17	24.0	0.43	0.15	12.90	0.68	0.25	0.02	4.0	0.20	160.00	0.02	0.05	0.13	1.56	159.00	12	57	31	SICL	87.3
151.5 – 156.5	8.5	1.27	22.8	0.64	0.18	14.60	0.50		0.03	6.0	0.18	69.90	0.01	0.03	0.15	0.94	68.90	16	50	34	SICL	96.5
156.5 – 161.5	8.3	1.25	20.4	0.80	0.16	14.10	0.78		0.02	5.5	0.15	102.00	0.01	0.01	0.14	0.31	101.00	17	47	37	SICL	95.2
161.5 – 162.8	8.5	0.99	10.7	0.88	1.26	11.10	0.56		0.02	4.9	0.15	118.00	0.01	0.01	0.15	–0.01	118.00	13	65	22	SIL	101.0
162.8 – 167.8	9.2	0.74	12.8	0.47	0.11	6.91	0.68	0.02	0.01	3.0	0.12	150.00	0.01	0.01	0.12	–0.01	150.00	42	36	23	L	213.0
167.8 – 170.0	9.0	0.74	12.0	0.46	0.22	7.02	0.68	0.10	0.01	3.5	0.14	149.00	0.01	0.01	0.13	–0.01	149.00	69	9	23	SCL	193.0
170.0 – 172.3	6.8	1.40	23.9	0.44	0.20	13.50	0.92	1.05	0.16	5.4	0.36	11.00	0.01	0.20	0.18	6.25	4.78	55	28	17	SL	107.0
186.1 – 190.7	9.2	0.94	21.6	0.45	0.25	12.80	0.78	0.65	0.08	5.1	0.46	11.30	0.01	0.31	0.17	9.68	1.60	15	34	51	C	107.0
190.7 – 191.1	8.3	2.48	30.1	0.93	0.20	22.60	1.10	0.70	0.04	22.7	1.53	12.60	0.01	1.09	0.44	34.10	–21.20	45	29	26	L	60.4
191.1 – 196.1	6.6	1.57	25.6	0.68	0.22	17.30	0.96	0.50	0.04	5.8	0.65	82.60	0.01	0.42	0.23	13.10	69.50	24	49	27	CL	86.1
196.1 – 199.4	9.0	1.49	21.5	0.65	0.40	15.60	0.96		0.04	5.7	0.60	81.10	0.01	0.40	0.20	12.50	68.60	31	43	25	L	68.1
199.4 – 203.7	8.7	1.66	26.1	0.79	0.13	17.70	0.58	0.20	0.02	3.9	0.16	130.00	0.01	0.01	0.16	–0.01	130.00	59	27	14	SL	30.4
203.7 – 207.3	8.6	1.24	21.8	0.56	0.17	13.20	0.88	0.60	0.04	3.7	0.72	60.70	0.01	0.51	0.21	15.90	64.80	23	32	45	C	93.3
210.1 – 215.5	8.4	1.68	25.6	0.76	0.21	17.60	0.62	0.45	0.05	4.7	0.62	9.97	0.01	0.45	0.17	14.10	–4.09	38	44	19	L	48.0
215.5 – 216.0	7.0	4.27	18.7	5.30	1.09	33.50	4.04	0.35	0.03	78.6	1.03	25.30	0.01	0.32	0.71	10.00	15.30	90	9	2	S	65.2
216.0 – 218.3	9.3	1.21	23.7	0.45	0.21	13.60	0.84	0.45	0.07	5.2	0.35	24.20	0.04	0.16	0.15	5.00	19.20	20	52	29	SICL	108.0
218.3 – 218.8	7.1	2.73	24.6	1.21	0.25	21.00	4.62	0.65	0.04	66.6	0.96	20.40	0.01	0.23	0.73	7.19	13.20	91	7	2	S	75.7
218.8 – 219.3	7.5	5.88	40.5	2.65	0.84	51.90	2.42		0.14	48.5	1.06	23.50	0.01	0.41	0.67	12.60	10.70	60	17	24	SCL	70.1
219.3 – 221.5	8.8	2.91	36.3	0.67	0.27	24.90	0.80	0.45	0.05	5.6	0.90	6.76	0.01	0.66	0.24	20.60	–11.90	25	48	27	CL	93.2
221.5 – 225.7	8.9	1.84	27.7	0.77	0.21	19.40	0.52	0.15	0.03	3.7	0.19	94.20	0.01	0.05	0.14	1.56	92.70	53	31	16	SL	42.3
225.7 – 230.7	9.2	1.62	26.2	0.68	0.22	17.60	0.92		0.04	5.2	1.67	14.80	0.04	1.35	0.28	42.20	–27.40	37	34	29	CL	96.3
230.7 – 234.6	9.1	1.42	24.8	0.63	0.14	15.40	0.96	0.80	0.06	5.3	1.76	14.10	0.02	1.43	0.31	44.70	–30.50	36	36	29	CL	87.4
243.0 – 248.0	8.9	2.25	34.2	0.56	0.09	19.50	1.14	0.45	0.06	4.3	0.89	10.50	0.01	0.64	0.25	20.00	–9.47	25	44	31	CL	146.0
248.0 – 250.2	9.0	1.93	28.7	0.59	0.16	17.60	0.92		0.05	3.6	0.79	10.10	0.12	0.50	0.17	15.60	–5.47	58	17	25	SCL	116.0
250.2 – 253.6	7.8	6.86	37.7	3.60	0.86	56.40	0.56	0.02	0.01	2.1	0.45	13.20	0.02	0.28	0.15	8.75	4.43	70	18	12	SL	58.3

APPENDIX 5–B. Drill Hole 289–03 Overburden Analysis

Interval (ft) Top– Bot	pH	EC (mmhos/cm @ 25 C)	SAR	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	Boron (ppm)	Total Selenium (ppm)	H2O Sol. Selenium (ppm)	Tot. Org. Carbon (%)	Total Sulfur (%)	Neut. Pot. (t/1000t)	Sulfate Sulfur (%)	Pyritic Sulfur (%)	Organic Sulfur (%)	Pyr S AB (t/1000t)	Pyr S ABP (t/1000t)	Sand (%)	Silt (%)	Clay (%)	Texture	Sat. (%)
0.0 – 5.0	8.1	2.96	12.4	8.49	2.39	28.90	0.48	0.35	0.01	2.6	0.14	131.00	0.02	0.01	0.12	−0.01	131.00	44	38	19	L	37.6
5.0 – 9.4	8.3	1.53	15.3	0.73	0.14	10.10	0.32	0.50	0.04	2.8	0.17	39.70	0.04	0.12	0.01	3.75	36.00	52	32	16	L	82.4
9.4 – 14.4	7.5	1.53	17.6	1.42	0.41	17.00	0.42	0.50	0.11	3.7	0.22	9.96	0.09	0.01	0.13	−0.01	9.96	32	47	22	L	77.4
14.4 – 17.6	7.6	1.06	16.7	0.85	0.22	12.20	0.28		0.11	3.1	0.17	8.13	0.03	0.01	0.14	−0.01	8.13	29	52	19	SIL	95.2
17.6 – 19.6	8.5	0.82	16.4	0.70	0.07	10.20	0.20	0.40	0.09	2.7	0.14	45.90	0.01	0.13	0.01	4.06	41.60	36	44	21	L	96.0
19.6 – 24.6	7.7	3.75	18.1	8.52	3.27	43.90	0.28		0.11	3.8	0.22	10.20	0.07	0.14	0.01	4.37	5.85	46	26	28	SCL	96.3
24.6 – 29.6	7.1	6.32	20.4	16.60	7.59	71.10	0.44	0.60	0.08	3.4	0.33	9.18	0.19	0.13	0.01	4.06	5.11	52	27	22	SCL	69.9
29.6 – 34.6	7.5	6.16	21.4	15.50	7.16	72.00	0.38		0.06	3.2	0.26	11.50	0.25	0.01	0.01	−0.01	11.50	50	32	18	L	67.0
34.6 – 37.0	7.2	1.93	22.9	1.25	0.64	22.30	0.30		0.02	2.8	0.18	8.50	0.17	0.01	0.01	−0.01	8.50	47	34	19	L	102.0
37.0 – 39.4	8.3	2.46	22.4	2.35	1.10	29.40	0.28	0.15	0.01	2.4	0.21	34.20	0.09	0.11	0.01	3.44	30.80	60	24	16	SL	124.0
39.4 – 43.0	8.7	1.94	26.6	0.99	0.53	23.20	0.42	0.55	0.06	3.3	0.26	15.00	0.09	0.04	0.15	1.25	13.70	26	46	24	L	152.0
43.0 – 48.0	9.0	1.95	31.7	0.74	0.35	23.40	0.54		0.08	3.1	0.23	14.10	0.01	0.05	0.18	1.56	12.50	40	32	28	CL	93.8
48.0 – 53.0	9.0	1.49	26.7	0.69	0.31	18.90	0.70	0.55	0.13	3.1	0.22	13.60	0.01	0.04	0.17	1.25	12.60	42	27	32	CL	90.7
53.0 – 55.0	8.8	1.95	29.2	0.89	0.38	23.30	0.56		0.17	4.1	0.30	11.10	0.01	0.11	0.19	3.44	7.67	37	29	34	CL	91.2
55.0 – 56.4	7.9	5.96	49.5	3.70	0.69	73.30	0.60	1.25	0.39	14.3	0.50	14.50	0.01	0.20	0.30	6.25	8.21	67	14	20	SL	67.4
56.4 – 61.4	9.1	0.87	17.6	0.51	0.26	10.90	0.94	0.50	0.11	2.6	0.19	19.20	0.02	0.02	0.15	0.62	18.50	35	42	22	L	137.0
61.4 – 66.3	9.2	0.78	18.1	0.43	0.23	10.40	1.02		0.07	2.9	0.20	16.40	0.01	0.05	0.15	1.56	14.60	24	54	22	SIL	154.0
66.3 – 71.3	9.7	0.55	11.8	0.37	0.25	6.56	0.54		0.01	2.0	0.17	60.10	0.01	0.16	0.01	5.00	55.10	52	28	20	SL	246.0
71.3 – 76.3	9.5	0.54	12.5	0.35	0.24	6.77	0.54	0.10	0.01	1.7	0.17	56.40	0.05	0.11	0.01	3.44	53.00	67	16	17	SL	231.0
76.3 – 79.0	9.4	0.68	15.3	0.27	0.27	7.94	0.66		0.03	3.4	0.21	44.60	0.04	0.02	0.15	0.62	44.20	68	14	19	SL	210.0
79.0 – 80.6	8.4	3.03	37.9	1.90	0.52	41.70	1.04	1.25	0.34	7.7	0.58	14.60	0.01	0.34	0.24	10.60	4.16	54	16	31	SCL	60.7
80.6 – 84.0	8.6	2.19	34.9	0.85	0.16	24.60	0.78	0.65	0.15	4.3	0.61	12.00	0.11	0.34	0.16	10.60	1.36	30	46	23	L	99.1
84.0 – 89.0	8.3	3.06	42.2	1.50	0.45	41.70	0.94		0.26	13.0	0.59	15.60	0.05	0.24	0.30	7.50	6.12	60	17	22	SCL	75.2
89.0 – 94.0	8.9	1.32	21.4	0.74	0.35	15.80	0.94	0.95	0.26	6.3	0.25	13.70	0.01	0.07	0.16	2.19	11.50	47	19	34	SCL	99.0
94.0 – 97.2	8.2	2.47	34.6	1.06	0.41	29.90	0.74		0.09	4.9	0.55	10.60	0.12	0.22	0.21	6.87	3.75	26	34	41	C	79.5
97.2 – 98.5	9.1	0.82	17.8	0.58	0.09	10.30	0.64	0.20	0.06	3.5	0.22	29.90	0.04	0.03	0.15	0.94	29.00	29	47	24	L	101.0
98.5 – 103.5	8.5	2.01	36.0	0.94	0.14	27.90	0.74	0.70	0.12	4.0	0.35	24.60	0.02	0.16	0.17	5.00	19.60	24	34	42	C	84.2
103.5 – 105.9	8.8	1.84	30.1	0.86	0.19	22.00	0.84		0.07	3.9	0.40	16.90	0.03	0.21	0.16	6.56	12.40	27	24	49	C	93.8
105.9 – 109.8	8.5	1.61	23.0	0.96	0.38	18.80	0.40	0.35	0.03	5.0	0.24	158.00	0.07	0.01	0.16	0.31	158.00	52	24	24	SCL	43.4
109.8 – 112.1	8.3	2.59	33.9	1.57	0.47	34.20	0.82	1.00	0.18	5.7	0.43	47.90	0.03	0.20	0.20	6.25	41.60	29	23	48	C	93.3
112.1 – 113.6	7.0	5.72	30.0	9.78	1.48	71.30	1.16	1.60	0.31	12.0	0.63	12.30	0.09	0.36	0.36	11.90	0.43	43	19	39	CL	80.5
113.6 – 114.1	5.9	6.35	27.8	13.40	2.24	77.70	2.24	1.20	0.15	24.1	1.36	6.96	0.04	0.72	0.62	22.50	−15.50	38	32	30	CL	75.5
114.1 – 118.3	8.3	3.22	42.9	1.63	0.27	41.60	0.90	0.65	0.09	5.0	0.48	9.81	0.01	0.30	0.18	9.37	0.43	33	25	43	C	89.4
118.3 – 123.3	8.6	2.29	36.1	1.10	0.20	29.10	0.94	0.50	0.06	4.5	0.43	23.90	0.01	0.29	0.18	9.06	14.90	33	39	28	CL	84.1
123.3 – 126.1	9.0	1.30	21.1	0.89	0.16	15.30	0.94		0.04	3.6	0.34	18.30	0.01	0.16	0.18	5.00	13.30	35	33	33	CL	96.9
126.1 – 128.6	8.8	1.12	23.2	0.62	0.12	14.10	1.08	0.45	0.03	4.8	0.57	62.60	0.04	0.35	0.18	10.90	51.60	26	47	27	CL	176.0
128.6 – 133.6	8.6	1.63	29.9	0.75	0.11	19.60	1.02	0.55	0.11	6.8	0.52	24.60	0.01	0.30	0.22	9.37	15.50	35	40	25	L	103.0
133.6 – 136.7	8.7	1.48	25.7	0.84	0.13	17.90	0.94		0.07	4.2	0.27	26.10	0.02	0.07	0.18	2.19	23.90	29	47	24	L	64.1
136.7 – 137.7	8.8	1.31	26.9	0.55	0.11	16.60	0.52	0.15	0.04	3.4	0.16	259.00	0.01	0.01	0.16	−0.01	259.00	58	27	15	SL	42.1
137.7 – 139.8	8.7	1.48	30.9	0.59	0.09	18.00	0.72	0.20	0.04	4.0	0.21	66.00	0.02	0.04	0.15	1.25	64.60	44	36	21	L	65.5
139.8 – 144.8	7.9	3.77	45.5	2.23	0.39	52.10	0.74		0.10	7.7	0.49	15.60	0.03	0.21	0.25	6.56	9.01	33	34	34	CL	72.1
144.8 – 149.8	7.1	4.33	35.2	4.16	0.74	55.10	1.06		0.17	8.8	0.88	9.40	0.01	0.56	0.31	17.50	−8.09	38	24	38	CL	75.1
149.8 – 153.8	8.0	3.10	33.6	2.09	0.36	37.20	0.96		0.12	6.2	0.56	11.50	0.01	0.35	0.23	10.90	0.56	33	26	42	C	82.0
153.8 – 158.8	8.0	4.42	49.7	1.79	0.37	51.60	0.98	0.45	0.06	4.7	0.41	71.20	0.01	0.22	0.18	6.87	64.30	15	46	40	SICL	80.5
158.8 – 163.8	7.8	3.44	37.4	2.10	0.38	41.60	1.10		0.06	5.4	0.49	70.40	0.01	0.26	0.21	8.75	61.60	16	44	40	SICL	77.4
163.8 – 168.8	8.0	2.99	35.5	1.67	0.29	35.10	0.78		0.04	6.4	0.76	116.00	0.03	0.50	0.23	15.60	101.00	15	46	40	SICL	65.1
168.8 – 171.2	8.6	1.29	21.8	0.84	0.12	15.10	0.72		0.04	4.9	0.23	125.00	0.01	0.03	0.20	0.94	124.00	10	55	35	SICL	91.7
171.2 – 176.9	8.6	0.86	22.0	0.25	0.04	8.39	0.58	0.20	0.01	3.9	0.17	155.00	0.01	0.02	0.15	0.62	155.00	35	46	19	L	122.0
176.9 – 180.9	8.6	0.63	19.9	0.42	0.07	9.85	0.74	0.35	0.02	4.6	0.21	117.00	0.01	0.04	0.17	1.25	116.00	20	53	27	CL	116.0
180.9 – 184.6	8.7	0.89	20.6	0.43	0.05	10.10	0.38	0.20	0.01	3.9	0.19	78.60	0.01	0.05	0.14	1.56	77.00	52	26	20	SL	89.2
184.6 – 189.6	8.1	0.97	24.4	0.54	0.07	13.50	0.62		0.01	5.0	0.22	154.00	0.03	0.03	0.16	0.94	153.00	28	49	24	L	81.0
189.6 – 194.6	8.6	0.97	23.0	0.41	0.09	11.50	0.86		0.03	4.5	0.21	154.00	0.01	0.02	0.19	0.62	154.00	20	52	28	CL	80.7
194.6 – 196.1	8.4	1.66	24.8	0.78	0.13	16.70	1.08	0.75	0.07	4.9	0.47	39.60	0.01	0.24	0.23	7.50	32.10	15	45	40	SICL	92.3
216.0 – 219.6	8.4	1.36	25.1	0.48	0.10	13.50	0.62	0.30	0.04	5.4	0.21	109.00	0.02	0.04	0.15	1.25	107.00	69	20	11	SL	27.5
219.6 – 223.6	8.8	0.83	21.7	0.46	0.09	11.40	1.56	0.55	0.05	4.9	0.53	87.40	0.01	0.33	0.20	10.30	77.10	16	37	47	C	99.5
227.0 – 230.5	8.1	2.56	27.9	1.18	0.23	23.40	0.74	0.35	0.06	4.3	0.55	5.61	0.05	0.32	0.18	10.00	−4.19	49	36	15	L	30.8
230.5 – 231.3	7.7	1.37	27.0	0.67	0.13	17.10	2.12	0.40	0.12	38.1	0.69	6.49	0.07	0.16	0.46	5.00	3.49	50	20	30	SCL	76.5
231.3 – 232.4	6.4	4.47	41.4	2.92	0.92	57.40	2.14	0.50	0.15	9.8	0.87	5.61	0.06	0.51	0.30	15.90	−10.30	23	40	37	CL	94.7
232.4 – 232.9	9.2	0.77	18.5	0.48	0.09	9.87	0.96	0.10	0.06	4.1	0.06	31.40	0.01	0.04	0.16	1.25	30.20	32	48	20	L	113.0
232.9 – 235.3	9.1	0.90	21.9	0.49	0.10	11.90	1.44	0.40	0.13	5.4	0.29	11.70	0.02	0.06	0.21	1.87	9.83	22	51	28	CL	111.0
235.3 – 235.9	7.4	1.70	27.0	0.67	0.17	19.50	2.66	0.95	0.08	70.7	0.76	10.40	0.01	0.12	0.64	3.75	6.70	76	13	11	SL	59.5
235.9 – 236.4	5.0	9.14	39.5	11.50	4.83	113.00	2.72	1.00	0.21	24.1	1.60	4.40	0.04	1.21	0.55	37.60	−33.40	56	16	28	SCL	72.7
236.4 – 241.4	8.8	1.34	25.5	0.59	0.14	15.40	1.02	0.25	0.08	4.3	0.51	7.49	0.01	0.31	0.20	9.66	−2.20	29	47	24	L	79.6
241.4 – 246.5	9.0	1.00	19.9	0.66	0.12	12.40	0.88		0.04	4.4	0.25	61.20	0.01	0.09	0.16	2.81	76.40	48	36	17	L	46.9
246.5 – 251.5	9.0	1.35	21.0	0.98	0.17	15.90	1.12		0.06	4.9	1.26	13.60	0.10	0.92	0.24	26.70	−15.00	26	42	32	CL	96.1
251.5 – 255.6	8.9	1.84	33.1	0.65	0.14	20.80	1.30	0.70	0.07	5.4	1.64	15.70	0.12	1.24	0.26	36.70	−23.10	29	38	33	CL	91.0
263.7 – 266.5	8.7	1.62	34.6	0.43	0.13	18.30	0.96	0.20	0.08	3.4	0.40	6.93	0.02	0.19	0.19	5.94	0.99	50	26	22	L	114.0
266.5 – 268.8	9.1	1.32	27.8	0.53	0.11	15.70	1.76	0.45	0.09	3.8	0.64	11.40	0.01	0.43	0.21	13.40	−1.99	28	32	40	C	125.0
268.8 – 273.8	8.7	1.62	29.7	0.72	0.15	19.60	0.52	0.30	0.03	2.1	0.44	22.70	0.01	0.25	0.18	7.81	14.90	69	15	16	SL	90.6
273.8 – 276.0	8.4	2.42	31.5	0.98	0.22	24.40	0.68		0.01	1.7	0.46	197.00	0.02	0.22	0.22	6.87	191.00	70	19	11	SL	78.4

APPENDIX 5–B. Drill Hole 289–04 Overburden Analysis

Interval (ft) Top– Bot	pH	EC (mmhos/cm @ 25 C)	SAR	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	Boron (ppm)	Total Selenium (ppm)	H2O Sol. Selenium (ppm)	Tot. Org. Carbon (%)	Total Sulfur (%)	Neut. Pot. (t/1000t)	Sulfate Sulfur (%)	Pyritic Sulfur (%)	Organic Sulfur (%)	Pyr S AB (t/1000t)	Pyr S ABP (t/1000t)	Sand (%)	Silt (%)	Clay (%)	Texture	Sat. (%)
0.0 – 5.0	7.8	16.50	34.4	23.10	22.40	164.00	0.44	0.40	0.25	2.6	0.30	32.60	0.15	0.14	0.01	4.37	26.50	42	37	20	L	60.5
5.0 – 10.0	9.3	0.92	16.4	0.50	0.13	9.20	0.32	0.05	0.02	1.9	0.17	46.00	0.06	0.06	0.01	2.50	43.50	47	31	22	L	341.0
10.0 – 13.8	9.0	1.19	20.4	0.68	0.16	13.20	0.28		0.03	2.3	0.15	19.30	0.07	0.07	0.01	2.19	17.10	58	22	20	SCL	276.0
13.8 – 15.0	4.5	10.70	36.2	17.60	9.95	135.00	1.20	1.00	0.12	6.5	0.61	1.46	0.45	0.01	0.16	−0.01	1.46	62	16	21	SCL	61.5
15.0 – 20.0	6.4	6.44	39.7	5.21	2.14	76.20	0.60		0.11	5.3	0.23	9.09	0.06	0.02	0.13	0.62	6.47	56	22	23	SCL	68.3
20.0 – 25.0	5.2	12.40	34.3	13.00	7.15	109.00	0.74		0.12	5.5	0.36	6.94	0.22	0.01	0.15	0.31	6.63	59	17	24	SCL	76.7
25.0 – 30.0	7.0	9.29	30.7	14.30	4.58	94.20	0.46	0.30	0.05	3.8	0.29	10.30	0.19	0.09	0.01	2.81	7.46	37	42	22	L	91.4
30.0 – 35.0	7.4	5.06	36.1	3.43	1.03	53.90	0.46		0.05	4.3	0.19	25.00	0.06	0.01	0.13	−0.01	25.00	43	32	25	L	100.0
35.0 – 40.0	8.9	1.35	30.1	0.28	0.11	13.30	0.26		0.06	2.6	0.17	27.10	0.06	0.06	0.01	2.50	24.60	25	48	27	CL	226.0
40.0 – 43.0	7.8	6.02	34.7	4.11	1.71	59.20	0.36		0.06	6.0	0.26	34.40	0.11	0.04	0.11	1.25	33.10	44	28	29	CL	107.0
43.0 – 44.2	4.4	11.90	32.9	17.90	7.39	117.00	0.80	1.20	0.09	20.8	0.81	1.46	0.51	0.01	0.30	−0.01	1.46	69	7	24	SCL	75.6
44.2 – 48.0	7.7	5.36	34.5	4.02	1.22	55.90	0.48	0.50	0.05	5.6	0.25	10.00	0.11	0.01	0.14	−0.01	10.00	50	17	34	SCL	101.0
48.0 – 48.9	4.9	9.87	28.0	19.10	4.54	96.30	6.00	0.80	0.07	59.6	0.77	8.19	0.19	0.06	0.52	1.87	6.32	79	7	14	SL	61.4
48.9 – 53.9	8.6	2.01	38.8	0.63	0.14	24.10	0.98		0.11	8.6	0.18	11.60	0.01	0.03	0.15	0.94	10.60	42	24	34	CL	107.0
53.9 – 58.9	8.5	2.52	36.0	1.07	0.18	28.50	1.00	0.65	0.12	4.6	0.42	26.00	0.01	0.26	0.16	8.12	17.60	27	31	42	C	94.0
58.9 – 60.0	8.6	3.20	46.4	0.99	0.16	35.20	0.88		0.24	5.8	0.32	10.80	0.01	0.19	0.13	5.94	4.84	49	22	29	SCL	82.5
60.0 – 61.8	7.8	3.97	41.8	1.63	0.27	40.50	2.42	1.10	0.30	19.7	0.54	12.30	0.02	0.22	0.30	6.87	5.45	68	13	19	SL	70.1
61.8 – 66.8	8.7	1.61	29.8	0.66	0.10	18.40	1.20		0.44	6.1	0.21	15.80	0.01	0.08	0.13	2.50	13.30	47	23	31	SCL	95.0
66.8 – 71.8	8.7	1.50	32.7	0.36	0.09	15.50	0.96	0.40	0.09	3.6	0.25	10.70	0.01	0.13	0.12	4.06	6.69	31	38	31	CL	91.4
71.8 – 76.8	9.1	0.93	19.3	0.46	0.11	10.30	0.52		0.05	3.3	0.16	10.50	0.01	0.06	0.10	1.87	8.60	29	37	34	CL	94.6
76.8 – 78.2	8.9	1.10	21.7	0.52	0.10	12.10	0.52		0.04	3.5	0.16	9.92	0.01	0.14	0.01	4.37	5.55	31	35	34	CL	82.2
78.2 – 83.0	9.0	0.87	18.7	0.42	0.08	9.33	0.80	0.20	0.02	3.5	0.15	142.00	0.01	0.13	0.01	4.06	138.00	34	44	22	L	73.4
83.0 – 88.0	8.7	1.10	19.3	0.60	0.12	11.60	1.44		0.04	4.4	0.22	83.80	0.01	0.10	0.12	3.12	60.60	18	46	35	SICL	77.5
88.0 – 93.0	8.4	2.70	43.4	1.21	0.21	36.60	1.42	0.70	0.09	5.6	0.32	55.60	0.01	0.18	0.14	5.62	50.00	26	30	44	C	85.1
93.0 – 95.4	8.4	7.96	27.1	15.30	2.89	61.60	1.98		0.24	13.5	1.07	8.52	0.06	0.64	0.35	20.00	−11.50	47	35	19	L	73.5
95.4 – 100.4	8.3	2.22	32.6	1.21	0.21	27.60	0.90		0.06	4.7	0.36	42.00	0.04	0.17	0.15	5.31	36.70	22	37	41	C	77.6
100.4 – 105.4	8.7	1.84	31.2	0.67	0.12	19.60	1.24	0.45	0.10	4.2	0.35	23.20	0.01	0.21	0.14	6.56	16.60	31	24	45	C	68.5
105.4 – 106.2	8.6	2.16	44.3	0.57	0.12	26.00	1.04		0.06	3.9	0.41	18.30	0.01	0.27	0.14	8.43	9.84	35	20	46	C	66.8
106.2 – 111.2	8.4	2.67	38.1	1.15	0.19	31.20	1.00	0.95	0.11	5.8	0.59	29.60	0.01	0.42	0.17	13.10	16.40	37	23	40	C	61.3
111.2 – 113.8	8.5	2.19	34.6	1.03	0.17	26.80	0.88		0.10	4.9	0.63	14.00	0.03	0.46	0.14	14.40	−0.34	32	29	39	CL	85.6
113.8 – 115.4	8.6	1.44	23.5	0.59	0.14	14.20	1.46	0.90	0.14	11.1	0.62	10.20	0.01	0.39	0.22	12.20	−1.94	46	28	24	L	89.8
115.4 – 119.6	8.7	1.08	20.3	0.49	0.13	11.30	0.76	0.35	0.04	3.9	0.20	10.70	0.01	0.06	0.12	2.50	6.17	29	42	29	CL	75.7
119.6 – 120.0	8.1	2.23	33.0	1.12	0.21	26.90	1.32	1.45	0.27	16.5	0.55	12.20	0.01	0.23	0.31	7.19	5.02	55	16	30	SCL	77.7
120.0 – 125.1	8.6	1.75	26.8	0.73	0.15	17.80	0.96	0.45	0.08	4.1	0.34	31.10	0.01	0.20	0.14	6.25	24.80	27	32	42	C	93.2
125.1 – 128.6	8.5	1.63	24.4	0.69	0.16	15.90	1.04		0.04	4.0	0.35	76.90	0.01	0.23	0.12	7.19	69.80	14	50	36	SICL	79.7
128.6 – 133.6	8.5	1.97	38.8	0.47	0.12	21.10	0.72		0.03	5.2	0.27	170.00	0.05	0.10	0.12	3.12	167.00	33	39	28	CL	50.2
133.6 – 138.6	8.4	2.07	34.6	0.65	0.13	21.60	0.42		0.03	5.7	0.17	143.00	0.01	0.05	0.12	1.56	141.00	36	32	33	CL	59.3
138.6 – 143.6	8.3	2.10	33.2	0.67	0.16	21.40	1.06		0.05	4.8	0.31	39.50	0.01	0.17	0.14	5.31	34.20	24	35	42	C	84.9
143.6 – 148.6	8.6	1.58	28.2	0.51	0.12	15.80	0.96		0.04	3.8	0.39	84.10	0.07	0.20	0.12	6.25	77.90	17	47	36	SICL	76.6
148.6 – 153.6	8.8	1.03	20.3	0.49	0.14	11.40	0.90		0.03	4.0	0.18	63.00	0.01	0.07	0.10	2.19	60.60	14	53	33	SICL	79.3
153.6 – 158.6	8.8	1.11	19.3	0.42	0.38	12.20	0.72		0.03	4.0	0.12	61.90	0.01	0.02	0.10	0.62	61.30	18	50	32	SICL	76.5
158.6 – 163.6	8.7	1.10	23.6	0.36	0.13	11.70	0.72		0.04	4.4	0.19	80.10	0.02	0.05	0.12	1.56	78.50	22	41	38	CL	81.0
163.6 – 168.6	8.4	1.66	23.0	0.94	0.18	17.20	1.16		0.07	4.4	0.37	74.40	0.02	0.20	0.15	6.25	68.10	13	33	54	C	99.7
168.6 – 173.6	8.4	2.17	20.7	0.70	0.15	13.50	1.32		0.03	5.0	0.38	126.00	0.01	0.24	0.14	7.50	119.00	10	46	44	SIL	83.3
173.6 – 178.6	8.5	1.12	17.9	0.72	0.18	12.00	0.88		0.02	4.7	0.28	163.00	0.07	0.06	0.13	2.50	161.00	22	46	33	CL	84.2
178.6 – 181.7	8.6	1.24	23.8	0.57	0.14	14.20	0.92	0.30	0.06	4.6	0.16	94.30	0.01	0.04	0.12	1.25	93.00	15	49	36	SICL	81.6
201.8 – 207.2	8.5	1.49	22.9	0.76	0.19	15.80	0.84	0.40	0.04	4.7	0.15	134.00	0.01	0.03	0.11	0.94	133.00	56	25	19	SL	31.1
207.2 – 210.4	8.8	1.33	21.1	0.73	0.15	14.00	1.32	0.45	0.04	4.6	0.62	56.80	0.01	0.46	0.16	14.40	42.40	20	31	50	C	107.0
215.0 – 217.6	7.6	3.74	41.6	1.59	0.46	42.10	1.88	0.85	0.21	16.2	0.73	6.72	0.02	0.38	0.33	11.90	−3.15	41	26	33	CL	87.6
217.6 – 220.3	9.0	1.14	23.2	0.49	0.12	12.80	1.10	0.40	0.09	5.2	0.21	9.07	0.01	0.08	0.13	2.50	6.57	17	56	27	SIL	97.6
220.3 – 223.6	7.3	6.19	44.1	4.55	1.17	74.50	1.60	0.50	0.14	16.4	1.36	9.54	0.01	1.04	0.34	32.50	−22.90	55	21	24	SCL	70.9
223.6 – 228.6	9.0	1.40	30.3	0.40	0.09	15.00	0.90	0.20	0.06	3.8	0.30	10.20	0.01	0.17	0.13	5.31	4.86	36	40	24	L	76.2
228.6 – 233.7	9.0	1.61	30.2	0.54	0.11	17.20	1.20		0.04	4.6	0.41	57.90	0.01	0.28	0.13	8.75	49.10	37	40	23	L	69.7
233.7 – 238.7	9.0	2.43	51.3	0.50	0.14	29.00	1.58		0.07	5.1	1.29	15.60	0.01	1.06	0.23	33.10	−17.50	25	45	30	CL	105.0
238.7 – 242.4	9.0	1.47	26.6	0.54	0.13	15.40	1.16	0.30	0.11	5.3	1.41	16.50	0.01	1.19	0.22	37.20	−20.70	28	43	30	CL	91.1
250.3 – 255.3	9.3	1.82	32.5	0.53	0.12	18.50	1.10		0.11	3.8	0.60	11.60	0.01	0.44	0.16	13.70	−2.15	27	38	36	CL	146.0
255.3 – 256.4	9.9	0.99	25.0	0.25	0.09	10.30	2.04		0.01	<4.0	0.58	18.70	0.02	0.41	0.15	12.60	5.88	61	17	22	SCL	416.0
256.4 – 260.0	9.1	1.91	30.1	0.62	0.15	18.70	0.68	0.25	0.01	2.1	0.43	131.00	0.01	0.27	0.16	8.43	123.00	72	13	15	SL	74.2

APPENDIX 5–B. Drill Hole 289–05 Overburden Analysis

Interval (ft) Top– Bot	pH	EC (mmhos/cm @ 25 C)	SAR	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	Boron (ppm)	Total Selenium (ppm)	H2O Sol. Selenium (ppm)	Tot. Org. Carbon (%)	Total Sulfur (%)	Neut. Pot. (t/1000t)	Sulfate Sulfur (%)	Pyritic Sulfur (%)	Organic Sulfur (%)	Pyr S AB (t/1000t)	Pyr S ABP (t/1000t)	Sand (%)	Silt (%)	Clay (%)	Texture	Sat. (%)
0.0 – 5.0	7.9	6.54	19.0	17.50	3.21	61.30	0.40	0.65	0.09	4.1	0.27	29.20	0.14	0.01	0.13	–0.01	29.20	28	22	50	C	81.4
5.0 – 10.0	7.5	5.07	23.1	6.87	3.69	53.10	0.24		0.07	4.2	0.17	12.90	0.02	0.01	0.14	0.31	12.60	28	22	50	C	98.1
10.0 – 15.3	7.4	7.20	19.6	15.10	9.04	68.90	0.16		0.05	5.2	0.28	36.50	0.14	0.01	0.13	0.31	36.20	27	33	41	C	94.2
15.3 – 16.8	8.0	5.25	29.1	3.74	4.09	57.50	0.16	0.95	0.03	9.7	0.13	6.75	0.07	0.05	0.01	1.56	7.19	66	19	15	SL	29.8
16.8 – 21.8	7.6	5.69	24.7	7.58	4.34	60.20	0.26		0.05	4.7	0.22	25.90	0.09	0.01	0.13	–0.01	25.90	25	26	50	C	87.8
21.8 – 26.8	7.5	6.55	23.4	10.60	6.47	68.40	0.32	0.35	0.05	4.5	0.15	105.00	0.01	0.01	0.13	0.31	105.00	24	36	41	C	69.1
26.8 – 32.2	7.9	6.21	23.9	9.38	5.35	64.80	0.30		0.03	4.5	0.17	93.80	0.16	0.01	0.01	–0.01	93.80	21	41	39	CL	68.7
32.2 – 33.5	4.6	8.94	23.2	18.50	12.50	91.50	0.68	1.10	0.09	11.9	0.27	1.96	0.05	0.01	0.22	–0.01	1.96	54	13	33	SCL	58.3
33.5 – 35.7	6.8	6.12	22.6	18.10	10.10	84.80	0.46	0.25	0.03	5.3	0.46	39.20	0.25	0.03	0.18	0.94	38.30	28	35	37	CL	71.5
35.7 – 36.7	7.8	6.15	30.8	4.12	4.56	64.10	0.38	0.30	0.01	19.6	0.49	189.00	0.06	0.22	0.19	6.87	183.00	76	9	15	SL	28.4
36.7 – 40.3	7.9	5.84	31.3	6.18	2.16	63.90	0.60	0.65	0.07	5.6	0.49	62.60	0.30	0.02	0.17	0.62	62.10	22	32	46	C	90.4
40.3 – 40.8	6.3	9.00	29.0	16.90	5.92	97.80	2.04	2.70	0.34	15.3	1.30	13.60	0.01	0.91	0.39	28.40	–14.80	50	17	33	SCL	69.3
40.8 – 45.8	8.1	4.03	37.7	2.75	0.86	50.70	0.42		0.07	5.1	0.66	12.70	0.07	0.43	0.18	13.40	–0.77	37	23	40	CL	95.0
45.8 – 50.8	8.9	1.38	23.1	0.49	0.32	14.70	0.40	0.30	0.02	3.6	0.43	29.40	0.01	0.18	0.24	5.62	23.80	25	46	30	CL	152.0
50.8 – 55.2	8.8	1.51	20.7	0.83	0.38	16.10	0.56		0.04	3.9	0.16	23.20	0.01	0.04	0.12	1.25	21.90	27	39	33	CL	100.0
55.2 – 60.2	8.2	4.14	42.4	1.92	0.65	48.10	0.56		0.06	8.5	0.62	13.00	0.01	0.41	0.21	12.80	0.18	35	37	29	CL	123.0
60.2 – 65.8	7.3	5.57	34.4	6.53	1.63	69.50	0.96	1.25	0.16	18.6	0.85	15.30	0.01	0.45	0.39	14.10	1.21	53	18	30	SCL	83.6
65.8 – 68.0	7.1	6.04	29.8	14.70	3.37	89.50	1.20		0.24	14.7	1.21	22.80	0.01	0.76	0.45	23.70	–0.96	45	20	36	CL	75.3
68.0 – 73.0	7.8	5.31	35.2	4.91	0.84	59.70	0.70	0.85	0.09	5.8	0.66	26.00	0.02	0.44	0.20	13.70	12.30	24	30	46	C	83.2
73.0 – 76.0	8.4	2.28	23.4	1.24	0.47	21.60	0.72		0.05	4.6	0.39	53.30	0.01	0.21	0.17	6.56	46.70	17	41	42	SIC	64.8
76.0 – 81.0	8.7	0.96	16.9	0.42	0.31	10.20	0.30		0.01	3.9	0.25	115.00	0.08	0.03	0.14	0.94	114.00	26	47	28	CL	134.0
81.0 – 86.0	9.1	0.64	17.5	0.36	0.18	9.09	0.40	0.15	0.01	3.6	0.12	103.00	0.01	0.01	0.12	–0.01	103.00	35	37	28	CL	169.0
86.0 – 91.0	9.2	0.63	8.8	0.77	0.28	6.37	0.32		0.01	4.1	0.13	157.00	0.01	0.01	0.12	0.31	156.00	50	26	24	SCL	126.0
91.0 – 93.8	9.3	0.88	19.3	0.36	0.12	9.44	0.36	0.10	0.01	3.4	0.12	151.00	0.01	0.01	0.12	–0.01	151.00	58	21	21	SCL	155.0
93.8 – 98.8	8.6	1.52	23.4	0.62	0.29	15.80	0.28		0.01	5.7	0.32	88.40	0.05	0.12	0.15	3.75	84.70	14	45	42	SIC	93.9
98.8 –103.8	8.6	1.46	22.3	0.83	0.35	15.60	0.50		0.01	5.9	0.30	88.00	0.01	0.15	0.14	4.69	83.30	8	49	43	SIC	92.8
103.8 –108.8	8.5	1.27	24.3	0.60	0.13	14.70	0.38		0.01	5.5	0.29	167.00	0.01	0.15	0.13	4.69	162.00	16	50	35	SICL	76.1
108.8 –113.8	8.5	1.15	18.6	0.72	0.27	13.10	0.98		0.03	5.4	0.27	170.00	0.05	0.10	0.12	3.12	166.00	20	46	34	CL	71.9
113.8 –118.8	8.4	1.92	28.1	0.68	0.27	19.40	0.60		0.01	6.0	0.28	156.00	0.01	0.12	0.15	3.75	152.00	17	50	33	SICL	70.2
118.8 –120.0	8.3	2.42	29.1	0.88	0.29	22.10	0.90	0.85	0.06	7.2	0.47	88.40	0.01	0.27	0.20	6.43	80.00	14	45	42	SIC	86.1
140.2 –144.6	8.5	2.62	39.7	0.95	0.35	32.00	0.54	0.40	0.02	5.9	0.32	214.00	0.06	0.10	0.14	3.12	211.00	56	25	19	SL	33.8
144.6 –146.5	8.8	2.36	33.3	0.72	0.21	22.70	0.76	0.65	0.02	4.6	0.64	94.30	0.01	0.47	0.17	14.70	79.60	17	35	48	C	31.0
153.6 –155.3	7.9	5.76	55.0	2.29	0.71	67.40	0.92	0.75	0.07	12.4	0.75	11.00	0.04	0.44	0.27	13.70	–2.73	30	33	37	CL	99.5
155.3 –156.9	9.2	1.53	29.8	0.50	0.10	16.30	0.60	0.40	0.02	4.6	0.19	24.60	0.01	0.06	0.13	1.87	22.90	26	46	28	CL	96.9
156.9 –161.6	8.9	3.31	53.3	0.85	0.21	38.80	0.84	0.80	0.06	9.5	1.00	13.30	0.01	0.78	0.22	24.40	–11.00	39	31	31	CL	95.2
161.6 –166.6	9.1	2.14	32.6	0.67	0.15	20.90	0.60	0.35	0.03	4.8	0.60	18.60	0.01	0.43	0.17	13.40	5.20	34	43	24	L	66.2
166.6 –168.2	9.0	2.07	31.8	0.69	0.18	21.00	0.42		0.02	8.1	0.33	155.00	0.01	0.19	0.14	5.94	149.00	52	30	18	L	45.5
168.2 –173.2	9.1	2.15	30.0	0.79	0.18	20.90	0.72		0.04	5.2	0.76	49.00	0.01	0.56	0.18	18.10	30.60	23	49	28	CL	90.9
173.2 –176.2	8.9	2.74	39.9	1.26	0.27	34.90	0.82		0.03	5.9	1.34	38.00	0.01	1.09	0.25	34.10	3.92	26	45	29	CL	87.8
176.2 –179.6	8.8	2.35	38.6	0.65	0.13	24.10	0.64	1.05	0.04	6.2	1.35	17.10	0.01	1.14	0.21	35.60	–18.60	29	38	33	CL	80.5
187.4 –192.4	9.5	1.68	33.3	0.39	0.09	16.30	4.32	0.40	0.02	3.7	0.49	26.10	0.05	0.27	0.17	8.43	19.70	27	41	32	CL	186.0
192.4 –195.0	9.9	1.29	26.1	0.43	0.12	13.70	0.80		0.01	4.0	0.48	45.30	0.01	0.30	0.18	9.37	36.00	36	28	36	CL	264.0
195.0 –198.2	9.2	3.19	54.0	0.80	0.21	36.40	0.40	0.30	0.01	2.7	0.39	39.80	0.01	0.21	0.18	6.56	33.30	70	15	15	SL	63.9

APPENDIX 5–B. Drill Hole 389–48 Overburden Analysis

Interval (ft) Top– Bot	pH	EC (mmhos/cm @ 25 C)	SAR	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	Boron (ppm)	Total Selenium (ppm)	H2O Sol. Selenium (ppm)	Tot. Org. Carbon (%)	Total Sulfur (%)	Neut. Pot. (t/1000t)	Sulfate Sulfur (%)	Pyritic Sulfur (%)	Organic Sulfur (%)	Pyr S AB (t/1000t)	Pyr S ABP (t/1000t)	Sand (%)	Silt (%)	Clay (%)	Texture	Sat. (%)
0.0 – 5.0	7.9	8.56	25.2	17.20	4.45	83.00	0.69	0.75	0.04	3.7	0.28	95.10	0.18	0.09	0.01	2.81	92.30	41	22	37	CL	57.8
5.0 – 9.0	7.7	4.60	28.9	3.53	1.37	45.20	0.45	0.20	0.02	3.5	0.28	15.10	0.27	0.01	0.01	−0.01	15.10	38	29	33	CL	52.0
9.0 – 14.0	7.7	8.37	23.3	15.90	7.31	79.50	0.48		0.03	3.6	0.55	14.90	0.54	0.01	0.01	−0.01	14.90	32	27	42	C	74.2
14.0 – 19.0	7.9	8.85	24.0	16.40	7.09	82.20	0.30	0.55	0.05	3.1	0.51	144.00	0.50	0.01	0.01	−0.01	144.00	31	38	32	CL	78.4
19.0 – 22.0	7.6	0.46	23.7	16.50	6.65	60.60	0.24		0.05	3.6	0.77	59.70	0.60	0.16	0.01	5.00	54.70	25	40	35	CL	68.6
22.0 – 24.2	7.4	11.10	31.1	16.10	8.43	109.00	0.33	0.85	0.11	8.1	0.75	9.37	0.55	0.01	0.20	−0.01	9.37	40	20	41	C	102.0
24.2 – 29.2	7.0	8.68	25.3	15.20	6.46	83.20	0.33		0.04	4.3	0.82	4.12	0.62	0.05	0.15	1.56	2.56	16	29	53	C	111.0
29.2 – 34.2	7.4	9.20	27.0	16.40	7.60	93.60	0.36	0.30	0.04	4.0	1.15	5.83	0.96	0.05	0.14	1.56	4.26	16	28	57	C	94.3
34.2 – 37.4	8.0	10.60	28.2	17.50	8.21	101.00	0.18		0.03	3.5	0.93	106.00	0.80	0.05	0.08	1.56	104.00	35	32	33	CL	60.6
37.4 – 42.4	8.1	6.88	27.6	7.09	3.23	62.70	0.12		0.04	3.8	0.59	110.00	0.39	0.03	0.17	0.94	109.00	24	36	40	CL	67.0
42.4 – 47.4	8.5	3.96	36.9	1.47	0.80	39.30	0.09	0.10	0.02	3.5	0.27	139.00	0.08	0.04	0.15	1.25	138.00	22	46	32	CL	101.0
47.4 – 52.4	8.1	6.21	28.4	6.55	3.15	62.60	0.12		0.01	4.2	0.38	68.10	0.18	0.04	0.16	1.25	66.80	19	42	39	SICL	97.5
52.4 – 55.8	8.0	8.07	27.6	11.80	5.72	81.60	0.15		0.01	4.0	0.43	78.40	0.24	0.04	0.15	1.25	77.20	31	36	32	CL	77.3
55.8 – 60.8	8.9	1.67	37.4	0.25	0.09	15.40	0.06		0.01	3.0	0.31	119.00	0.06	0.11	0.14	3.44	116.00	39	41	21	L	155.0
60.8 – 65.8	9.4	1.06	35.0	0.12	0.05	10.20	0.12		0.01	2.8	0.26	131.00	0.06	0.19	0.01	5.94	125.00	32	46	22	L	220.0
65.8 – 70.8	9.5	0.97	22.8	0.31	0.09	10.20	0.15	0.05	0.01	2.7	0.25	117.00	0.07	0.05	0.13	1.56	115.00	36	43	22	L	237.0
70.8 – 75.8	9.4	0.86	17.3	0.36	0.09	8.20	0.18		0.01	2.9	0.01	93.20	0.01	0.01	0.01	−0.01	93.20	36	40	24	L	203.0
75.8 – 79.2	9.3	0.90	20.2	0.35	0.09	9.50	0.09		0.01	3.4	0.23	119.00	0.02	0.07	0.14	2.19	117.00	45	33	22	L	153.0
79.2 – 84.2	8.6	1.76	36.1	0.28	0.09	16.40	0.24		0.01	4.0	0.27	101.00	0.02	0.07	0.16	2.19	99.20	25	42	33	CL	120.0
84.2 – 85.0	8.9	2.19	41.0	0.50	0.12	22.80	0.21	0.40	0.01	4.7	0.30	72.20	0.03	0.11	0.16	3.44	68.70	24	43	33	CL	121.0
106.0 – 107.4	7.8	7.04	43.1	3.83	1.14	68.00	0.30	0.50	0.04	4.7	0.54	4.63	0.03	0.30	0.21	9.37	−4.54	42	31	27	CL	49.4
107.4 – 109.2	7.5	8.41	55.3	2.02	0.67	64.10	0.46	0.80	0.04	8.6	1.55	5.39	0.01	1.19	0.36	37.20	−31.80	20	46	35	SICL	54.7
109.2 – 114.2	8.5	3.54	33.8	1.59	0.55	35.00	0.09	0.15	0.01	3.7	0.30	72.20	0.01	0.13	0.16	4.06	68.20	69	20	11	SL	24.0
114.2 – 118.1	9.0	2.60	47.2	0.59	0.12	28.10	0.12		0.01	2.9	0.01	122.00	0.01	0.01	0.01	−0.01	122.00	67	22	11	SL	21.5
118.1 – 121.4	9.0	2.59	36.6	0.47	0.56	26.30	0.36	0.60	0.01	6.0	1.00	71.00	0.01	0.75	0.25	23.40	47.60	22	35	44	C	90.5
121.4 – 122.6	7.2	9.95	32.3	12.60	3.52	92.30	0.81	1.80	0.07	38.9	1.96	10.90	0.05	1.31	0.62	40.90	−30.00	58	18	24	SCL	50.2
122.6 – 124.5	8.9	1.86	30.7	0.52	0.24	18.90	0.27	0.55	0.04	5.9	0.84	6.72	0.09	0.48	0.27	15.00	−8.28	16	38	46	C	101.0
124.5 – 127.3	7.0	7.83	45.6	5.85	1.65	68.30	0.81	1.05	0.15	18.3	1.74	5.13	0.01	1.09	0.65	34.10	−28.90	41	21	37	CL	74.2
132.0 – 137.0	8.8	2.36	34.3	0.91	0.16	25.10	0.27	0.65	0.03	7.0	1.32	8.28	0.01	1.01	0.31	31.60	−23.30	37	39	24	L	69.4
137.0 – 138.8	8.2	3.33	26.1	1.72	0.71	28.80	0.39		0.03	6.4	1.77	5.36	0.04	1.41	0.32	44.00	−38.70	36	43	21	L	64.7
138.8 – 140.8	7.4	4.54	39.0	2.01	0.67	45.10	0.72	0.10	0.04	14.7	1.78	6.21	0.10	1.17	0.51	36.60	−30.30	36	37	27	CL	78.4
140.8 – 145.8	9.0	1.95	20.7	0.86	0.38	16.30	0.30	0.15	0.01	5.0	0.44	114.00	0.16	0.11	0.17	3.44	110.00	51	30	19	L	46.0
145.8 – 147.2	8.8	1.34	15.2	0.76	0.51	12.10	0.42		0.03	5.0	1.95	5.18	0.97	0.66	0.32	20.60	−15.40	22	50	28	CL	68.5
147.2 – 152.2	9.0	2.56	28.6	0.58	0.46	20.60	0.42		0.02	5.9	2.45	15.00	0.01	2.08	0.36	65.00	−50.00	26	43	31	CL	97.7
152.2 – 153.5	8.9	1.93	27.1	0.89	0.29	20.80	0.42	0.75	0.04	5.6	1.50	8.30	0.01	1.25	0.25	39.00	−30.80	25	46	30	CL	84.3
164.3 – 168.3	9.5	2.56	9.9	0.92	0.14	7.20	0.36	0.45	0.03	4.1	0.38	8.55	0.21	0.01	0.17	−0.01	8.55	21	41	38	CL	147.0
168.3 – 172.0	9.2	1.31	19.4	0.57	0.29	12.70	0.30		0.02	4.0	0.78	69.30	0.01	0.54	0.24	16.90	52.40	29	45	26	L	179.0
175.0 – 177.3	9.2	1.99	23.8	0.98	0.18	18.10	0.39	0.60	0.01	4.9	1.36	95.60	0.01	0.93	0.43	29.10	66.60	60	25	15	SL	107.0
182.7 – 186.7	8.1	4.76	40.8	1.97	0.61	46.30	0.24	0.55	0.02	3.2	0.58	5.44	0.08	0.30	0.20	9.37	−3.93	49	42	9	L	49.6
186.7 – 189.7	7.7	7.42	43.9	3.88	1.33	70.80	0.27		0.01	2.8	1.54	5.80	0.10	1.20	0.24	37.50	−31.70	51	42	8	L	49.1
189.7 – 194.2	9.4	2.36	42.5	0.42	0.24	24.40	0.45	0.35	0.01	4.6	2.49	4.98	0.52	1.60	0.37	50.00	−45.00	41	46	13	L	108.0
194.2 – 196.9	9.5	1.88	32.1	0.63	0.18	20.40	0.36	0.15	0.01	3.9	0.33	121.00	0.01	0.16	0.17	5.00	116.00	60	29	11	SL	79.1
196.9 – 197.9	9.4	1.62	24.3	0.54	0.22	15.00	0.36	0.10	0.01	4.0	0.20	121.00	0.01	0.04	0.16	1.25	120.00	62	28	10	SL	75.7
203.0 – 208.0	8.4	4.23	78.4	0.46	0.12	42.20	0.21	0.02	0.01	1.7	0.26	126.00	0.03	0.11	0.12	3.44	125.00	85	8	7	LS	34.1
208.0 – 213.8	8.4	5.04	74.6	0.65	0.14	47.00	0.21		0.01	1.3	0.24	6.26	0.03	0.06	0.13	2.50	3.76	86	8	6	LS	34.9

APPENDIX 5–B. Drill Hole 389–49 Overburden Analysis

Interval (ft) Top– Bot	pH	EC (mmhos/cm @ 25 C)	SAR	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	Boron (ppm)	Total Selenium (ppm)	H2O Sol. Selenium (ppm)	Tot. Org. Carbon (%)	Total Sulfur (%)	Neut. Pot. (t/1000t)	Sulfate Sulfur (%)	Pyritic Sulfur (%)	Organic Sulfur (%)	Pyr S AB (t/1000t)	Pyr S ABP (t/1000t)	Sand (%)	Silt (%)	Clay (%)	Texture	Sat. (%)
0.0 – 5.0	7.4	7.66	26.2	14.40	3.17	77.80	0.51	0.50	0.07	4.7	0.36	10.60	0.21	0.04	0.11	1.25	9.52	39	29	31	CL	81.4
5.0 – 10.0	7.7	9.92	25.8	15.40	6.82	85.90	0.24	0.40	0.14	3.9	0.45	20.90	0.27	0.06	0.12	1.87	19.00	30	41	30	CL	67.7
10.0 – 15.0	7.5	9.86	24.7	15.30	6.10	84.50	0.15	0.65	0.10	4.3	0.46	6.53	0.31	0.16	0.01	5.00	1.53	29	29	42	C	164.0
15.0 – 17.0	7.1	3.66	26.1	2.37	1.34	38.30	0.30		0.12	4.0	0.29	5.62	0.28	0.01	0.01	–0.01	5.62	16	35	50	C	111.0
17.0 – 18.0	7.1	7.20	22.0	12.60	6.90	69.20	0.15	1.00	0.06	5.3	0.71	4.22	0.53	0.03	0.15	0.94	3.28	14	37	46	C	108.0
18.0 – 20.9	7.6	8.70	23.4	15.30	8.21	80.20	0.30	1.30	0.13	4.8	0.67	35.60	0.70	0.12	0.05	3.75	31.90	22	30	48	C	104.0
20.9 – 21.4	7.3	9.70	26.0	15.90	12.20	97.30	0.33	1.35	0.25	10.1	2.03	8.47	1.75	0.07	0.21	2.19	6.28	24	28	49	C	99.1
21.4 – 23.3	7.3	7.02	22.9	12.20	6.29	69.70	0.33	0.50	0.11	4.8	0.57	4.01	0.56	0.01	0.01	–0.01	4.01	19	34	48	C	103.0
23.3 – 28.3	8.9	4.82	23.4	5.00	2.66	45.90	0.24	0.50	0.10	3.6	0.26	6.45	0.11	0.16	0.01	5.00	1.45	23	38	40	CL	85.9
28.3 – 30.0	8.0	6.07	24.6	13.80	7.14	79.50	0.12		0.02	3.4	0.30	57.70	0.16	0.13	0.01	4.06	53.60	25	42	33	CL	77.0
30.0 – 35.0	8.4	3.14	27.5	1.96	0.86	32.70	0.18		0.07	3.7	0.22	86.50	0.21	0.01	0.01	–0.01	86.50	21	42	37	CL	80.8
35.0 – 40.0	8.3	4.94	24.7	5.71	2.74	50.70	0.21	0.35	0.06	4.1	0.23	118.00	0.11	0.01	0.12	–0.01	118.00	22	38	40	C	77.7
40.0 – 41.0	8.0	8.70	24.5	13.90	6.94	79.00	0.15		0.06	3.6	0.35	122.00	0.17	0.05	0.13	1.56	121.00	22	41	38	CL	65.9
41.0 – 42.1	8.2	5.41	29.8	4.43	2.51	55.50	0.09	0.30	0.04	4.2	0.30	60.40	0.14	0.02	0.14	0.62	59.60	13	36	51	C	112.0
42.1 – 47.1	8.7	2.63	24.9	1.30	0.55	23.90	0.06		0.01	3.1	0.24	142.00	0.06	0.04	0.12	1.25	141.00	51	23	26	SCL	96.6
47.1 – 52.4	9.3	1.26	16.1	1.00	0.13	12.10	0.12	0.40	0.01	3.2	0.15	160.00	0.01	0.01	0.15	–0.01	160.00	52	25	23	SCL	149.0
64.3 – 69.3	8.6	3.49	29.3	2.35	0.52	35.10	0.24	0.20	0.03	4.1	0.56	25.00	0.05	0.33	0.20	10.30	14.70	28	51	22	SIL	99.4
69.3 – 74.3	9.0	1.48	17.0	1.19	0.16	14.00	0.30		0.02	5.8	0.29	109.00	0.01	0.12	0.17	3.75	106.00	22	41	36	CL	99.4
74.3 – 76.5	8.8	1.38	10.4	2.30	0.66	12.70	0.36		0.04	22.9	0.75	13.30	0.01	0.36	0.39	11.20	2.04	38	29	33	CL	91.1
76.5 – 78.9	9.6	7.86	10.6	0.69	0.10	6.60	0.18	0.70	0.02	6.3	0.36	14.60	0.09	0.11	0.16	3.44	11.30	50	31	20	L	145.0
78.9 – 82.2	8.3	3.45	33.7	1.47	0.43	32.80	0.90	0.65	0.17	3.5	0.27	101.00	0.06	0.05	0.16	1.56	99.30	61	15	24	SCL	66.7
82.2 – 87.2	9.0	1.42	18.8	0.98	0.26	14.80	0.45	0.20	0.03	6.1	0.30	9.89	0.04	0.09	0.17	2.81	7.08	28	35	37	CL	87.3
87.2 – 92.6	8.6	1.09	15.7	0.97	0.16	11.80	0.45		0.04	8.0	0.25	10.10	0.05	0.03	0.17	0.94	9.21	25	37	39	CL	69.2
92.6 – 94.3	7.6	4.04	34.5	2.27	0.46	40.30	0.78	1.55	0.09	39.1	0.79	10.60	0.10	0.11	0.58	3.44	7.15	74	9	17	SL	52.3
94.3 – 95.0	8.9	5.74	27.7	6.54	1.30	54.60	0.87	1.95	0.05	65.3	1.49	11.20	0.17	0.44	0.88	13.70	–2.56	88	8	5	S	58.6
95.0 – 98.0	6.7	4.31	18.7	7.21	1.11	38.20	2.07	0.95	0.02	88.0	1.16	11.60	0.06	0.23	0.87	7.19	4.60	90	6	4	S	66.7
102.1 –107.1	8.6	0.79	10.8	0.89	0.13	7.70	0.39	0.50	0.01	5.8	0.43	68.20	0.01	0.21	0.22	6.56	61.70	24	45	31	CL	59.9
107.1 –112.1	8.8	0.87	8.8	1.46	0.62	9.00	0.21		0.01	3.8	0.28	100.00	0.01	0.05	0.23	1.56	98.90	54	26	21	SCL	32.2
112.1 –113.1	8.7	1.52	23.4	0.46	0.31	14.70	0.21		0.01	3.9	0.27	122.00	0.01	0.04	0.22	1.25	121.00	14	44	42	SICL	64.0
113.1 –113.9	8.9	1.74	25.3	0.49	0.28	15.70	0.36	0.80	0.01	4.5	1.28	67.20	0.01	0.99	0.29	30.90	36.30	15	36	49	C	96.5
121.1 –123.8	8.9	1.68	23.3	0.65	0.22	15.40	0.42	0.85	0.03	7.8	0.45	8.03	0.04	0.28	0.13	8.75	–0.72	38	38	24	L	58.2
123.8 –124.9	7.1	2.37	24.4	0.86	0.31	18.70	2.76	0.65	0.01	90.5	1.11	9.79	0.10	0.31	0.70	9.68	0.10	93	6	1	S	63.8
124.9 –125.5	6.6	7.09	38.4	4.58	1.50	86.90	0.51	0.70	0.03	13.4	1.32	4.30	0.06	1.03	0.23	32.20	–27.90	42	38	20	L	58.5
125.5 –130.8	9.0	1.64	26.5	0.55	0.11	15.20	0.36	0.40	0.02	4.8	0.60	57.70	0.01	0.42	0.18	13.10	44.50	41	35	24	L	58.0
130.8 –135.8	8.9	2.55	26.3	0.94	0.24	20.20	0.48		0.02	6.1	1.57	14.70	0.04	1.25	0.28	39.00	–24.30	29	44	27	CL	85.5
135.8 –137.7	9.0	1.83	17.8	1.38	0.33	16.50	0.33	0.55	0.02	5.1	1.31	13.20	0.01	1.07	0.24	33.40	–20.20	23	52	25	SIL	74.0
149.0 –151.4	9.5	1.31	26.4	0.39	0.08	12.80	0.39	0.20	0.01	4.0	0.46	107.00	0.01	0.25	0.23	7.81	99.50	18	52	30	SICL	129.0
151.4 –153.0	9.3	1.79	27.0	0.59	0.13	16.20	0.33	0.20	0.01	5.3	0.71	160.00	0.01	0.48	0.23	15.00	145.00	37	38	25	L	133.0
155.0 –157.6	9.7	1.43	26.4	0.32	0.10	12.10	0.36	0.35	0.01	3.7	0.34	114.00	0.01	0.16	0.16	5.62	109.00	33	39	28	CL	245.0
157.6 –161.2	9.2	2.59	38.0	0.46	0.11	20.30	0.42	0.75	0.01	5.4	1.63	26.50	0.01	1.31	0.32	40.90	–14.40	43	27	31	CL	96.4
167.0 –172.0	8.4	5.37	45.7	1.86	0.60	50.70	0.30	0.15	0.01	2.6	0.46	11.20	0.06	0.25	0.15	7.81	3.38	46	41	11	L	44.4
172.0 –177.2	9.4	2.40	32.6	0.43	0.14	17.40	0.30	0.15	0.01	3.4	0.69	6.29	0.16	0.32	0.21	10.00	–3.70	27	57	16	SIL	85.3
177.2 –160.7	9.6	1.36	23.0	0.47	0.12	12.50	0.51	0.40	0.01	6.1	0.37	126.00	0.01	0.17	0.20	5.31	120.00	44	32	24	L	125.0
187.2 –192.2	8.7	5.06	54.4	0.97	0.37	44.50	0.21	0.02	0.01	1.3	0.27	3.55	0.06	0.07	0.12	2.19	1.36	64	8	8	LS	33.8
192.2 –196.2	8.5	5.78	50.2	1.46	0.57	50.60	0.24		0.01	1.4	0.27	2.77	0.05	0.07	0.15	2.19	0.58	66	8	6	LS	33.8

APPENDIX 5–B. Drill Hole 389–50 Overburden Analysis

Interval (ft) Top– Bot	pH	EC (mmhos/cm @ 25 C)	SAR	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	Boron (ppm)	Total Selenium (ppm)	H2O Sol. Selenium (ppm)	Tot. Org. Carbon (%)	Total Sulfur (%)	Neut. Pot. (t/1000t)	Sulfate Sulfur (%)	Pyritic Sulfur (%)	Organic Sulfur (%)	Pyr S AB (t/1000t)	Pyr S ABP (t/1000t)	Sand (%)	Silt (%)	Clay (%)	Texture	Sat. (%)
0.0 – 5.0	8.0	6.53	26.5	19.10	2.32	93.20	0.75	0.85	0.01	4.1	0.51	38.00	0.32	0.18	0.01	5.62	32.30	17	15	68	C	151.0
5.0 – 10.0	8.6	2.88	26.5	2.46	0.33	33.70	0.45		0.01	2.9	0.22	38.80	0.06	0.15	0.01	4.69	34.10	34	21	45	C	157.0
10.0 – 15.0	8.4	3.28	29.6	2.26	0.82	36.70	0.51	0.10	0.01	1.8	0.16	23.30	0.17	0.01	0.01	–0.01	23.30	60	12	29	SCL	66.3
15.0 – 16.9	8.6	8.57	24.2	16.90	7.91	85.30	0.51		0.02	3.9	0.25	16.10	0.07	0.03	0.15	0.94	15.20	56	15	29	SCL	46.9
16.9 – 21.6	3.8	13.90	22.2	26.90	31.50	120.00	0.39		0.01	15.1	2.30	–8.11	1.93	0.07	0.30	2.19	–10.30	63	17	20	SL	52.0
21.6 – 25.4	3.3	16.90	15.6	25.10	96.50	123.00	0.18	1.50	0.01	19.7	1.17	–11.10	0.66	0.02	0.29	0.62	–11.70	73	13	14	SL	46.9
29.4 – 33.4	7.7	4.61	32.1	5.06	1.72	59.10	0.39	0.80	0.02	5.8	0.54	54.50	0.01	0.33	0.21	10.30	44.20	24	42	34	CL	64.7
33.4 – 37.7	8.6	3.78	41.5	1.93	0.84	48.80	0.30	0.15	0.02	5.9	0.24	224.00	0.01	0.05	0.18	1.56	223.00	68	17	16	SL	24.8
37.7 – 41.0	8.7	3.18	48.5	1.04	0.41	41.30	0.30	0.60	0.02	5.8	0.38	116.00	0.01	0.18	0.19	5.62	112.00	18	44	38	SICL	77.5
52.3 – 55.3	8.9	2.26	36.0	0.74	0.12	23.60	0.24	0.55	0.03	6.7	0.20	92.20	0.01	0.06	0.14	1.67	90.40	47	32	22	L	52.0
55.3 – 60.3	8.0	7.31	45.4	5.26	1.63	84.30	0.54		0.04	6.5	1.20	26.30	0.01	0.94	0.26	29.40	–3.05	30	41	29	CL	79.1
60.3 – 63.7	8.9	3.67	51.3	1.17	0.35	44.70	0.36	0.80	0.04	5.3	1.25	14.40	0.01	1.02	0.23	31.90	–17.50	21	54	25	SIL	61.0
77.4 – 82.4	9.3	1.94	23.8	1.13	0.19	19.30	0.33	0.25	0.03	5.3	0.63	94.20	0.01	0.43	0.20	13.40	80.80	22	46	33	CL	126.0
82.4 – 83.7	9.8	1.32	26.4	0.39	0.15	13.70	0.30		0.01	4.3	0.24	124.00	0.14	0.01	0.10	–0.01	124.00	15	56	29	SICL	220.0
83.7 – 87.5	10.1	1.12	24.6	0.37	0.08	11.40	0.30	0.55	0.01	2.9	0.26	144.00	0.06	0.07	0.13	2.19	142.00	31	47	22	L	312.0
87.5 – 92.9	9.3	3.27	54.4	0.69	0.18	35.90	0.48	0.90	0.01	5.6	1.38	25.90	0.02	1.04	0.32	32.50	–6.57	40	25	35	CL	125.0
98.6 –103.6	6.4	4.26	36.4	1.96	1.01	44.40	0.30	0.45	0.02	2.4	0.41	4.23	0.06	0.19	0.16	5.94	–1.71	47	43	10	L	43.2
103.6 –108.6	7.6	5.11	29.7	5.01	1.49	53.50	0.24		0.01	2.5	0.45	15.20	0.06	0.24	0.15	7.50	7.66	46	42	13	L	42.5
108.6 –113.6	7.4	7.93	19.3	23.20	5.59	73.70	0.16		0.01	2.6	0.62	17.30	0.10	0.35	0.17	10.90	6.38	55	35	11	SL	30.2
113.6 –118.6	9.1	2.71	25.1	1.88	0.41	26.90	0.45		0.03	3.4	0.27	174.00	0.01	0.10	0.17	3.12	171.00	49	29	22	L	68.5
118.6 –120.3	7.7	6.75	44.9	3.88	1.47	73.40	1.32		0.05	25.6	1.13	46.30	0.01	0.75	0.38	23.40	22.90	33	36	31	CL	92.1
120.3 –121.6	7.9	5.57	45.2	2.39	0.93	58.30	0.66	0.90	0.04	9.4	1.05	8.45	0.01	0.79	0.25	24.70	–16.20	25	53	23	SIL	86.1
129.4 –134.4	7.3	6.95	30.4	13.60	3.74	89.40	0.66		0.01	3.4	0.67	7.05	0.04	0.45	0.18	14.10	–7.01	74	16	11	SL	33.9
134.4 –139.4	3.7	10.70	20.7	18.60	6.43	76.10	0.21		0.01	1.5	0.45	0.00	0.09	0.23	0.13	7.19	–7.18	87	8	5	LS	31.6
139.4 –141.3	3.4	11.30	19.2	22.60	9.65	77.00	0.24	0.35	0.01	1.9	0.45	–0.31	0.07	0.22	0.16	6.87	–7.19	86	8	5	LS	31.0
145.6 –150.6	8.3	3.96	44.0	1.02	0.41	37.20	0.33	0.30	0.01	1.5	0.36	3.63	0.05	0.16	0.15	5.00	–1.37	62	8	11	LS	66.0
150.6 –154.6	9.1	2.38	32.1	0.48	0.25	19.40	0.30		0.01	1.5	0.33	4.75	0.13	0.05	0.15	1.56	3.19	62	11	7	LS	114.0

APPENDIX 5–B. Drill Hole 389–51 Overburden Analysis

Interval (ft) Top– Bot	pH	EC (mmhos/cm @ 25 C)	SAR	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	Boron (ppm)	Total Selenium (ppm)	H2O Sol. Selenium (ppm)	Tot. Org. Carbon (%)	Total Sulfur (%)	Neut. Pot. (t/1000t)	Sulfate Sulfur (%)	Pyritic Sulfur (%)	Organic Sulfur (%)	Pyr S AB (t/1000t)	Pyr S ABP (t/1000t)	Sand (%)	Silt (%)	Clay (%)	Texture	Sat. (%)
5.5 – 6.3	8.2	4.03	26.3	2.08	2.38	39.20	0.18	0.02	0.01	2.7	0.01	61.80	0.01	0.01	0.01	−0.01	61.80	68	18	14	SL	33.2
6.3 – 8.8	8.4	2.18	22.2	1.11	0.73	21.30	0.24	0.20	0.01	2.9	0.01	37.90	0.01	0.01	0.01	−0.01	37.90	76	16	9	SL	33.4
8.8 – 13.8	8.2	2.15	13.3	1.94	1.11	16.40	0.09	0.45	0.01	2.1	0.15	237.00	0.14	0.01	0.01	−0.01	237.00	76	15	9	SL	26.1
13.8 – 14.8	7.9	3.50	15.7	4.66	3.49	31.60	0.12		0.02	3.0	0.21	48.30	0.20	0.01	0.01	−0.01	48.30	60	25	15	SL	32.2
14.8 – 19.8	7.8	3.91	14.9	5.84	5.39	35.30	0.21		0.04	3.3	0.20	33.30	0.06	0.11	0.01	3.44	29.80	33	45	22	L	39.5
19.8 – 24.8	7.9	4.68	16.0	4.73	5.46	36.20	0.12	0.05	0.04	3.6	0.22	67.40	0.07	0.14	0.01	4.37	63.00	35	43	22	L	38.7
24.8 – 27.7	8.0	5.61	16.5	6.14	6.36	44.50	0.03		0.02	4.3	0.20	75.50	0.03	0.16	0.01	5.00	70.50	28	47	26	L	41.9
27.7 – 28.7	8.0	3.20	18.7	2.47	3.13	31.30	0.12	1.05	0.02	5.2	0.22	68.00	0.05	0.05	0.12	1.56	66.40	12	59	30	SICL	55.9
28.7 – 29.7	7.8	6.05	14.6	11.50	14.40	53.30	0.18		0.02	5.4	0.23	67.50	0.07	0.15	0.01	4.69	62.60	42	34	24	L	40.0
29.7 – 31.2	8.2	3.23	20.3	2.29	3.16	33.50	0.12	0.45	0.09	3.8	0.19	55.30	0.03	0.04	0.12	1.25	54.00	46	33	21	L	37.3
31.2 – 32.6	7.8	5.86	12.6	14.70	16.80	50.10	0.12	0.10	0.01	4.4	0.19	53.30	0.04	0.14	0.01	4.37	48.90	53	27	20	SCL	33.2
32.6 – 37.6	7.8	3.93	6.2	17.20	12.10	23.90	0.03	0.10	0.01	1.7	0.17	209.00	0.16	0.01	0.01	−0.01	209.00	76	17	8	SL	24.6
37.6 – 40.3	8.4	2.48	17.1	1.74	1.22	20.80	0.03		0.01	2.8	0.19	90.50	0.18	0.01	0.01	−0.01	90.50	66	23	11	SL	26.2
40.3 – 43.4	8.0	4.16	17.0	6.63	4.64	40.40	0.09	0.20	0.01	2.6	0.17	124.00	0.16	0.01	0.01	−0.01	124.00	71	18	11	SL	20.5
43.4 – 46.6	8.5	4.17	46.3	1.16	0.79	45.70	0.54	0.60	0.04	4.5	0.51	49.30	0.15	0.22	0.14	6.87	42.40	25	37	39	CL	77.7
54.8 – 59.8	8.7	4.12	67.6	0.87	0.51	56.30	0.54	0.55	0.07	5.7	0.77	17.40	0.01	0.57	0.20	17.80	−0.37	35	41	24	L	73.4
59.8 – 63.0	8.3	5.04	45.6	1.39	0.41	43.30	0.54		0.06	5.4	1.43	8.47	0.06	1.14	0.21	35.80	−27.10	22	54	24	SIL	62.4
71.0 – 72.4	8.9	2.72	24.4	0.70	0.26	16.90	0.45	0.55	0.08	5.2	0.29	8.16	0.02	0.12	0.15	3.75	4.41	20	46	35	SICL	86.1
72.4 – 73.0	8.2	2.73	43.7	0.89	0.33	34.10	1.11	1.05	0.20	25.3	0.61	15.60	0.01	0.20	0.41	6.25	9.34	46	20	34	SCL	110.0
73.0 – 76.8	7.8	5.99	51.1	2.59	1.00	68.40	0.63	0.90	0.09	11.3	0.83	22.50	0.04	0.51	0.28	15.90	6.58	27	35	39	CL	101.0
76.8 – 81.8	8.9	2.05	37.6	0.39	0.24	21.10	0.39		0.04	4.4	0.25	116.00	0.01	0.12	0.12	3.75	113.00	22	53	25	SIL	82.4
81.8 – 86.8	9.0	2.04	40.3	0.46	0.23	23.70	0.39	0.40	0.03	4.0	0.20	130.00	0.01	0.01	0.20	−0.01	130.00	30	44	26	L	83.9
86.8 – 91.8	8.9	2.40	39.6	0.48	0.41	26.40	0.45		0.03	3.8	0.43	132.00	0.20	0.08	0.15	2.50	129.00	19	57	24	SIL	67.5
91.8 – 94.2	8.7	2.51	46.3	0.47	0.23	27.40	0.48		0.04	6.5	0.31	85.90	0.01	0.11	0.20	3.44	82.40	42	30	28	CL	90.3
94.2 – 94.7	7.1	5.59	41.9	2.91	1.03	58.60	1.41	1.25	0.07	70.7	2.76	0.73	0.10	2.03	0.63	83.40	−62.70	82	11	8	LS	83.2
94.7 – 96.2	4.6	11.30	39.4	17.50	8.82	143.00	1.14	1.15	0.06	70.3	1.36	11.30	0.02	0.50	0.84	15.60	−4.35	53	16	30	SCL	80.3
96.2 – 101.2	8.8	2.74	43.4	0.62	0.23	28.30	0.30		0.03	6.2	0.68	93.90	0.01	0.46	0.21	14.40	79.60	23	44	33	CL	120.0
101.2 – 106.2	9.6	1.20	19.0	0.53	0.24	11.80	0.30		0.01	3.3	0.26	126.00	0.06	0.05	0.15	1.56	124.00	20	51	30	SICL	211.0
106.2 – 111.2	9.4	1.33	18.6	0.78	0.19	13.10	0.45		0.02	5.6	1.30	37.40	0.01	1.03	0.27	32.20	5.23	43	25	32	CL	136.0
111.2 – 113.7	9.2	1.79	30.6	0.52	0.29	19.50	0.51	0.60	0.01	4.9	1.35	27.80	0.01	1.07	0.28	33.40	−5.61	31	31	39	CL	106.0
120.9 – 121.5	9.8	1.90	39.2	0.42	0.17	21.30	0.60	0.25	0.06	3.6	0.22	30.10	0.02	0.07	0.13	2.19	27.90	20	40	40	SIC	119.0
121.5 – 126.7	9.5	1.58	29.3	0.42	0.17	15.90	0.57	0.40	0.04	4.6	0.23	152.00	0.01	0.07	0.15	2.19	150.00	30	42	26	CL	74.2
126.7 – 127.2	7.2	6.13	35.5	5.62	1.28	65.90	2.25	1.30	0.07	74.3	1.36	25.10	0.01	0.69	0.69	21.60	3.52	85	11	5	LS	60.3
127.2 – 129.0	8.6	3.00	55.5	0.48	0.19	32.10	0.69	0.50	0.07	7.6	0.96	5.29	0.02	0.70	0.24	21.90	−16.60	21	58	21	SIL	75.2
137.0 – 139.6	9.6	2.64	52.2	0.47	0.09	27.60	0.66	0.65	0.02	5.0	0.79	8.11	0.02	0.56	0.21	17.50	−9.39	21	54	26	SIL	114.0
144.5 – 149.5	7.5	6.77	55.3	2.83	0.91	75.60	0.78	0.30	0.01	3.8	0.96	5.21	0.32	0.43	0.21	13.40	−6.22	65	18	17	SL	62.3
149.5 – 153.6	9.0	3.32	60.0	0.53	0.14	34.70	0.27		0.01	6.7	0.42	4.90	0.19	0.10	0.13	3.12	1.77	83	12	5	LS	88.8

APPENDIX 5-B. Drill Hole 487-01 Overburden Analysis

Interval (ft) Top- Bot	pH	EC (mmhos/cm @ 25 C)	ESP	SAR	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	Boron (ppm)	H2O Sol. Selenium (ppm)	Tot. Org. Carbon (%)	Total Sulfur (%)	Carbonate Total % CaCO3	Sulfate Sulfur (%)	Pyritic Sulfur (%)	Organic Sulfur (%)	Total S ABP (t/1000t)	Pyritic S ABP (t/1000t)	Sand (%)	Silt (%)	Clay (%)	Texture	Sat. (%)
5.0 - 15.0	7.5	5.56		14.2	24.30	6.70	55.90	1.60	0.12	1.2	1.73	0.5	1.65	0.05	0.03	-49.00	3.00	8	47	45	SIC	98
16.0 - 17.2	8.0	2.23	27.5	23.8	1.80	0.70	26.40	0.30	0.33	0.3	0.11	14.4				141.00		43	31	26	L	68
17.2 - 19.9	7.6	6.49		19.3	21.10	4.90	69.50	0.20	0.08	1.1	0.34	10.0				89.00		5	45	50	SIC	99
19.9 - 22.6	8.5	1.62	47.5	22.5	0.60	0.70	16.10	2.50	0.09	0.1	0.03	6.3				62.00		6	37	57	C	264
33.7 - 35.0	4.0	4.60		10.2	22.10	11.60	41.60	1.70	0.50	2.2	0.41	0.1	0.26	0.02	0.13	-12.00	0.00	2	34	64	C	74
35.0 - 39.1	7.6	2.20		10.0	4.90	2.60	19.60	0.40	0.06	1.2	0.11	17.2				169.00		28	43	29	CL	45
39.1 - 41.5	9.0	0.88		16.1	0.40	0.30	9.50	0.40	0.04	0.1	0.06	39.0				388.00		43	37	20	CL	32
41.5 - 43.5	9.2	1.24	51.9	17.1	0.40	1.40	16.20	1.60	0.13	1.3	0.34	6.3				52.00		3	54	43	SIC	94
46.7 - 47.0	8.5	1.62		24.6	0.20	1.20	20.60	1.50	0.18	6.3	1.53	0.2	0.26	1.03	0.24	-46.00	-30.00	3	67	30	C	67
53.4 - 57.3	9.1	0.94		6.6	1.20	9.90	15.50	1.80	0.12	2.4	0.56	0.2	0.09	0.36	0.11	-16.00	-9.00	4	58	38	SICL	94
57.3 - 60.7	9.0	0.98	58.8	17.6	0.10	0.80	11.80	0.76	0.15	4.5	0.65	0.3	0.18	0.36	0.11	-17.00	-8.00	12	59	29	SICL	76
65.3 - 70.0	9.4	0.89		16.0	0.50	0.30	10.10	1.90	0.10	0.6	0.06	0.2				0.00		4	50	46	SIC	147
70.0 - 74.6	9.4	1.00	63.1	17.0	0.50	0.40	11.40	1.50	0.06	0.4	0.14	1.1				7.00		10	48	42	SIC	106
74.6 - 77.9	9.5	0.97		7.9	1.30	6.60	15.70	0.50	0.05	1.0	0.06	22.2				220.00		32	42	26	L	66
77.9 - 81.4	9.3	1.15		22.5	0.30	0.40	13.30	2.00	0.18	3.1	0.37	4.4				32.00		10	74	16	SIL	135
81.4 - 84.8	9.0	1.86	63.7	36.2	0.40	0.30	21.40	2.00	0.24	3.6	0.51	0.2	0.03	0.35	0.13	-14.00	-9.00	3	39	58	C	150
85.8 - 89.7	9.5	0.97		21.2	0.40	0.20	11.60	2.60	0.08	0.6	0.04	0.4				3.00		5	53	42	SIC	181
89.7 - 93.5	9.6	0.75	70.0	16.4	0.30	0.20	9.20	3.40	0.06	0.8	0.02	1.1				10.00		6	54	40	SIC-SICL	181
93.5 - 98.5	9.7	0.59		13.6	0.30	0.20	6.90	2.50	0.03	0.1	0.01	6.9				69.00		38	32	30	CL	215
98.5 -103.5	9.6	0.57	69.8	14.5	0.30	0.10	6.50	2.60	0.02	0.2	0.00	6.7				67.00		52	19	29	SCL	229
103.5 -108.5	9.8	0.61		19.4	0.20	0.10	7.50	1.50	0.02	0.7	0.02	9.0				89.00		57	32	11	SL	133
108.5 -113.5	9.7	0.64	55.6	15.6	0.20	0.20	7.10	0.30	0.03	1.1	0.06	6.0				58.00		56	33	11	SICL	67
113.5 -118.5	9.3	1.32		27.6	0.30	0.20	13.60	2.40	0.17	5.4	0.60	0.2	0.08	0.37	0.15	-17.00	10.00	1	42	57	SIC	172
118.5 -123.1	9.8	0.94	66.1	28.9	0.20	0.10	11.10	2.10	0.06	2.1	0.65	15.0				130.00		8	61	31	SICL	128
123.1 -127.7	10.1	0.87		24.8	0.20	0.20	11.10	3.80	0.05	3.2	1.50	1.6	0.00	1.30	0.20	-31.00	-25.00	10	59	31	SICL	123
127.7 132.4	9.4	1.23	59.4	35.4	0.20	0.10	13.70	2.70	0.04	2.2	1.42	1.1	0.52	0.73	0.17	-33.00	-12.00	2	61	37	SICL	112
136.1 -140.4	9.8	0.70		27.2	0.10	0.10	8.60	2.30	0.12	2.4	0.15	0.2				-3.00		0	41	59	SIC	111
143.2 -145.2	9.6	0.63		8.7	0.20	2.30	9.70	3.00	0.17	8.6	0.22	0.2	0.01	0.07	0.14	-5.00	1.00	4	41	55	SIC	112
149.2 -152.6	9.9	0.59	69.6	17.8	0.10	0.40	8.90	2.90	0.18	1.4	0.15	0.2				-3.00		2	25	73	C	125
152.6 -156.0	9.9	0.74		29.1	0.10	0.10	9.20	3.10	0.15	4.2	0.16	0.2				-3.00		2	47	51	SIC	128
162.4 -165.2	9.5	1.07	72.6	38.2	0.10	0.10	12.40	1.90	0.11	3.4	0.66	0.0	0.18	0.55	0.13	-27.00	-17.00	11	52	37	SICL	104
165.2 -168.0	8.8	1.65		70.5	0.10	0.00	22.30	1.30	0.02	3.2	1.68	4.2	0.14	1.33	0.21	-11.00	0.00	10	62	28	SICL	96
168.8 -171.0	9.6	0.62		9.8	0.10	1.10	7.50	0.40	0.02	0.8	0.08	0.1				-2.00		72	19	9	SL	30

APPENDIX 5–B. Drill Hole 487–02 Overburden Analysis

Interval (ft) Top– Bot	pH	EC (mmhos/cm @ 25 C)	ESP	SAR	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	Boron (ppm)	H2O Sol. Selenium (ppm)	Tot. Org. Carbon (%)	Total Sulfur (%)	Carbonate Total % CaCO3	Sulfate Sulfur (%)	Pyritic Sulfur (%)	Organic Sulfur (%)	Total S ABP (t/1000t)	Pyritic S ABP (t/1000t)	Sand (%)	Silt (%)	Clay (%)	Texture	Sat. (%)
0.0 – 5.0	8.1	0.56		2.8	2.60	1.20	3.30	0.40	0.00	0.4	0.03	7.2				71.00		56	26	18	SCL	33
5.0 – 6.4	8.5	1.20	13.5	15.6	0.60	0.70	12.60	1.20	0.00	0.0	0.02	7.4				73.00		6	59	35	SICL	59
6.4 – 9.8	8.4	0.33		6.0	0.50	0.40	4.00	0.40	0.00	0.1	0.01	5.9				59.00		66	27	7	SL	26
9.8 – 13.1	8.5	0.21		3.9	0.60	0.30	2.60	0.20	0.00	0.0	0.01	18.3				183.00		52	39	9	L	24
13.1 – 14.0	8.5	0.46		7.8	0.40	0.40	4.90	0.60	0.01	0.1	0.01	8.1				81.00		13	56	29	SICL	46
15.0 – 18.5	8.5	0.32		5.5	0.40	0.40	3.50	0.60	0.02	0.1	0.01	4.6				46.00		40	43	17	L	38
18.5 – 22.1	8.4	0.66		19.9	0.20	0.20	8.90	0.60	0.02	0.2	0.01	9.4				94.00		20	53	27	SICL–SIL	42
22.1 – 25.7	8.2	0.43		8.4	0.40	0.40	5.30	0.70	0.04	0.4	0.02	7.7				76.00		16	60	24	SIL	51
25.7 – 29.4	8.2	0.46		6.3	0.60	0.60	4.90	0.50	0.04	0.3	0.02	8.0				79.00		18	61	21	SIL	41
29.4 – 32.0	8.3	0.31		3.6	0.60	0.50	2.70	0.20	0.03	0.0	0.02	28.9				288.00		32	59	9	SIL	29
32.0 – 35.6	8.1	0.52		6.1	0.60	0.90	5.30	0.30	0.02	0.2	0.03	9.6				95.00		23	56	21	SIL	42
35.6 – 37.2	7.8	1.21		4.5	2.70	3.20	7.80	0.50	0.10	0.9	0.06	10.6				103.00		7	63	30	SICL	49
42.9 – 47.7	8.7	1.55	41.5	29.9	0.20	0.40	16.40	1.20	0.12	3.1	1.05	0.2	0.11	0.80	0.14	−31.00	−23.00	2	67	31	SICL	93
47.7 – 52.2	8.8	1.07		37.6	0.10	0.10	11.90	0.70	0.06	1.0	1.89	0.6	1.54	0.26	0.09	−53.00	−2.00	5	78	17	SIL	50
52.2 – 56.7	9.1	0.48	40.6	17.9	0.20	0.50	10.60	0.40	0.04	0.5	0.15	4.1				36.00		2	82	16	SIL	60
56.7 – 61.2	9.5	0.87		34.5	0.10	0.00	10.90	0.50	0.04	0.7	0.06	1.7				15.00		1	76	23	SIL	154
61.2 – 65.7	9.7	0.90	61.1	32.6	0.10	0.00	10.30	0.40	0.03	0.3	0.07	7.4				72.00		1	75	24	SIL	207
65.7 – 70.2	9.7	1.07		37.6	0.10	0.00	11.90	0.50	0.04	0.7	0.10	4.6				45.00		0	75	25	SIL	226
70.2 – 74.8	9.3	1.00	51.0	35.1	0.10	0.10	11.10	0.60	0.09	1.0	0.14	5.3				49.00		5	62	33	SICL	95
74.8 – 78.4	8.8	1.05		25.7	0.10	0.30	11.50	0.70	0.19	1.7	0.32	0.2	0.02	0.27	0.03	−8.00	−6.00	11	70	19	SIL	47
84.1 – 88.6	9.2	1.83	66.2	34.5	0.20	0.50	20.40	1.40	0.23	1.4	0.31	0.3	0.01	0.18	0.12	−7.00	−3.00	4	36	60	C	165
88.6 – 93.2	9.6	1.77		53.2	0.20	0.10	20.60	1.00	0.19	3.6	0.66	14.9				126.00		1	60	39	SICL	195
93.2 – 97.8	9.9	1.22	73.1	41.1	0.10	0.00	13.00	1.10	0.09	3.7	0.90	4.0				12.00		3	64	33	SICL	162
97.8 – 102.4	9.5	1.39		49.0	0.10	0.00	15.50	1.00	0.09	2.2	0.67	1.4	0.14	0.42	0.11	−7.00	1.00	1	68	31	SICL	124
102.4 – 106.9	9.6	1.43	67.6	45.9	0.10	0.10	14.50	1.40	0.04	1.9	1.27	1.2	0.14	0.96	0.15	−28.00	−19.00	0	53	47	SIL	121
106.9 – 110.8	8.7	2.09		60.8	0.20	0.10	23.60	1.50	0.07	5.2	2.03	0.1	0.27	1.65	0.11	−62.00	−51.00	3	59	38	SICL	108
119.5 – 122.9	9.7	1.31	71.6	47.1	0.10	0.00	14.90	2.30	0.31	3.8	0.28	0.1	0.11	0.14	0.03	−8.00	−3.00	1	92	7	SI	164
122.9 – 126.2	8.7	2.20		66.7	0.10	0.10	21.10	1.80	0.24	9.2	1.65	0.0	0.35	0.99	0.31	−52.00	−31.00	5	37	58	C	154
126.2 – 127.8	9.8	1.66	80.8	49.0	0.00	0.00	15.50	1.30	0.17	1.7	0.29	0.1	0.04	0.19	0.06	−8.00	−5.00	0	35	65	C	166
127.8 – 132.2	9.4	1.61		54.7	0.00	0.00	17.30	1.80	0.17	11.4	2.11	0.6	0.00	1.74	0.37	−60.00	−48.00	7	39	54	C	155
132.2 – 132.7	8.3	2.96	41.4	68.2	0.30	0.10	30.50	2.50	0.11	25.6	3.41	3.2				−75.00		33	22	45	C	84
132.7 – 135.7	8.5	2.04		61.4	0.10	0.00	19.40	2.40	0.07	25.7	2.20	0.2	0.16	1.65	0.39	−67.00	−50.00	22	57	21	SIL	77
138.8 – 141.8	9.0	2.18	71.5	64.5	0.10	0.00	20.40	1.70	0.13	4.6	1.67	0.3	0.12	1.35	0.20	−49.00	−39.00	3	55	42	SIC	156
141.8 – 144.8	8.0	2.66		60.9	0.10	0.10	25.60	1.50	0.02	3.7	1.67	1.5	0.10	1.37	0.20	−37.00	−26.00	25	42	33	CL	110
146.0 – 147.2	8.8	0.56		5.9	0.10	2.70	7.00	0.90	0.02	6.5	0.22	0.1	0.00	0.12	0.10	−6.00	−3.00	63	22	15	SL	38
147.2 – 150.0	9.5	1.05		10.3	0.10	2.00	10.60	0.40	0.00	0.1	0.18	0.5				−1.00		78	8	14	SL	35

APPENDIX 5–B. Drill Hole 487–03 Overburden Analysis

Interval (ft) Top– Bot	pH	EC (mmhos/cm @ 25 C)	ESP	SAR	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	Boron (ppm)	H2O Sol. Selenium (ppm)	Tot. Org. Carbon (%)	Total Sulfur (%)	Carbonate Total (% CaCO3)	Sulfate Sulfur (%)	Pyritic Sulfur (%)	Organic Sulfur (%)	Total S ABP (t/1000t)	Pyritic S ABP (t/1000t)	Sand (%)	Silt (%)	Clay (%)	Texture	Sat. (%)
0.0 – 5.0	8.4	1.81	5.1	12.1	2.50	1.20	16.50	1.40	0.00	0.1	0.06	16.1				159.00		29	49	22	L	44
5.0 – 9.0	6.7	0.73		6.6	0.80	0.60	5.70	0.30	0.02	0.0	0.01	22.3				223.00		26	59	15	SIL	32
9.0 – 10.0	8.4	0.91		8.3	0.70	0.60	6.70	0.40	0.02	0.2	0.02	12.6				125.00		14	59	27	SICL–SIL	47
10.0 – 11.7	8.0	1.03		3.8	3.20	2.10	6.10	0.20	0.02	0.1	0.04	15.6				155.00		22	64	14	SIL	38
11.7 – 12.2	8.3	0.68		7.3	0.70	0.80	6.30	0.40	0.02	0.5	0.02	9.5				94.00		6	56	38	SICL	60
12.2 – 14.0	8.3	0.62		6.5	0.60	0.70	5.20	0.20	0.02	0.2	0.02	13.4				133.00		18	59	23	SIL	42
14.0 – 17.7	8.4	0.54		5.9	0.60	0.60	4.60	0.20	0.03	0.1	0.02	30.7				306.00		9	71	20	SIL	38
17.7 – 21.4	8.4	0.54		3.7	0.90	0.80	3.40	0.20	0.02	0.2	0.01	18.4				184.00		16	64	20	SIL	38
21.4 – 23.1	8.2	0.47		2.6	1.10	0.60	2.40	0.30	0.01	0.9	0.00	68.3				683.00		4	85	11	SI	31
23.1 – 27.0	8.4	0.74		5.6	0.80	0.60	4.70	0.20	0.03	0.4	0.04	26.2				261.00		8	69	23	SIL	40
29.6 – 31.9	8.3	1.00		7.8	0.90	0.80	7.20	0.50	0.08	0.6	0.07	19.6				194.00		15	58	27	SICL–SIL	50
33.9 – 39.0	8.8	1.58		39.5	0.20	0.00	15.30	1.30	0.22	1.7	0.30	1.5				6.00		1	34	65	C	128
45.0 – 49.0	9.0	1.41	48.9	44.3	0.10	0.00	14.00	1.00	0.07	0.4	0.10	1.9				16.00		3	51	46	SIC	133
49.0 – 53.0	9.4	1.15		28.9	0.10	0.20	11.20	0.80	0.04	0.3	0.11	7.6				75.00		15	52	33	SICL	319
53.0 – 57.0	9.0	1.49	51.2	39.0	0.20	0.00	15.10	1.00	0.12	1.2	0.10	0.9				6.00		1	50	49	SIC	144
61.0 – 61.6	7.0	3.04		46.8	0.60	0.20	29.60	2.60	0.29	12.7	1.84	0.1	0.00	1.66	0.27	–59.00	–51.00	29	29	42	C	83
61.6 – 63.3	8.9	1.53	50.9	45.9	0.10	0.00	14.50	1.20	0.17	2.3	0.32	1.7				7.00		1	48	51	SIC	119
63.6 – 65.9	9.3	0.88		26.3	0.10	0.00	8.30	0.60	0.02	0.5	0.05	12.5				123.00		23	60	17	SIL	38
65.9 – 68.5	9.5	0.69	24.0	21.5	0.10	0.00	6.80	0.40	0.01	0.3	0.02	47.3				472.00		23	64	13	SIL	27
68.5 – 69.3	8.7	0.95		30.7	0.10	0.00	9.70	0.50	0.01	0.4	0.10	58.6				583.00		1	86	13	SIL	26
69.3 – 71.7	8.9	1.54	52.1	47.4	0.10	0.00	15.00	1.30	0.05	2.0	0.60	6.2				57.00		0	58	42	SIC	101
71.7 – 72.2	8.4	2.07		51.6	0.20	0.00	20.00	1.50	0.06	5.5	1.76	0.3	0.14	1.46	0.18	–53.00	–43.00	1	33	66	C	62
73.5 – 77.9	9.0	1.49	51.8	46.5	0.10	0.00	14.70	1.10	0.13	1.0	0.22	0.2	0.00	0.16	0.06	–5.00	–3.00	0	51	49	SIC	112
77.9 – 82.3	8.8	1.88		57.9	0.10	0.00	18.30	1.20	0.14	1.6	0.43	1.2				–1.00		1	45	54	SIC	105
85.1 – 86.0	8.8	1.64	52.2	50.0	0.10	0.00	15.80	1.20	0.16	2.8	0.36	0.2	0.00	0.26	0.10	–9.00	–6.00	2	38	60	C	127
87.1 – 92.0	8.8	1.62		50.9	0.10	0.00	16.10	1.20	0.13	3.0	0.24	5.0				42.00		1	54	45	SIC	97
92.0 – 96.8	9.0	1.34	50.0	43.3	0.10	0.00	13.70	0.90	0.06	1.1	0.10	11.8				115.00		2	55	43	SIC	101
96.8 – 98.1	9.3	0.84		28.1	0.10	0.00	8.90	0.70	0.01	0.4	0.05	45.9				457.00		23	61	16	SIL	29
98.1 –102.3	9.1	1.18	51.3	39.2	0.10	0.00	12.40	1.10	0.03	1.7	0.10	12.6				123.00		3	62	35	SICL	99
102.3 –106.4	9.1	1.16		39.2	0.10	0.00	12.40	1.10	0.09	1.3	0.12	10.4				100.00		2	58	40	SIC–SICL	104
114.3 –119.5	9.1	1.34	53.1	42.7	0.10	0.00	13.50	1.30	0.10	2.5	0.25	7.0				62.00		1	54	45	SIC	119
120.0 –124.2	9.2	1.16		39.5	0.10	0.00	12.50	0.90	0.06	1.2	0.20	6.4				76.00		0	51	49	SIC	134
124.2 –125.2	9.4	0.94	51.0	31.0	0.10	0.10	9.80	0.70	0.05	1.0	0.10	13.5				132.00		1	69	30	SICL	86
125.5 –130.5	9.3	0.86		29.1	0.10	0.10	9.20	0.40	0.02	0.4	0.07	25.7				255.00		14	65	21	SIL	52
130.5 –132.2	9.4	1.22	53.4	40.8	0.10	0.00	12.90	0.90	0.09	2.3	0.13	6.7				63.00		1	57	42	SIC	127
132.2 –132.9	9.4	1.36		45.2	0.10	0.00	14.30	1.30	0.15	7.4	1.06	1.0	0.00	0.88	0.18	–23.00	–16.00	7	51	42	SIC	123
132.9 –133.9	9.1	1.52	59.9	51.2	0.10	0.00	16.20	1.00	0.18	5.4	0.35	0.2	0.00	0.23	0.12	–9.00	–5.00	2	30	68	C	144
139.0 –141.6	9.4	1.41		47.4	0.10	0.00	15.00	0.80	0.10	3.7	0.70	2.0				–2.00		2	61	37	SICL	154
141.6 –142.2	9.5	1.18	61.0	39.5	0.10	0.00	12.50	0.40	0.01	1.7	0.33	38.1				371.00		8	74	18	SIL	115
142.2 –145.1	9.8	1.26		41.7	0.00	0.00	13.20	1.20	0.04	3.0	1.09	4.8				14.00		1	56	41	SIC	136
145.1 –145.5	10.1	1.03	74.2	33.2	0.10	0.00	10.50	1.90	0.04	0.1	0.22	1.2				5.00		5	18	77	C	691
145.5 –149.5	9.4	1.36		46.2	0.10	0.10	14.60	1.00	0.02	2.5	1.52	2.3	0.04	1.34	0.14	–25.00	–19.00	5	52	43	SIC	102
149.5 –153.6	9.4	1.36	57.4	45.2	0.00	0.00	14.30	1.00	0.04	1.6	1.25	5.2				13.00		1	56	41	SIC	112
159.4 –161.0	9.2	1.19		39.5	0.10	0.10	12.50	1.10	0.13	3.9	0.36	0.1	0.00	0.27	0.09	–10.00	–7.00	5	50	45	SIC	116
165.4 –168.3	9.3	1.56	65.4	50.9	0.10	0.00	16.10	1.50	0.16	5.2	0.42	0.1	0.00	0.30	0.12	–12.00	–8.00	2	30	68	C	141
169.8 –171.5	9.6	1.41		48.1	0.00	0.00	15.20	1.40	0.16	1.7	0.09	1.7				14.00		0	53	47	SIC	134
171.5 –172.1	9.5	0.84	26.5	22.5	0.10	0.20	8.70	0.20	0.01	0.2	0.04	69.7				696.00		0	86	14	SIL	22
172.1 –175.0	9.6	1.00		34.5	0.00	0.00	10.90	0.80	0.07	0.7	0.04	2.0				19.00		10	64	26	SIL	75
175.0 –175.6	8.5	0.69	57.7	21.8	0.00	0.00	6.90	2.80	0.11	34.0	0.55	0.1	0.00	0.19	0.36	–16.00	–5.00	26	52	20	SIL	70
181.1 –182.0	9.3	1.80		56.3	0.00	0.00	17.80	1.90	0.19	5.8	0.95	0.2	0.46	0.25	0.22	–28.00	–6.00	9	52	39	SICL	134
182.0 –184.0	9.6	1.62	74.9	49.7	0.00	0.00	15.70	1.60	0.10	2.4	0.76	0.3	0.00	0.63	0.13	–21.00	–17.00	9	54	37	SICL	125
184.0 –187.0	9.2	1.97		63.9	0.10	0.00	20.20	2.20	0.09	3.5	1.69	1.2	0.27	1.27	0.15	–41.00	–26.00	5	55	40	SIC–SICL	121
188.5 –189.4	9.2	1.40	66.2	46.5	0.00	0.00	14.70	3.30	0.45	12.7	0.43	0.1	0.00	0.31	0.12	–12.00	–9.00	9	43	48	SIC	102
189.4 –193.3	9.7	1.16		35.1	0.10	0.00	11.10	0.20	0.00	0.2	0.11	0.5				2.00		76	8	16	SL	36
193.3 –197.2	9.9	1.17	38.2	34.8	0.00	0.00	11.00	0.70	0.01	0.2	0.38	0.5				–7.00		77	10	13	SL	46
197.2 –201.1	10.0	1.21		36.4	0.10	0.00	11.50	0.10	0.01	0.1	0.09	0.1				–2.00		75	12	13	SL	75
201.1 –205.0	10.0	1.23	50.7	37.0	0.00	0.00	11.70	0.10	0.01	0.1	0.03	1.5				14.00		74	15	11	SL	87

APPENDIX 5–B. Drill Hole 487–04 Overburden Analysis

Interval (ft) Top– Bot	pH	EC (mmhos/cm @ 25 C)	ESP	SAR	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	Boron (ppm)	H2O Sol Selenium (ppm)	Tot. Org. Carbon (%)	Total Sulfur (%)	Carbonate Total % CaCO3	Sulfate Sulfur (%)	Pyritic Sulfur (%)	Organic Sulfur (%)	Total S ABP (t/1000t)	Pyritic S ABP (t/1000t)	Sand (%)	Silt (%)	Clay (%)	Texture	Sat. (%)
0.0 – 5.0	8.8	7.54		28.20	15.00	0.40	78.30	0.10	0.06	0.0	0.34	9.0				79.00		47	24	29	SCL	216
5.0 – 8.0	9.5	3.35	59.9	55.90	0.50	0.10	30.60	0.00	0.18	0.1	0.07	14.4				142.00		46	25	29	SCL	270
8.0 – 10.0	9.3	2.41		37.80	0.60	0.20	23.90	0.00	0.28	0.4	0.05	9.6				94.00		4	57	39	SICL	132
10.0 – 11.1	9.4	1.03	25.0	25.10	0.20	0.00	9.70	0.00	0.10	16.8	0.00	83.6				838.00		0	86	14	SIL	27
11.1 – 15.9	8.8	2.79		61.00	0.30	0.10	27.30	0.10	0.26	0.5	0.07	8.6				84.00		3	50	47	SIC	101
15.9 – 20.7	8.2	4.69	29.7	34.20	2.50	1.00	45.30	0.10	0.08	0.4	0.16	7.1				66.00		4	48	48	SIC	93
20.7 – 25.5	9.2	1.99		60.10	0.10	0.00	19.00	0.20	0.10	0.2	0.06	6.3				61.00		8	55	37	SICL	99
25.5 – 30.3	9.3	1.44	56.5	42.40	0.10	0.10	13.40	0.40	0.08	0.3	0.05	6.4				62.00		4	54	42	SIC	102
30.0 – 34.9	9.3	1.55		9.30	1.40	5.80	17.60	1.40	0.10	0.5	0.12	3.7				33.00		1	48	51	SIC	110
34.9 – 36.0	9.5	0.94		29.70	0.10	0.00	9.40	0.30	0.03	0.1	0.05	33.8				336.00		3	72	25	SIL	49
36.0 – 39.5	9.2	1.17	49.9	35.70	0.10	0.00	11.30	0.60	0.08	1.3	0.13	12.7				123.00		0	54	46	SIC	89
39.5 – 42.9	9.2	1.37		35.60	0.20	0.00	13.80	1.00	0.11	1.2	0.20	6.4				58.00		0	44	56	SIC	102
42.9 – 44.2	8.3	2.30	39.2	53.00	0.30	0.00	23.70	1.70	0.32	14.5	0.98	0.2	0.01	0.63	0.34	–29.00	–18.00	6	47	47	SIC	70
44.2 – 48.1	9.0	1.30		41.40	0.10	0.00	13.10	0.80	0.09	1.2	0.24	9.0				82.00		2	48	52	SIC	90
48.1 – 52.0	8.1	2.32	37.1	42.80	0.60	0.10	25.30	1.30	0.28	4.4	0.82	0.3	0.14	0.50	0.18	–23.00	–13.00	2	35	63	C	102
52.0 – 56.0	8.9	1.60		36.00	0.30	0.00	16.10	0.80	0.09	1.6	0.36	7.7				66.00		0	45	55	SIC	91
56.0 – 56.5	9.2	0.86	41.3	23.20	0.20	0.00	9.00	0.70	0.02	1.3	0.08	31.0				307.00		0	72	28	SICL	64
56.5 – 59.9	9.1	1.03		28.70	0.20	0.00	11.10	0.60	0.06	0.9	0.10	17.7				174.00		0	60	40	SIC–SICL	94
59.9 – 63.3	9.1	0.98	47.4	36.10	0.10	0.00	11.40	0.90	0.10	1.7	0.13	6.6				62.00		0	44	56	SIC	103
63.3 – 66.7	9.0	1.54		40.50	0.20	0.10	15.70	0.90	0.19	4.9	0.39	1.0				–2.00		2	40	58	C–SIC	98
73.8 – 75.0	8.0	2.06	40.0	51.00	0.30	0.00	22.80	1.60	0.71	17.1	1.15	0.4	0.11	0.58	0.46	–32.00	–14.00	10	41	49	SIC	65
77.6 – 78.9	7.3	1.97		44.20	0.40	0.10	22.10	2.50	0.46	33.9	2.06	0.3	0.06	1.12	0.86	–61.00	–32.00	22	50	28	SICL	65
78.9 – 82.6	8.3	1.90	39.2	47.00	0.30	0.00	21.00	1.30	0.25	6.6	1.36	0.2	0.29	0.66	0.21	–41.00	–25.00	3	40	57	C–SIC	88
82.6 – 86.3	8.8	1.18		40.50	0.10	0.00	12.80	0.90	0.09	2.3	0.34	12.3				112.00		0	49	51	SIC	83
86.3 – 90.0	8.6	1.57	39.4	41.80	0.20	0.00	16.20	1.20	0.19	3.4	0.86	1.4	0.06	0.45	0.10	–5.00	0.00	1	29	70	C	95
90.0 – 94.0	8.0	1.83		45.20	0.30	0.00	20.20	1.70	0.39	14.5	1.86	0.4	0.16	0.99	0.51	–46.00	–27.00	7	23	70	C	66
101.0 –102.1	8.9	1.18	46.9	28.20	0.30	0.00	12.60	1.10	0.14	5.6	0.11	0.2				–1.00		3	44	53	SIC	128
102.1 –103.5	9.3	1.21		33.50	0.10	0.00	10.60	0.60	0.08	0.5	0.23	10.3				96.00		0	59	41	SIC	152
103.5 –105.4	8.6	1.63	44.7	34.60	0.40	0.00	17.30	0.90	0.21	5.6	0.79	0.7	0.06	0.55	0.16	–18.00	–10.00	2	52	46	SIC	92
110.6 –112.6	8.8	1.01		34.20	0.10	0.00	10.80	0.70	0.11	3.9	0.35	7.3				62.00		10	63	27	SI	51
112.6 –114.3	9.0	0.94	42.8	24.80	0.30	0.00	11.10	1.00	0.12	1.7	0.14	5.3				49.00		0	59	41	SIC	79
114.3 –117.8	9.0	0.88		25.30	0.20	0.00	9.80	0.80	0.03	1.1	0.18	34.8				342.00		2	73	25	SIL	43
117.8 –120.8	9.3	0.61	30.0	20.60	0.10	0.00	6.50	0.40	0.02	0.6	0.06	29.3				291.00		13	72	15	SIL	26
120.8 –123.8	9.1	0.72		26.60	0.10	0.00	8.40	0.60	0.03	0.9	0.06	27.3				271.00		5	74	21	SIL	29
123.8 –127.6	9.0	1.20	33.9	39.80	0.10	0.00	12.60	1.30	0.08	2.4	0.62	9.5				75.00		2	51	47	SIC	74
130.6 –134.1	9.0	1.31		41.40	0.10	0.00	13.10	1.60	0.21	4.6	0.62	0.3	0.03	0.64	0.15	–23.00	–17.00	1	44	55	SIC	93
141.7 –146.3	9.7	0.96	69.1	23.20	0.20	0.00	9.00	1.80	0.15	2.4	0.11	0.2				–1.00		1	39	60	C	125
146.3 –150.9	9.6	1.20		38.60	0.00	0.00	12.20	2.50	0.22	1.4	0.15	0.2				–3.00		1	36	63	C	140
150.9 –151.5	9.8	0.86	50.5	27.50	0.00	0.10	8.70	1.00	0.06	1.0	0.05	2.2				5.00		6	58	36	SICL	102
151.5 –155.4	9.8	1.02		33.50	0.00	0.00	10.60	1.80	0.11	0.9	0.07	0.2				0.00		0	48	52	SIC	136
155.4 –159.2	9.9	0.97	60.6	32.90	0.00	0.00	10.40	0.80	0.09	0.8	0.41	8.0				67.00		3	57	40	SIC–SICL	127
159.2 –162.1	10.0	0.83		27.50	0.00	0.00	8.70	0.50	0.04	0.6	0.68	6.5				37.00		9	54	37	SICL	165
162.1 –165.0	9.9	0.99	64.1	33.20	0.10	0.00	10.50	0.60	0.03	0.6	0.05	16.2				160.00		9	59	32	SICL	152
165.0 –169.3	9.8	1.04		28.70	0.20	0.00	11.10	1.70	0.09	0.8	0.05	7.6				76.00		1	48	51	SIC	141
169.3 –170.3	9.1	1.13	61.9	39.50	0.10	0.00	12.50	0.90	0.05	1.0	0.04	6.0				56.00		4	49	47	SIC	152
170.3 –174.4	9.4	1.25		45.50	0.10	0.00	14.40	1.10	0.06	1.4	0.07	3.7				34.00		2	43	55	SIC	127
174.4 –179.4	9.5	0.97	55.1	35.10	0.10	0.10	11.10	0.70	0.02	0.7	0.05	22.5				223.00		18	55	27	SICI–SIL	70
179.4 –184.4	9.4	1.27		46.40	0.00	0.00	15.30	1.30	0.07	1.3	0.16	11.7				112.00		2	52	46	SIC	111
184.4 –189.4	9.3	1.28	57.4	46.80	0.00	0.00	14.80	1.30	0.09	2.7	0.51	9.2				76.00		1	54	45	SIC	99
193.1 –196.5	9.8	1.29		46.20	0.00	0.00	14.60	1.40	0.09	4.5	1.16	4.2				5.00		4	55	41	SIC	122
196.5 –198.1	9.7	1.39		50.30	0.00	0.00	15.90	1.50	0.03	4.3	1.64	0.6	0.00	0.63	1.01	–50.00	–18.00	3	54	43	SIC	70
198.1 –201.9	9.3	1.65		40.90	0.30	0.00	18.30	1.50	0.04	1.6	1.29	3.3	0.14	1.10	0.14	–7.00	1.00	3	49	48	SIC	64
201.9 –202.5	9.5	1.24	44.4	46.20	0.10	0.00	14.60	0.80	0.00	0.4	0.56	51.6				498.00		0	79	21	SIL	54
202.5 –206.0	9.6	1.50		37.80	0.30	0.00	16.90	1.50	0.05	1.5	1.08	7.5				41.00		3	46	51	SIC	88
206.0 –209.5	9.0	1.31	56.8	48.70	0.10	0.00	15.40	1.60	0.26	15.7	1.19	1.3	0.00	0.96	0.23	–24.00	–17.00	5	54	41	SIC	70
223.3 –226.3	9.0	1.84		64.50	0.10	0.00	20.40	2.00	0.40	10.4	0.85	0.2	0.20	0.44	0.21	–25.00	–12.00	9	42	49	SIC	114
226.3 –229.3	9.6	1.32	77.6	47.10	0.10	0.00	14.90	1.50	0.09	1.4	0.30	0.1	0.03	0.20	0.07	–8.00	–5.00	5	50	45	SIC	96
229.3 –233.5	9.6	1.01		34.50	0.00	0.00	10.90	1.30	0.09	0.9	0.11	0.5				2.00		14	73	13	SIL	80
233.5 –237.7	9.6	1.13	88.4	38.30	0.00	0.00	12.10	0.80	0.04	0.9	0.18	1.4				8.00		42	31	27	CL–L	60
237.7 –238.8	9.7	1.50		53.10	0.00	0.00	16.60	1.60	0.15	1.0	0.18	0.5				–1.00		10	41	49	SIC	111
238.8 –240.0	9.6	1.40	77.0	51.20	0.00	0.00	16.20	1.30		1.9	0.09	16.1				176.00		14	59	27	SICL	79

APPENDIX 5–B. Drill Hole 487–05 Overburden Analysis

Interval (ft) Top– Bot	pH	EC (mmhos/cm @ 25 C)	ESP	SAR	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	Boron (ppm)	H2O Sol. Selenium (ppm)	Tot. Org. Carbon (%)	Total Sulfur (%)	Carbonate Total % CaCO3	Sulfate Sulfur (%)	Pyritic Sulfur (%)	Organic Sulfur (%)	Total S ABP (t/1000t)	Pyritic S ABP (t/1000t)	Sand (%)	Silt (%)	Clay (%)	Texture	Sat. (%)
0.0 – 4.0	8.1	1.00		5.4	3.10	0.60	7.30	0.30	0.00	0.1	0.03	21.8				217.00		40	43	17	L	32
4.0 – 8.0	8.4	0.66		9.5	0.60	0.30	6.40	0.30	0.00	0.4	0.01	14.9				149.00		44	46	10	L	29
8.0 – 12.0	8.5	0.53		11.9	0.30	0.10	5.30	0.20	0.00	0.0	0.01	16.9				169.00		43	39	18	L	29
12.0 – 15.8	5.6	0.71		21.2	0.10	0.00	6.70	1.10	0.00	0.2	0.01	0.1				1.00		1	35	64	C	64
15.8 – 19.6	4.7	0.84	15.2	25.3	0.10	0.00	8.00	0.80	0.00	1.0	0.03	0.1				0.00		1	39	60	C	81
19.6 – 20.2	4.0	2.49		27.9	0.90	0.90	26.20	1.40	0.01	19.5	0.41	0.0	0.09	0.00	0.32	–13.00	0.00	7	68	25	SIL	58
20.2 – 22.2	4.0	2.37	7.1	24.1	1.10	1.00	24.70	1.30	0.01	6.9	0.23	0.1	0.06	0.00	0.17	–6.00	1.00	3	55	42	SIC	46
29.0 – 33.0	4.1	4.84		15.2	8.50	8.50	44.30	0.70	0.00	0.9	0.28	0.2	0.17	0.00	0.11	–7.00	2.00	1	23	76	C	88
33.0 – 36.9	3.6	6.22		11.1	22.50	15.50	48.30	0.80	0.01	3.5	0.74	0.1	0.45	0.00	0.29	–22.00	1.00	1	45	54	SIC	61
39.1 – 44.0	7.0	5.46	10.3	17.9	13.00	5.50	54.40	0.50	0.08	1.2	0.22	3.8				31.00		0	37	63	C	88
44.0 – 47.0	8.9	2.10		42.7	0.40	0.20	23.40	0.20	0.07	0.4	0.07	15.5				153.00		6	51	43	SIC	132
47.0 – 50.0	9.4	1.46	46.6	36.9	0.30	0.10	16.50	0.10	0.02	0.3	0.05	16.5				163.00		8	55	37	SICL	178
50.0 – 52.6	9.3	1.45		41.6	0.20	0.10	18.10	0.00	0.06	0.6	0.05	2.6				24.00		7	54	39	SICL	165
52.6 – 53.9	9.8	1.45	43.9	39.8	0.20	0.10	15.40	0.10	0.06	0.7	0.04	4.5				44.00		3	47	50	SIC	163
53.9 – 57.6	9.9	1.24		39.5	0.10	0.00	12.50	0.30	0.03	2.3	0.04	7.8				77.00		9	48	43	SIC	234
57.6 – 62.3	9.7	1.32	46.1	44.3	0.10	0.00	14.00	0.30	0.02	0.5	0.04	10.6				105.00		12	43	45	SIC	233
62.3 – 67.0	9.6	1.35		47.4	0.10	0.00	15.00	0.60	0.04	0.9	0.04	11.1				110.00		2	48	50	SIC	198
67.0 – 67.5	9.5	1.03	52.1	34.5	0.10	0.00	10.90	0.40	0.14	1.0	0.06	5.9				57.00		37	25	38	CL	219
70.4 – 74.3	8.9	1.50		50.0	0.10	0.00	15.60	0.90	0.12	2.1	0.22	3.9				32.00		2	52	46	SIC	79
74.3 – 78.1	9.3	1.22	34.6	40.5	0.10	0.00	12.60	0.80	0.06	1.2	0.22	22.2				215.00		3	58	39	SICL	55
78.1 – 81.3	9.5	0.87		30.4	0.10	0.00	9.60	0.80	0.03	0.6	0.05	32.3				321.00		3	69	28	SICL	34
81.3 – 84.0	9.1	1.68	41.4	45.4	0.20	0.00	17.60	1.60	0.07	1.6	0.55	7.9				62.00		1	46	53	SIC	74
86.0 – 86.3	7.5	3.02		43.7	0.70	0.30	30.90	1.30	0.18	6.7	1.76	0.1	0.11	1.43	0.22	–54.00	–44.00	1	47	52	SIC	63
92.5 – 96.9	9.2	1.57	55.5	51.6	0.10	0.00	16.30	2.10	0.15	2.1	0.53	10.0				63.00		5	63	32	SICL	73
96.9 – 101.9	9.1	2.04		55.0	0.20	0.00	21.30	3.30	0.08	3.3	1.45	0.2	0.05	1.27	0.13	–43.00	–38.00	4	62	34	SICL	78
101.3 – 105.8	9.7	1.40	52.8	46.2	0.10	0.00	14.60	1.70	0.12	1.7	0.99	1.2	0.11	0.85	0.03	–19.00	–15.00	3	69	28	SICL	70
110.9 – 114.5	9.2	1.63		62.6	0.10	0.00	19.60	0.90	0.22	9.8	0.53	0.3	0.09	0.23	0.21	–14.00	–4.00	5	34	61	C	128
114.5 – 118.1	9.9	1.19	57.9	39.2	0.10	0.00	12.40	1.50	0.10	1.5	0.16	4.0				35.00		4	47	49	SIC	98
118.1 – 119.1	10.0	0.92		31.3	0.00	0.00	9.90	1.10	0.05	1.1	0.07	8.5				6.00		9	52	39	SICL	84
119.1 – 124.2	10.0	0.95	56.5	13.6	0.30	0.90	10.50	1.10	0.03	1.1	0.06	12.7				125.00		9	56	35	SICL	60
124.2 – 129.2	9.9	0.96		31.9	0.10	0.00	10.10	4.60	0.02	4.8	0.06	13.9				127.00		2	65	33	SICL	102
129.2 – 134.3	9.8	1.06	55.1	36.4	0.10	0.00	11.50	1.30	0.07	1.3	0.03	11.9				116.00		1	62	37	SICL	100
136.5 – 139.3	8.2	2.31		61.7	0.20	0.00	23.90	2.10	0.35	21.6	1.79	0.1	0.06	1.14	0.59	–55.00	–35.00	13	43	44	SIC	75
139.3 – 140.3	9.9	0.97	58.2	32.9	0.10	0.00	10.40	3.00	0.12	3.0	0.38	8.7				75.00		1	81	18	SIL	121
140.3 – 144.7	10.3	0.97		30.7	0.10	0.00	9.70	1.90	0.06	1.9	0.49	13.2				118.00		1	72	27	SIL	125
144.7 – 149.1	9.9	1.05	60.5	33.2	0.00	0.00	10.50	2.70	0.05	2.7	1.31	3.4	0.07	1.09	0.15	–7.00	0.00	2	73	25	SIL	65
149.1 – 153.5	9.9	1.31		41.1	0.00	0.00	13.00	2.30	0.04	2.3	1.39	1.7	0.19	1.06	0.14	–26.00	–16.00	1	74	25	SIL	96
157.6 – 159.2	9.6	1.01	62.9	32.6	0.00	0.00	10.30	1.60	0.19	6.9	0.23	0.1	0.00	0.10	0.13	–6.00	–3.00	3	65	32	SICL	110
159.2 – 160.0	9.7	0.80		24.0	0.10	0.00	7.60	0.30	0.02	0.3	0.05	6.0				59.00		57	40	3	SL	28
160.0 – 164.6	9.7	1.07	62.2	35.1	0.10	0.00	11.10	1.00	0.06	1.0	0.06	10.5				104.00		4	63	33	SICL	107
164.6 – 169.2	10.1	1.04		35.4	0.10	0.00	11.20	1.00	0.04	1.1	0.06	25.3				252.00		4	72	24	SIL	71
177.5 – 181.1	10.4	1.31	74.1	43.0	0.10	0.00	13.60	2.40	0.32	2.5	0.27	0.0	0.00	0.14	0.13	–8.00	–4.00	1	46	53	SIC	143
181.1 – 185.1	10.2	1.36		44.3	0.10	0.00	14.00	2.60	0.13	5.9	0.66	0.1	0.19	0.31	0.16	–20.00	–9.00	9	46	45	SIC	129
185.1 – 190.0	8.3	1.63	12.2	29.4	0.60	0.10	17.40	0.70	0.00	0.8	0.94	0.9	0.17	0.61	0.16	–20.00	–10.00	63	31	6	SL	37
190.0 – 190.7	9.1	1.48		46.8	0.00	0.00	14.80	1.70	0.07	8.7	1.95	5.7				–4.00		10	77	13	SIL	65
190.7 – 194.9	7.4	1.17	5.2	33.5	0.00	0.00	10.60	0.50	0.00	2.0	0.40	0.0	0.08	0.18	0.14	–13.00	–6.00	79	21	0	LS	33
194.9 – 199.0	9.9	1.25		36.4	0.00	0.00	11.50	0.30	0.00	0.1	0.06	0.3				1.00		87	13	0	S	30

Appendix 17.C

1987 Methods of Analysis

1987 METHODS OF ANALYSIS.

Sample Preparation

Crushing and grinding to minus 2.0 mm (for AB potential to .25 mm).

Saturation percent

Richards, 1954
Method 27a. Saturated paste.

pH

Richards, 1954.

Method 21c. 1:2 (soil:water) extract, pH meter.

E.C.

Richards, 1954.

Method 4. 1:2 (soil:water) extract, EC meter.

Calcium, Magnesium and Sodium

Richards, 1954.

Method 3. 1:2 (soil:water) extract, ICP.

(1987 Methods of Analysis -cont'd)

SAR

Richards, 1954. Calculation.

Boron (hot water soluble)

Page et al., 1982

Hot water extraction, ICP.

Selenium (hot water soluble)

Page et al., 1982

Hot water extraction, AA-hydride.

Acid-Base Potential

Sulfur (total)

Sulfur Forms (for samples with A-B potential < -5)

Neutralization Potential (Calculated from $CaC0_3$%)

Sobek et al., 1978 EPA 600/2-78-054.

Calcium Carbonate (total)

ASTM Method 513--82, Acid neutralization-colorimetric detection of $C0_2$.

(1987 Methods of Analysis -cont'd)

Organic Carbon (total)

ASTM Method 4129-82, Hi-temp combustion-colorimetric Detection of CO_2.

Texture

Page et al., 1982

Method 4304. Particle size by pipet method after pre-treatment with H_20_2, HCl, washing with H_2O, and dispersing with Sodium hexa-meta phosphate.

ESP

Richards, 1954
Method 20a. Exchangeable cation percentages.

Appendix 17.D

1989 Methods of Analysis

1989 METHODS OF ANALYSIS.

Saturated Paste

Page et al., 1982
Method 10-2.3.1.

Measure 1/3 to 1/2 cup soil into plastic cup which has a snap tight lid. All deionized water to the soil while mixing with a spatula. When the paste glistens, flows slightly with the container is tipped, and slides cleanly off the spatula. The saturation criteria are reached. Allow the paste to stand at least 4 hours, but preferable overnight. Recheck the saturation criteria. Free water should not have collected on the surface. Add either more soil or water to attain proper consistency. At this point, pH and saturation percentage are obtained. Paste is then filtered through a Buchner funnel using vacuum filtration. The extract is collected in a test tube for E.C. and SAR analysis.

pH

Richards, 1954 Method (21a)
Page et al., 1982. Method 12.6

Standardize the pH meter with pH 7 and pH 4 buffers before use. If samples have exceptionally high pH's also check the pH 10 buffer. After remixing the pastes to check the saturation criteria, insert pH electrode into the paste, and move the electrode gently through the paste until a stable reading is obtained. Record sample pH.

Saturation Percentage

Page et al., 1982. Method 10-2.
Richards, 1954. Method (27a).

After remixing the pastes to check the saturation criteria, place a subsample of the paste into a small cup of known weight. Weigh and record the wet weight of the cup and sample, then place in a 105°C oven until dry, usually overnight. Reweigh dried sample and record as dry weight.

Electrical Conductivity

Page et al., 1982. Method 10-3.3.

Prepare a water bath at 25°C. Place saturated paste extracts and a KCL standard in the bath and allow them to come to equilibrium. Measure conductivity of KCl standard and record to be used as a correction factor. Measure and record conductivities of paste extracts.

Water Soluble Ca, Mg and Na

Page et al., 1982. Method 10-3.4.

Place 1 ml of saturated paste extract in a small plastic cup and add 20 ml of 0.6% $SrN0_3$. Cap samples if they are not to be analyzed immediately. Analyze for Ca, Mg and Na by atomic absorption spectrometer.

SAR

Richards, 1954. Method (20B)

Calculated value:

$$SAR = Na / [(Ca + Mg) / 2]^{1/2}$$

Neutralization Potential

Sobek et al., 1978. Method 3.2.3.

Determine amount of fizz for each sample with 10% HC1 to insure that enough acid is added to react with all the $CaCO_3$. Weigh 2.00 g of -60 mesh sample into a 250 ml beaker. Add amount of standardized 0.1 N HC1 indicated by the fizz test. Heat to almost boiling (do NOT allow to boil) for 10 min. or until reaction complete. Add Deionized water to bring total volume to approximately 125 ml. Cover with a watch glass and boil for at least one minute. Cool and titrate with standardized 0.1 N NaOH to a pH of 7. If less than 3 ml of NaOH is used to titrate the sample, rerun sample using more HC1.

Calculations:

Tons $CaCO_3$ per 1000 tons Material = {(mls HCl added x N HC1) - (mls NaOH titrated x N NaOH)} x 25

Total, HCl Extractable, HNO_3 Extractable, and Nonextractable Sulfur

Sobek et al., 1978. Method 3.2.4 and 3.2.6.

Weigh one portion of -60 mesh sample for total sulfur determination. Rinse approximately 5 g of sample with 2:3 HC1 until a total of 50 ml of acid has been added. Rinse with approximately 50 ml of deionized water. Dry sample and filter paper. Scrape sample from filter paper and, if necessary, grind with a mortar and pestle. Weight a portion for sulfur analysis.

Place remaining HCl rinsed sample in a beaker and add 50 ml of 1:7 HNO_3. Cover with a watch glass and boil gently for 30 min. Cool and filter. Rinse with 50 ml of deionized water. alternatively, sample may be allowed to stand in 50 ml of 1:7 HNO_3 overnight. Filter and rinse as above. Dry sample and filter paper. Scrape sample from filter paper, grind, and weigh a portion for sulfur analysis.

Analyze all samples using a Fisher Sulfur Analyzer.

Calculations:

Sulfate Sulfur % = Total Sulfur % - HCl Rinsed Sulfur %

Pyritic Sulfur % = HCl Rinsed Sulfur % - HNO_3 Rinsed Sulfur %

Organic Sulfur % = Sulfur % after HNO_3 Rinse Potential Acidity

or;

Pyritic Sulfur Acid-Base in tons $CaCO_3$ per 1000 tons material = Pyritic Sulfur % x 31.24

Boron

Page et al., 1982. Method 25-9.1

Weigh a 25 g sample of soil into a 4 oz. plastic bottle. Add 50 ml of 0.1% $CaCl_2$. Place lid loosely on bottle and heat in the microwave until steaming hot - do not boil. Heating time in the microwave depends on the number of samples being heated. Allow to cool 15 to 20 minutes. Be consistent with the cooling time. Filter the sample and collect the extract for Boron and Selenium analysis. Analyze by ICP spectrometer.

Selenium (water soluble)

Page et al., 1982. Method 25-9.1 and 3-5.5.4

Use same extraction procedure as for Boron analysis. Pretreat sample before analysis to convert Selenium (VI) to Selenium (IV) and to destroy any organic matter in the extract. Place 10 ml of sample in a large test tube. Add 1 ml of 30% H_2O_2 and heat for exactly 20 minutes in a boiling water bath. Add 10 ml of concentration HCl and heat again in the water bath for exactly 20 minutes. Cool and analyze by hydride method of analysis on the ICP spectrometer.

Selenium (total)

Page et al., 1982. Method 3-5.3.3 and 3-5.3.4

Weigh 0.5 g of mesh soil into a 50 ml Teflon digestion tubes. Add 5 ml of HNO_3 and 5 ml of $HClO_4$. Heat in digestion block at about 200°C until volume is reduced to 2 or 3 ml. Cool, add 2 more ml $HClO_4$ and 5 ml of HF, and heat at 200°C until all silicates are dissolved. Reduce volume again to 2 or 3 ml. Cool, transfer solution to 50 ml volumetric flask and bring to volume. Pretreat extract in the same manner as the water-soluble Selenium and analyze by hydride method on the ICP spectrometer.

Acid-Base Account

Sobek et al., 1978 Methods 3.2.4 through 3.2.6.

Calculated value:

Acid-Base Account = Neutralization Potential - (Pyritic Sulfur % x 31.24)

Calcium Carbonate

Richards, 1954.

Procedure is the same as for Neutralization Potential, except that 2.00 g of -10 mesh sample is used. Report results as % $CaCO_3$.

Organic Carbon

Page et al., 1982

Dry about 1 tsp. to 1 tbsp. of -60 mesh sample in 105°C oven for at least one hour. Cool in a desiccator. Using an analytical balance, weigh a porcelain combustion capsule which has also been oven dried and desiccated. Record weight. Add approximately 2 g of cooled sample to capsule, weigh and record as first weight. Place capsule in a muffle furnace, bring temperature to 550°C and hold for 8 hours. Cool sample in desiccator and reweigh. Record final weight.

Texture

EPA 600/4-79-054, 1983. Method 3.4.3.

Weigh 55 g of soil into an 8 oz wide-mouth plastic bottle. Add 100 ml of Calgon, cap and shake overnight. Rinse contents of bottle into hydrometer cylinder and bring to volume. Stopper cylinder and mix contents by inverting cylinder once per second for 1 min. Remove stopper and rinse. Place hydrometer in cylinder and take a reading exactly 40 sec. from the time the cylinder was set down. Record reading. After taking the hydrometer reading, measure the temperature of the suspension and record. At 8 hr., replace the hydrometer in the suspension and record second reading. Measure and record temperature.