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14.C	Prime Farmland Determination Correspondence

SECTION 14

SOIL

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REV. NUMBER	REVISION DESCRIPTION	DATE APPROVED

SECTION 14 SOIL

14.1 Origin and General Nature of the Survey Area

The Pinabete Mine Plan permit area (permit area) comprises approximately 5,569 acres of BHP Navajo Coal Company's (BNCC) mining lease (Exhibit 14.1-1). The permit area is comprised of portions of both Area 4 North and Area 4 South of BNCC's mining lease. Buchanan Consultants, Ltd. (BCL) conducted multiple soil surveys covering the permit area. In 1987, BCL conducted an Order 2 soil survey for BNCC which included Area 4 North. In 1998, an Order 2 soil survey was conducted for Area 4 South. In 2008, an Order 2 soil survey was conducted for portions of Area 4 South and Area 5. These soils surveys, along with other soil surveys conducted within the BNCC mining lease, are summarized in the Soil Resource Comprehensive Report (Appendix 14.A).

The Soil Resource Comprehensive Report is a composite report that summarizes the soil surveys that apply to the permit area and describes the extent and proportion of soils, locations and estimated volumes of topdressing, soil profile descriptions, and prime farmland investigation results (Appendix 14.A).

The permit area occurs within the Colorado Plateau physiographic province (Fenneman 1931, Hunt 1956). The Colorado Plateau has within its borders a wide diversity of topography, geologic materials, soils, and vegetation. The general terrain in the vicinity of the permit area is characterized by rough and broken topography, badlands, plateaus, and mesas, intermingled with escarpments, and valleys or washes. Many of the soils in the permit area are formed from alluvium and eolian sediments derived out of shale and sandstone from the Fruitland formation. Some soils have formed directly from bedrock. Most of the soils in the permit area have formed since the late-Pleistocene and Holocene Eras. It is very common to find buried soils that date back to the Pleistocene Era. The average annual precipitation for the permit area is approximately 5.6 inches and the mean annual air temperature near 54^{o} F (Section 12, Climate). Therefore, the permit area is described as having an aridic moisture regime and a mesic temperature regime.

In November 1980, the Natural Resources Conservation Service (NRCS) issued the Soil Survey of San Juan County New Mexico, Eastern Part (Keetch 1980). The permit area is included in this Order 3 soil survey presented at a scale of 1:63,360. Many of the soil series names used to describe the soil resources in the permit area are the same as those used in the 1980 NRCS soil survey. Additional soil series names came from NRCS soil surveys in Arizona, Colorado, New Mexico, and Utah. The soil series names used to describe the soil resources of the permit area represent the current correlation of soil series for the BNCC mining lease (Appendix 14.A).

14.2 Soil Types

The soils of the permit area are highly complex and variable. In most cases, the geomorphic surfaces have been influenced by constructional and erosional processes, thus resulting in a high occurrence of buried and

truncated soils. Nearly all of the soils were developed under the influence of erosion as indicated by the present day frequency of moderate and severely eroded surfaces. Additionally, many profiles were described with lithologic discontinuities. The soil sample site number of each profile with its northing and easting coordinates is provided in Table 14.2-1. The coordinate system used to describe each soil sample site was the North American Datum 1927 State Plane New Mexico West projection.

14.2.1 Soil Series Classification

The soil series used to describe the soil resource in the permit area include Aridisol or Entisol soils that developing an aridic moisture regime and a mesic temperature regime. Each series was classified to the family level (Soil Survey Staff 2010) and each was assigned a hydrologic group (Soil Survey Staff 2008) (Table 14.2-2). Series descriptions for each soil series are available from the NRCS website (NRCS 2012). Laboratory data for each major series are included in Table 14.2-3. The laboratory data were used to classify soils and determine topdressing suitability using the Office of Surface Mining Reclamation and Enforcement (OSM) Topsoil and Topsoil Substitute Suitability Criteria for the Southwestern United States (Table 14.2-4). The interpretations for soil classification and topdressing suitability are limited to the upper 60 inches of unconsolidated material.

All soil series used to describe the permit area soil resources are included in the Key to Soils (Appendix 14.B). A few series (Chipeta, Mesa, Redlands, Sogzie and Uffens) were only used to describe inclusions within the mapping units. These soil series were not used to name map units nor sampled because of their limited extent.

Most of the soil series names used in the 1987 soil survey for BNCC came from the 1980 NRCS soil survey (Keetch 1980). The remaining soil series names were correlated to soil series used by the NRCS in adjacent states. In subsequent surveys for BNCC, soil series names used were correlated to represent current soil series names used by the NRCS. The soil series described for the permit area came from the Soil Resources Comprehensive Report (Appendix 14.A).

14.2.2 Description of Soil Mapping Units

A total of 28 mapping units are described using 16 soils series and three miscellaneous land types (Badlands, Natric, and Rock Outcrop) (Table 14.2-5). Twenty-four of the 28 mapping units are consociations, two are complexes, and two are undifferentiated map units. The map components used to name the majority of mapping units were phases of soil series. Phase criteria included surface texture, depth of suitable topdressing, and slope. Mapping unit names and symbols are listed in Table 14.2-5. A description of each soil mapping unit, including the proportion and distribution of named components and inclusions, is provided in Appendix 14.A. The location and extents of the mapping units are presented in Exhibit 14.1-1.

One of the map units, Natric soils, is comprised of two Great Groups Natrargids and Natrigypsids. The Natrargids include the soil series Huerfano, Fajada, Muff, Patel and Uffens. The Natrigypsids include the soil series Hoskay and Benally. These sodium affected soils do not provide a source of topdressing because of electrical conductivity (EC) and/or sodium adsorption ratio (SAR) levels that exceed topsoil suitability guidelines (Table 14.2-4). Since none of these soil series provide a source of topdressing, there was no justification in mapping them separately, therefore they were combined into one map unit called Natric soils.

Some Natric soils, however, have a surface deposit of sandy eolian material suitable as a source of topdressing. Therefore, a phase of the Natric soils was created to represent a soil type providing a potential suitable source of topdressing. This soil type was called Natric soils, overblown phase. The mapping unit used to describe these soils is called Natric soils, overblown phase and characterizes soils having a potential source of suitable topdressing.

14.3 Topdressing Volume

The Surface Mining Control and Reclamation Act of 1977 (SMCRA) defines topsoil as the A and E soil horizons (30 CFR 701.5). These are the uppermost soil horizons of a soil profile and are characterized by accumulations of organic matter (A horizon) or intensely weathered and leached horizons that have not accumulated organic matter (E horizon) (Brady and Weil 1996). The baseline soil resources within the permit area consist of Aridisols and Entisols soil series (Section 14.2.1), which contain negligible resources that meet the SMCRA topsoil definition. Therefore, BNCC relies on topsoil substitute material, (topdressing) for reclamation. BNCC defines topdressing as all unconsolidated material capable of supporting plant growth in the upper 60 inches of the native *in-situ* soil profile. This includes all topsoil material (A and E soil horizons) and suitable topsoil substitute material (B and C soil horizons).

One objective of the various soil surveys was to determine the volume of available soil material for use as topdressing during reclamation of areas disturbed by mining activities. Soils were mapped at scales appropriate to produce, whenever possible, homogeneous mapping units. Generally, soils were mapped in the field at scales of either 1:6,000 or 1:12,000. It is assumed when similar soils are mapped together, then characteristics of a few soil samples within the unit can be extrapolated for the entire unit. The assumption is valid when homogeneous areas exist or when small delineations can be made to maintain homogeneous components. The mapping scales used in various soil surveys allow delineations of 0.5 to 1.0 acres, depending upon field mapping scales. In areas of very heterogeneous soils, the delineations tend to be smaller and more samples are required to describe the soils than in homogeneous areas where the delineations tend to be larger. Topdressing volume of any given map unit delineation is the product of its

area and its mean depth of suitable topdressing. Total topdressing volume for any given mapping unit is the sum of its mapping unit delineations.

14.3.1 Pinabete Mine Plan Permit Area

The total estimated volume of *in-situ* topdressing within the permit area is 8,042,225 back cubic yards (bcy) (Table 14.3-1). Table 14.3-1 also includes the *in-situ* topdressing volume for each individual map unit. Approximately 42% of the permit area provides all of the suitable *in-situ* topdressing and the remaining 58% of the area has no suitable topdressing (Table 14.3-1).

14.3.2 Summary of Available Topdressing for Reclamation

Using a conservative handling loss of 10%, it is estimated that the available topdressing in the permit area is approximately 7,238,000 bcy (Table 14.3-2). The estimation of available topdressing for reclamation is limited to the upper 60 inches of unconsolidated material. Potentially suitable sources of topdressing material likely exist below a depth of 60 inches (i.e., regolith) within the proposed permit area. These additional potential sources of topdressing were not evaluated, since sufficient quantities of suitable topdressing are available from the permit area to support successful reclamation.

14.4 Prime Farmland Reconnaissance Investigation Results

BNCC has conducted multiple investigations to determine whether lands within the BNCC mining lease area were classified as prime farmland. Norman Vigil, Acting State Conservationist from the NRCS, was asked to determine if the BNCC mining lease, including the permit area, contained prime farmland and to provide a letter of documentation (Appendix 14.C). The results of his investigation follow.

14.4.1 Results of Prime Farmland Investigation

1. The area within the BNCC mining lease, including the permit area, has not been historically used as crop land.
2. The area within the BNCC mining lease, including the permit area, has an average annual precipitation of six inches and has no naturally sub-irrigated lands.
3. The area within the BNCC mining lease, including the permit area, has no soil mapping units that can be classified as prime farmland under the definition of prime farmland by the USDA-NRCS (7 CFR 657.5)

14.5 Soil Information Collection and Analysis

Detailed soils information including methods and procedures are described in the preceding sections and are fully detailed in the "BHP Navajo Coal Company Coal Lease Soil Resources Comprehensive Report" (Appendix 14.A).

Personnel

Persons or organizations responsible for data collection, analysis, and preparation of this permit application package section:

Kent Applegate	Buchanan Consultants, Ltd.
Matt Owens	Farmington, NM
BHP Navajo Coal Company	

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Table 14.2-1 Pinabete Mine Plan Permit Area Soil Sample Sites (#) with Easting and Northing by Resource Area

Sample Site, #	Easting	Northing	Resource Area
1	297646.94	1994713.00	Area 4 South
3	297389.88	1993815.00	Area 4 South
4	297454.03	1993276.63	Area 4 South
5	297519.94	1992898.50	Area 4 South
6	297579.16	1992420.38	Area 4 South
181	294255.28	1999152.50	Area 4 North
194	298036.69	1992587.38	Area 4 South
195	297998.78	1992970.50	Area 4 South
196	298019.13	1993403.38	Area 4 South
197	298094.28	1993720.13	Area 4 South
198	297959.56	1994196.25	Area 4 South
199	298130.97	1994690.25	Area 4 South
200	298370.69	1994978.50	Area 4 South
235	299919.66	1990186.13	Area 4 South
236	299909.50	1990796.75	Area 4 South
237	299491.91	1991122.75	Area 4 South
238	299536.22	1990541.88	Area 4 South
239	300445.34	1989635.13	Area 4 South
240	300411.06	1989054.63	Area 4 South
397	302795.72	1995178.25	Area 4 South
398	303478.78	1994799.50	Area 4 South
399	304612.72	1994927.25	Area 4 South
400	304513.56	1995229.63	Area 4 South
401	305126.00	1995099.13	Area 4 South
402	305458.81	1995199.13	Area 4 South
403	306039.59	1995150.63	Area 4 South
404	306632.34	1994922.88	Area 4 South
406	305097.88	1994717.00	Area 4 South
407	304004.31	1995146.13	Area 4 South
408	303491.84	1995149.63	Area 4 South
409	302754.69	1994811.13	Area 4 South
410	303366.03	1994473.38	Area 4 South
411	304602.91	1994548.38	Area 4 South
412	305062.91	1994375.00	Area 4 South
413	305623.06	1994421.13	Area 4 South
415	305100.16	1993866.13	Area 4 South
416	306100.47	1994455.13	Area 4 South
418	306606.25	1994442.63	Area 4 South
419	306503.00	1993966.88	Area 4 South
420	306536.84	1993355.75	Area 4 South
421	304596.47	1994242.63	Area 4 South
422	304574.66	1993862.00	Area 4 South
423	304544.06	1993360.00	Area 4 South
425	304967.75	1992850.00	Area 4 South
426	304905.84	1992403.63	Area 4 South

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
427	305371.03	1992256.63	Area 4 South
428	305443.81	1992697.25	Area 4 South
429	305522.94	1993162.38	Area 4 South
430	306026.94	1993008.63	Area 4 South
431	305891.38	1992551.75	Area 4 South
432	305780.16	1992130.13	Area 4 South
433	306230.50	1991953.38	Area 4 South
434	306355.06	1992361.13	Area 4 South
435	306419.41	1992642.63	Area 4 South
436	306901.03	1992589.00	Area 4 South
437	307000.03	1993106.75	Area 4 South
438	306817.75	1992175.13	Area 4 South
439	307256.44	1991996.25	Area 4 South
440	307144.72	1991543.50	Area 4 South
441	307047.47	1991105.88	Area 4 South
442	307207.69	1994152.63	Area 4 South
444	307304.38	1995178.75	Area 4 South
445	307302.47	1994638.25	Area 4 South
446	306553.31	1991190.25	Area 4 South
447	306647.44	1991653.00	Area 4 South
449	306049.97	1991268.38	Area 4 South
450	307111.16	1993659.00	Area 4 South
451	305471.75	1990926.38	Area 4 South
452	305601.81	1991375.88	Area 4 South
453	305234.47	1991414.00	Area 4 South
454	305291.84	1991785.75	Area 4 South
455	307346.16	1991095.13	Area 4 South
456	307406.47	1991519.63	Area 4 South
457	307489.72	1992089.13	Area 4 South
458	304778.81	1991677.50	Area 4 South
459	304665.53	1991229.13	Area 4 South
460	304605.44	1990912.63	Area 4 South
461	304196.81	1991074.50	Area 4 South
462	303767.19	1991263.63	Area 4 South
463	303223.69	1991523.25	Area 4 South
464	302817.25	1991714.75	Area 4 South
465	302755.63	1992149.63	Area 4 South
466	303256.38	1992245.50	Area 4 South
467	303342.69	1991966.00	Area 4 South
468	303650.09	1992312.50	Area 4 South
469	304094.19	1992394.75	Area 4 South
470	304494.72	1992474.50	Area 4 South
471	303723.59	1992093.00	Area 4 South
472	303821.09	1991749.38	Area 4 South
473	303853.78	1991509.25	Area 4 South

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
474	303588.41	1991222.25	Area 4 South
475	302706.81	1991220.75	Area 4 South
476	303145.28	1990977.13	Area 4 South
477	303646.56	1990750.00	Area 4 South
478	304023.50	1990608.75	Area 4 South
481	303120.97	1990328.50	Area 4 South
482	302941.75	1990329.00	Area 4 South
483	302785.59	1992470.13	Area 4 South
484	302584.53	1992969.38	Area 4 South
485	303754.22	1994103.25	Area 4 South
486	301905.28	1994899.00	Area 4 South
487	302049.03	1994306.00	Area 4 South
488	301518.50	1994303.75	Area 4 South
489	301206.66	1995061.88	Area 4 South
490	301009.50	1994475.25	Area 4 South
491	300698.31	1993995.88	Area 4 South
492	302211.31	1993625.25	Area 4 South
493	301833.06	1993721.25	Area 4 South
494	300166.44	1994351.13	Area 4 South
495	300525.56	1994931.13	Area 4 South
496	300830.13	1995061.13	Area 4 South
497	301930.47	1991669.50	Area 4 South
498	301436.72	1991829.75	Area 4 South
499	300839.31	1991939.25	Area 4 South
500	300144.88	1991936.25	Area 4 South
501	299517.44	1991895.75	Area 4 South
502	300060.22	1992303.00	Area 4 South
503	300936.03	1990641.38	Area 4 South
504	300595.53	1990554.25	Area 4 South
505	300363.19	1990980.13	Area 4 South
506	302193.22	1991122.63	Area 4 South
507	302406.38	1990753.75	Area 4 South
508	302465.94	1990460.75	Area 4 South
509	302071.13	1990301.50	Area 4 South
510	301624.50	1990372.38	Area 4 South
511	301670.81	1990568.13	Area 4 South
512	301425.63	1990789.75	Area 4 South
513	301093.81	1990600.25	Area 4 South
514	300823.22	1990854.38	Area 4 South
515	300672.03	1991125.88	Area 4 South
516	300388.22	1991372.00	Area 4 South
517	300073.38	1991306.88	Area 4 South
518	299845.56	1991424.75	Area 4 South
519	299649.41	1991549.75	Area 4 South
520	299280.53	1991590.50	Area 4 South

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
521	299163.44	1991703.50	Area 4 South
522	299164.63	1992263.88	Area 4 South
523	299533.09	1992551.88	Area 4 South
524	299987.31	1992681.38	Area 4 South
525	300498.69	1992445.38	Area 4 South
526	299859.78	1992962.63	Area 4 South
527	299778.16	1993461.50	Area 4 South
527	295430.28	2004502.37	Area 4 North
528	299573.03	1993657.13	Area 4 South
528	295444.56	2004747.38	Area 4 North
529	299565.56	1994100.75	Area 4 South
530	299031.84	1994139.38	Area 4 South
531	298618.69	1994175.50	Area 4 South
532	299386.97	1994572.00	Area 4 South
533	299516.25	1995150.00	Area 4 South
534	300088.16	1995085.38	Area 4 South
534	294345.72	2004442.88	Area 4 North
535	299653.34	1994821.38	Area 4 South
535	294340.59	2004632.50	Area 4 North
536	299776.78	1994209.00	Area 4 South
536	294356.31	2004935.50	Area 4 North
537	299852.47	1995395.88	Area 4 South
538	299192.97	1995247.25	Area 4 South
539	299649.97	1995693.25	Area 4 South
540	299113.09	1995550.63	Area 4 South
541	298377.59	1995427.00	Area 4 South
542	297982.03	1995316.25	Area 4 South
543	297573.28	1995278.00	Area 4 South
544	297236.89	1995286.13	Area 4 South
545	297065.75	1995619.75	Area 4 South
545	293704.06	2004910.63	Area 4 North
546	297042.78	1995916.75	Area 4 South
546	293739.66	2004651.88	Area 4 North
547	297269.44	1996145.00	Area 4 South
547	293707.31	2004464.50	Area 4 North
548	297780.88	1996377.63	Area 4 South
548	295036.69	2004631.50	Area 4 North
549	301453.69	1993894.63	Area 4 South
549	295070.84	2004859.75	Area 4 North
550	302098.41	1992413.25	Area 4 South
551	301841.72	1992699.88	Area 4 South
552	301595.47	1992530.50	Area 4 South
553	301307.78	1992849.25	Area 4 South
554	300983.88	1993145.50	Area 4 South
554	293338.19	2004452.38	Area 4 North

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
555	300498.56	1993545.50	Area 4 South
555	293342.59	2004715.50	Area 4 North
556	301176.94	1992731.38	Area 4 South
557	300808.94	1992863.50	Area 4 South
559	300729.13	1993552.38	Area 4 South
560	301174.88	1993531.63	Area 4 South
561	301564.63	1993262.38	Area 4 South
562	300993.66	1993753.38	Area 4 South
563	299433.56	1992054.38	Area 4 South
564	300457.00	1992139.38	Area 4 South
565	301063.44	1992236.25	Area 4 South
566	302565.69	1993558.25	Area 4 South
567	304336.81	1990462.50	Area 4 South
568	305049.13	1990782.25	Area 4 South
569	307598.16	1992692.75	Area 4 South
570	307690.56	1993277.38	Area 4 South
570	291660.09	2004122.63	Area 4 North
571	307641.56	1993912.38	Area 4 South
571	291632.75	2003869.75	Area 4 North
572	307559.13	1994664.75	Area 4 South
572	291601.94	2003482.75	Area 4 North
573	302583.16	1990044.63	Area 4 South
573	291572.13	2003236.37	Area 4 North
574	302297.13	1990046.13	Area 4 South
574	291487.84	2002718.25	Area 4 North
575	301901.16	1990052.88	Area 4 South
575	291062.84	2003410.25	Area 4 North
576	301614.66	1990036.75	Area 4 South
576	291173.66	2003659.13	Area 4 North
577	301294.44	1990076.00	Area 4 South
577	291194.09	2004064.62	Area 4 North
578	301176.72	1990061.50	Area 4 South
578	290507.09	2003591.87	Area 4 North
579	300963.00	1990035.88	Area 4 South
579	290468.50	2003306.13	Area 4 North
580	300766.50	1989674.75	Area 4 South
580	290480.44	2003090.37	Area 4 North
581	301303.53	1989678.25	Area 4 South
581	290377.81	2002731.50	Area 4 North
582	301694.97	1989707.00	Area 4 South
582	289974.41	2002678.50	Area 4 North
583	302487.25	1989706.25	Area 4 South
583	289969.47	2002963.13	Area 4 North
584	302545.34	1989333.75	Area 4 South
585	302224.59	1989252.25	Area 4 South

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
585	291938.91	2004026.25	Area 4 North
586	301823.03	1989236.38	Area 4 South
586	291905.87	2003744.37	Area 4 North
587	301440.56	1989223.13	Area 4 South
587	291897.56	2003360.87	Area 4 North
588	301033.38	1989104.13	Area 4 South
588	291873.81	2002980.88	Area 4 North
589	291798.72	2002623.75	Area 4 North
590	292273.12	2002813.25	Area 4 North
591	301798.63	1988770.13	Area 4 South
591	292415.16	2003294.00	Area 4 North
592	302139.06	1988817.13	Area 4 South
592	292442.28	2003587.87	Area 4 North
593	302369.84	1988854.88	Area 4 South
593	292511.25	2003855.50	Area 4 North
594	302410.88	1988964.88	Area 4 South
594	292540.13	2004113.38	Area 4 North
595	302219.28	1988467.00	Area 4 South
595	293301.78	2004192.00	Area 4 North
596	301817.25	1988520.63	Area 4 South
596	293264.53	2003885.12	Area 4 North
597	293229.97	2003600.75	Area 4 North
598	293179.59	2003342.50	Area 4 North
599	293186.06	2003064.37	Area 4 North
600	293693.19	2004311.50	Area 4 North
601	293712.00	2004079.37	Area 4 North
602	293667.03	2003808.50	Area 4 North
603	293648.13	2003615.13	Area 4 North
604	293630.50	2003324.13	Area 4 North
605	293602.12	2003066.62	Area 4 North
606	294380.00	2002964.63	Area 4 North
608	294403.03	2003520.12	Area 4 North
609	294342.28	2003692.12	Area 4 North
610	294347.44	2003992.63	Area 4 North
611	294327.44	2004267.88	Area 4 North
612	294945.69	2004357.37	Area 4 North
613	294882.25	2004023.25	Area 4 North
614	294853.63	2003803.38	Area 4 North
615	294855.47	2003574.75	Area 4 North
616	294819.41	2003359.87	Area 4 North
617	294799.25	2003201.50	Area 4 North
618	295317.03	2002611.38	Area 4 North
619	295306.13	2002832.00	Area 4 North
620	295277.41	2003215.37	Area 4 North
621	295764.91	2004512.12	Area 4 North

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
622	295840.16	2004821.75	Area 4 North
623	295806.34	2005054.62	Area 4 North
627	295743.91	2004376.25	Area 4 North
628	295755.62	2004129.63	Area 4 North
629	295710.03	2003913.25	Area 4 North
630	295654.28	2003672.13	Area 4 North
631	295645.41	2003416.00	Area 4 North
632	295710.41	2003140.00	Area 4 North
633	295772.66	2002965.50	Area 4 North
634	296276.16	2004952.00	Area 4 North
635	296247.81	2004766.63	Area 4 North
636	296230.37	2004501.62	Area 4 North
637	296218.75	2004348.62	Area 4 North
638	296271.78	2004211.75	Area 4 North
639	296206.81	2004012.62	Area 4 North
640	296229.84	2003809.38	Area 4 North
641	296277.03	2003562.00	Area 4 North
642	296215.72	2003312.75	Area 4 North
643	296226.28	2003044.62	Area 4 North
644	302960.13	1988453.75	Area 4 South
644	296464.03	2004450.63	Area 4 North
645	302646.97	1988487.25	Area 4 South
645	296485.91	2004641.50	Area 4 North
646	302718.22	1988771.50	Area 4 South
646	296518.22	2004821.38	Area 4 North
646	296709.37	2004837.12	Area 4 North
647	303057.16	1988727.00	Area 4 South
647	296711.44	2004364.00	Area 4 North
648	303431.69	1988675.00	Area 4 South
648	296715.47	2004574.50	Area 4 North
649	303820.69	1988623.38	Area 4 South
650	304194.09	1988570.75	Area 4 South
651	304554.28	1988524.38	Area 4 South
652	304951.16	1988469.25	Area 4 South
652	297001.25	2004885.25	Area 4 North
653	305150.00	1988553.50	Area 4 South
653	297029.50	2004577.00	Area 4 North
654	305124.09	1988957.38	Area 4 South
654	297015.75	2004402.50	Area 4 North
655	305016.44	1989240.88	Area 4 South
655	297301.75	2004397.12	Area 4 North
656	304693.13	1989242.13	Area 4 South
656	297295.06	2004647.75	Area 4 North
657	304476.06	1988940.75	Area 4 South
657	297286.69	2004805.38	Area 4 North

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
658	304263.13	1988893.00	Area 4 South
659	303905.06	1989079.38	Area 4 South
660	303534.00	1989173.63	Area 4 South
661	303189.63	1989230.88	Area 4 South
661	297674.75	2004873.87	Area 4 North
662	302853.44	1989272.38	Area 4 South
662	297703.34	2004610.63	Area 4 North
663	302834.69	1989881.25	Area 4 South
663	297689.91	2004414.63	Area 4 North
664	303093.81	1989821.38	Area 4 South
664	298252.84	2004464.00	Area 4 North
665	298243.38	2004678.62	Area 4 North
666	298244.06	2004907.25	Area 4 North
668	298634.00	2004483.00	Area 4 North
669	298623.59	2004700.75	Area 4 North
670	298635.97	2004890.75	Area 4 North
674	298626.72	2004305.50	Area 4 North
675	298252.97	2004275.00	Area 4 North
676	298271.84	2004119.75	Area 4 North
677	297762.56	2004295.63	Area 4 North
678	297804.72	2004181.87	Area 4 North
679	296462.25	2004345.62	Area 4 North
680	296466.16	2004195.00	Area 4 North
681	296480.91	2003953.88	Area 4 North
682	296749.25	2003924.63	Area 4 North
683	296752.03	2003760.50	Area 4 North
684	296716.28	2003520.12	Area 4 North
685	296708.62	2003291.63	Area 4 North
686	296689.37	2002983.13	Area 4 North
687	296726.37	2002773.75	Area 4 North
688	296748.66	2002535.62	Area 4 North
689	297214.84	2002556.50	Area 4 North
690	297195.31	2002828.75	Area 4 North
691	297175.16	2003219.00	Area 4 North
692	297154.91	2003461.75	Area 4 North
693	297064.72	2003915.50	Area 4 North
694	296996.06	2004101.00	Area 4 North
695	296983.63	2004251.13	Area 4 North
696	297317.31	2004201.50	Area 4 North
697	297308.75	2004055.50	Area 4 North
698	300255.22	2004212.00	Area 4 North
699	300125.75	2004352.37	Area 4 North
700	300059.81	2004501.37	Area 4 North
701	299985.03	2004672.37	Area 4 North
702	299859.78	2004913.75	Area 4 North

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
707	299398.66	2004970.25	Area 4 North
708	299467.19	2004768.75	Area 4 North
709	299538.86	2004608.28	Area 4 North
710	299640.55	2004504.38	Area 4 North
711	299764.66	2004348.62	Area 4 North
712	300473.81	2004633.25	Area 4 North
713	300386.63	2004814.38	Area 4 North
714	300231.97	2004999.87	Area 4 North
717	298977.16	2004426.38	Area 4 North
718	298986.22	2004574.75	Area 4 North
719	298994.41	2004736.87	Area 4 North
720	298987.16	2004979.50	Area 4 North
722	290012.97	2002550.25	Area 4 North
723	290430.56	2002487.00	Area 4 North
724	290715.47	2002472.63	Area 4 North
725	290785.91	2002323.13	Area 4 North
726	292358.44	2002509.00	Area 4 North
727	292339.91	2002230.00	Area 4 North
728	292285.97	2002034.38	Area 4 North
729	292175.25	2001523.38	Area 4 North
730	292146.22	2001311.50	Area 4 North
731	292079.50	2001076.75	Area 4 North
732	291996.34	2000852.25	Area 4 North
733	292002.72	2000766.25	Area 4 North
734	291924.22	2000557.13	Area 4 North
735	291859.31	2000368.00	Area 4 North
736	291791.66	2000140.37	Area 4 North
737	291736.69	1999938.62	Area 4 North
738	292832.50	2002441.87	Area 4 North
739	292779.94	2002156.63	Area 4 North
740	292728.97	2001954.88	Area 4 North
741	292680.28	2001793.63	Area 4 North
742	292603.03	2001552.62	Area 4 North
743	292606.81	2001249.50	Area 4 North
744	292554.69	2001027.75	Area 4 North
745	292520.66	2000816.88	Area 4 North
746	292407.03	2000457.00	Area 4 North
747	292359.06	2000255.75	Area 4 North
748	292226.13	1999782.87	Area 4 North
749	292794.84	1999666.63	Area 4 North
750	292833.88	1999878.00	Area 4 North
751	292871.06	2000108.87	Area 4 North
752	292970.34	2000491.38	Area 4 North
753	293058.56	2000792.87	Area 4 North
754	293117.09	2001002.50	Area 4 North

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
755	293104.37	2001180.25	Area 4 North
756	293152.34	2001449.00	Area 4 North
757	293257.72	2001709.37	Area 4 North
758	293283.34	2001863.75	Area 4 North
759	293340.69	2002116.00	Area 4 North
760	293411.84	2002343.13	Area 4 North
761	291062.56	2002478.88	Area 4 North
762	291133.37	2000731.87	Area 4 North
763	291236.56	2001030.25	Area 4 North
764	291320.09	2001241.25	Area 4 North
765	291412.19	2001526.75	Area 4 North
766	291759.41	2001755.62	Area 4 North
767	291747.94	2001555.62	Area 4 North
768	291699.50	2001289.37	Area 4 North
769	291706.31	2001056.75	Area 4 North
770	291648.37	2000793.50	Area 4 North
771	291590.87	2000583.75	Area 4 North
772	293815.06	2002018.88	Area 4 North
773	293819.31	2001782.25	Area 4 North
774	293810.06	2001540.75	Area 4 North
775	293768.53	2001328.50	Area 4 North
776	293703.34	2001168.88	Area 4 North
777	293621.00	2000983.75	Area 4 North
778	293554.91	2000763.12	Area 4 North
779	293499.91	2000488.88	Area 4 North
780	293306.66	2000047.00	Area 4 North
781	293282.28	1999790.50	Area 4 North
782	293224.87	1999526.38	Area 4 North
783	293197.91	1999327.38	Area 4 North
784	293655.16	1999282.87	Area 4 North
785	293625.06	1999476.75	Area 4 North
786	293888.41	2000622.37	Area 4 North
787	294065.34	1999166.75	Area 4 North
788	294095.53	1999330.63	Area 4 North
789	294143.72	1999558.88	Area 4 North
790	294129.00	1999943.12	Area 4 North
791	294131.59	2000163.13	Area 4 North
792	294163.25	2000388.50	Area 4 North
793	294205.62	2000646.88	Area 4 North
794	294229.37	2000889.75	Area 4 North
795	294316.88	2001161.88	Area 4 North
796	294317.69	2001343.38	Area 4 North
797	294326.09	2001605.87	Area 4 North
798	294360.63	2001881.37	Area 4 North
799	294385.69	2002031.25	Area 4 North

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
800	294372.28	2002315.88	Area 4 North
801	294613.16	2002020.75	Area 4 North
802	294847.56	2002075.25	Area 4 North
803	295023.03	2002064.62	Area 4 North
804	295191.66	2002081.00	Area 4 North
805	295108.88	2001767.37	Area 4 North
806	294975.38	2001770.75	Area 4 North
807	294792.59	2001735.00	Area 4 North
808	294605.19	2001680.13	Area 4 North
809	294759.53	2001451.62	Area 4 North
810	294719.28	2001210.75	Area 4 North
811	294685.44	2000959.87	Area 4 North
812	294658.13	2000779.00	Area 4 North
813	294572.56	2000562.50	Area 4 North
814	294556.22	2000379.50	Area 4 North
815	294441.97	2000208.63	Area 4 North
816	294319.19	1999827.88	Area 4 North
817	294252.91	1999652.75	Area 4 North
819	294174.69	1998937.00	Area 4 North
820	294455.28	1998808.62	Area 4 North
821	294405.19	1999002.00	Area 4 North
822	294455.75	1999148.75	Area 4 North
823	294532.22	1999415.75	Area 4 North
824	294612.34	1999706.88	Area 4 North
825	294819.56	2000146.25	Area 4 North
826	294903.41	2000398.75	Area 4 North
827	294960.97	2000614.50	Area 4 North
828	295036.37	2000873.63	Area 4 North
829	295124.69	2001122.12	Area 4 North
830	295345.22	2001400.25	Area 4 North
831	295286.28	2001544.25	Area 4 North
832	295359.41	2001835.88	Area 4 North
833	295384.97	2002120.25	Area 4 North
834	295571.56	2002337.63	Area 4 North
835	296133.84	2002366.00	Area 4 North
836	295981.50	2001978.88	Area 4 North
837	295931.81	2001676.50	Area 4 North
838	295861.19	2001456.37	Area 4 North
839	295830.69	2001247.00	Area 4 North
840	295652.94	2001011.63	Area 4 North
841	295585.69	2000839.50	Area 4 North
842	295554.97	2000602.12	Area 4 North
843	295528.62	2000352.13	Area 4 North
844	295417.16	2000151.38	Area 4 North
845	295330.94	1999707.75	Area 4 North

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
846	295261.37	1999356.50	Area 4 North
847	295217.94	1999160.25	Area 4 North
848	295164.41	1998952.00	Area 4 North
849	295138.28	1998797.12	Area 4 North
850	295099.59	1998566.25	Area 4 North
851	296478.47	2002239.75	Area 4 North
852	296437.84	2002015.88	Area 4 North
853	296373.78	2001735.75	Area 4 North
854	296285.94	2001483.13	Area 4 North
855	296152.91	2001273.50	Area 4 North
856	296220.53	2001012.88	Area 4 North
857	296136.41	2000793.87	Area 4 North
858	296077.06	2000541.25	Area 4 North
859	296047.69	2000281.75	Area 4 North
860	295992.97	2000113.62	Area 4 North
861	295898.56	1999855.13	Area 4 North
862	295855.75	1999604.25	Area 4 North
863	295790.31	1999409.63	Area 4 North
864	295730.84	1999206.00	Area 4 North
865	295673.91	1998943.75	Area 4 North
866	295635.34	1998797.37	Area 4 North
867	295557.84	1998524.38	Area 4 North
868	294702.28	1998803.50	Area 4 North
869	294766.28	1999077.13	Area 4 North
870	294821.84	1999292.87	Area 4 North
871	294897.62	1999535.00	Area 4 North
872	294944.84	1999769.75	Area 4 North
873	295065.66	2000226.13	Area 4 North
874	295985.59	1998755.13	Area 4 North
875	296093.13	1999102.62	Area 4 North
876	296316.69	1999384.25	Area 4 North
877	296394.56	1999776.37	Area 4 North
878	296459.13	2000060.50	Area 4 North
879	296752.28	2002281.00	Area 4 North
880	297015.28	2002274.25	Area 4 North
881	297196.87	2002285.63	Area 4 North
882	297376.31	2002271.87	Area 4 North
883	297599.75	2002259.50	Area 4 North
884	297828.19	2002249.00	Area 4 North
885	296532.97	2001688.13	Area 4 North
886	296716.56	2001630.50	Area 4 North
887	296954.09	2001564.37	Area 4 North
888	297141.78	2001515.63	Area 4 North
889	297370.31	2001446.62	Area 4 North
890	297576.88	2001385.25	Area 4 North

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
891	297774.38	2001312.50	Area 4 North
892	297700.19	2000737.75	Area 4 North
893	297543.53	2000785.75	Area 4 North
894	297316.34	2000904.25	Area 4 North
895	297101.41	2000984.75	Area 4 North
896	296872.34	2001047.25	Area 4 North
897	296694.91	2001128.37	Area 4 North
898	296470.84	2001192.88	Area 4 North
899	296345.19	2000830.00	Area 4 North
900	296613.72	2000758.75	Area 4 North
901	296916.78	2000692.25	Area 4 North
902	297074.50	2000651.25	Area 4 North
903	297311.47	2000576.25	Area 4 North
904	297501.66	2000531.00	Area 4 North
905	297716.41	2000490.00	Area 4 North
906	297938.97	2000430.12	Area 4 North
907	298157.59	2000372.63	Area 4 North
908	298116.03	2000019.25	Area 4 North
909	297874.34	2000069.37	Area 4 North
910	297675.12	2000110.12	Area 4 North
911	297456.94	2000156.13	Area 4 North
912	297248.84	2000216.50	Area 4 North
913	297283.69	1999850.63	Area 4 North
914	297518.25	1999784.62	Area 4 North
915	297697.72	1999710.88	Area 4 North
916	297894.44	1999670.13	Area 4 North
917	298072.16	1999627.37	Area 4 North
918	298365.84	1999578.50	Area 4 North
919	298453.91	1999171.25	Area 4 North
920	298237.78	1999229.75	Area 4 North
921	298031.69	1999286.00	Area 4 North
922	297873.91	1999320.62	Area 4 North
923	297658.37	1999386.00	Area 4 North
924	297421.25	1999445.12	Area 4 North
925	297211.16	1999504.50	Area 4 North
926	297248.00	1998860.50	Area 4 North
927	297460.34	1998768.12	Area 4 North
928	297687.56	1998656.00	Area 4 North
929	297883.87	1998558.25	Area 4 North
930	298053.19	1998459.62	Area 4 North
931	298259.03	1998437.75	Area 4 North
932	298472.37	1998342.88	Area 4 North
933	298624.91	1998274.87	Area 4 North
934	298827.09	1998159.50	Area 4 North
935	298659.87	1998751.25	Area 4 North

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
936	298428.03	1998778.25	Area 4 North
937	298193.91	1998834.88	Area 4 North
938	297974.69	1998877.25	Area 4 North
939	297739.16	1998942.37	Area 4 North
940	297539.12	1999010.13	Area 4 North
941	297321.47	1999062.63	Area 4 North
942	297492.59	1998456.75	Area 4 North
943	297698.72	1998266.37	Area 4 North
944	297932.63	1998177.25	Area 4 North
945	298105.91	1998148.12	Area 4 North
946	298320.37	1998071.25	Area 4 North
947	298583.09	1998029.00	Area 4 North
948	297542.50	1997756.13	Area 4 North
949	297595.28	1997516.25	Area 4 North
950	297633.56	1997420.00	Area 4 North
951	297338.56	1997285.37	Area 4 North
952	297037.59	1997364.25	Area 4 North
953	296870.94	1997482.87	Area 4 North
954	296663.84	1997610.87	Area 4 North
955	302308.06	1995131.88	Area 4 South
956	302080.41	1995194.75	Area 4 South
957	302214.53	1995691.00	Area 4 North
958	302305.44	1996174.25	Area 4 North
959	302061.88	1996247.38	Area 4 North
960	301892.56	1996334.12	Area 4 North
961	301650.97	1996404.63	Area 4 North
962	301664.56	1996549.38	Area 4 North
963	301529.13	1996667.25	Area 4 North
964	301332.91	1996719.88	Area 4 North
965	301087.31	1996744.50	Area 4 North
966	300709.66	1997102.75	Area 4 North
967	300931.50	1997056.50	Area 4 North
968	301150.91	1997019.62	Area 4 North
969	301362.72	1996972.87	Area 4 North
970	301603.56	1996926.38	Area 4 North
971	301857.56	1996843.25	Area 4 North
972	302049.25	1996788.62	Area 4 North
973	302283.75	1996710.75	Area 4 North
974	300717.38	1997626.87	Area 4 North
975	301004.44	1997547.88	Area 4 North
976	301226.03	1997526.00	Area 4 North
977	301407.75	1997472.62	Area 4 North
978	301616.94	1997416.38	Area 4 North
979	301840.47	1997343.12	Area 4 North
980	302031.34	1997306.12	Area 4 North

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
981	302250.09	1997253.25	Area 4 North
982	302266.00	1997792.25	Area 4 North
983	302040.63	1997834.12	Area 4 North
984	301840.78	1997875.75	Area 4 North
985	301694.19	1997932.38	Area 4 North
986	301475.28	1997972.62	Area 4 North
987	301301.41	1998052.88	Area 4 North
988	301126.31	1998114.25	Area 4 North
989	300930.22	1998178.37	Area 4 North
990	300808.47	1998539.88	Area 4 North
991	301093.31	1998486.37	Area 4 North
992	301363.56	1998381.13	Area 4 North
993	301572.09	1998354.38	Area 4 North
994	301857.22	1998280.87	Area 4 North
995	302050.91	1998224.38	Area 4 North
996	302215.25	1998143.12	Area 4 North
997	302410.72	1998111.62	Area 4 North
998	302286.91	1998742.50	Area 4 North
999	302071.69	1998797.75	Area 4 North
1000	301780.75	1998844.88	Area 4 North
1001	301565.16	1998958.12	Area 4 North
1002	301310.19	1998996.75	Area 4 North
1003	301082.91	1999046.75	Area 4 North
1004	300909.84	1999063.50	Area 4 North
1005	302289.22	1999368.13	Area 4 North
1006	302094.56	1999425.62	Area 4 North
1007	301916.62	1999456.62	Area 4 North
1008	301667.88	1999512.75	Area 4 North
1009	301523.16	1999559.75	Area 4 North
1010	301317.44	1999613.37	Area 4 North
1011	302570.25	1999791.87	Area 4 North
1012	302290.00	1999851.88	Area 4 North
1013	302089.09	1999890.00	Area 4 North
1014	302053.81	2000373.13	Area 4 North
1015	302248.94	2000357.50	Area 4 North
1016	302404.69	2000311.38	Area 4 North
1017	302291.34	2000893.25	Area 4 North
1018	302074.03	2000939.50	Area 4 North
1019	301848.44	2000961.87	Area 4 North
1020	301462.37	2001101.50	Area 4 North
1021	300791.97	2001705.75	Area 4 North
1022	301022.06	2001683.38	Area 4 North
1023	301217.25	2001629.25	Area 4 North
1024	301410.31	2001607.25	Area 4 North
1025	301668.59	2001551.00	Area 4 North

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
1026	301838.06	2001526.25	Area 4 North
1027	302019.50	2001496.25	Area 4 North
1028	302249.91	2001453.87	Area 4 North
1029	300658.47	2002230.37	Area 4 North
1030	300839.91	2002198.50	Area 4 North
1031	301102.59	2002135.75	Area 4 North
1032	302759.12	2001267.00	Area 4 North
1033	303007.41	2001259.87	Area 4 North
1034	302696.50	2000255.75	Area 4 North
1035	302918.28	2000204.00	Area 4 North
1036	303178.81	2000124.75	Area 4 North
1037	303372.41	2000061.25	Area 4 North
1038	302876.66	1999740.12	Area 4 North
1039	303096.84	1999681.88	Area 4 North
1040	306346.47	1995574.50	Area 4 North
1040	302658.69	1999269.75	Area 4 North
1041	302840.16	1999241.88	Area 4 North
1042	306829.25	1995352.00	Area 4 North
1042	303052.97	1999148.62	Area 4 North
1043	307056.97	1995340.62	Area 4 South
1043	303287.12	1999085.12	Area 4 North
1044	303470.63	1999012.25	Area 4 North
1045	303891.91	1998934.75	Area 4 North
1046	303941.06	1998850.88	Area 4 North
1047	304162.69	1998879.50	Area 4 North
1048	304332.22	1998813.12	Area 4 North
1049	304570.81	1998741.63	Area 4 North
1050	306376.53	1997687.00	Area 4 North
1051	306152.81	1997744.88	Area 4 North
1052	305947.63	1997800.00	Area 4 North
1053	305707.78	1997849.50	Area 4 North
1054	305513.78	1997922.13	Area 4 North
1055	305314.34	1997954.25	Area 4 North
1056	305612.97	1995401.00	Area 4 North
1056	305118.81	1998023.75	Area 4 North
1057	304872.31	1998102.87	Area 4 North
1058	304710.62	1998200.50	Area 4 North
1060	304318.31	1998317.12	Area 4 North
1061	304175.22	1998375.63	Area 4 North
1062	303884.91	1998431.62	Area 4 North
1063	303654.38	1998459.62	Area 4 North
1064	303402.22	1998526.75	Area 4 North
1065	303223.94	1998617.62	Area 4 North
1066	303062.41	1998590.38	Area 4 North
1067	302829.03	1998680.75	Area 4 North

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
1068	302672.38	1998686.50	Area 4 North
1069	303133.09	1998002.87	Area 4 North
1070	303305.28	1997949.12	Area 4 North
1071	303549.03	1997892.50	Area 4 North
1072	303785.28	1997837.62	Area 4 North
1073	303947.53	1997793.37	Area 4 North
1074	304145.38	1997750.75	Area 4 North
1075	304412.72	1997653.00	Area 4 North
1076	304650.66	1997616.00	Area 4 North
1077	304853.28	1997554.38	Area 4 North
1078	305029.78	1997528.00	Area 4 North
1079	305189.66	1997495.25	Area 4 North
1080	305543.69	1997496.50	Area 4 North
1081	305366.12	1997423.50	Area 4 North
1082	305646.63	1997383.00	Area 4 North
1083	307170.84	1996551.75	Area 4 North
1084	306893.50	1996605.13	Area 4 North
1085	306622.88	1996676.00	Area 4 North
1086	306351.16	1996739.38	Area 4 North
1087	306146.84	1996785.50	Area 4 North
1088	302729.19	1997653.87	Area 4 North
1089	302946.47	1997649.12	Area 4 North
1090	303187.16	1997586.13	Area 4 North
1091	303369.78	1997527.13	Area 4 North
1092	303611.22	1997444.12	Area 4 North
1093	303835.53	1997395.25	Area 4 North
1094	304105.22	1997330.00	Area 4 North
1095	304145.00	1997257.00	Area 4 North
1096	304472.59	1997221.63	Area 4 North
1097	304706.44	1997174.62	Area 4 North
1098	304865.19	1997131.50	Area 4 North
1099	305139.28	1997055.63	Area 4 North
1100	305296.00	1997008.37	Area 4 North
1101	305510.94	1996925.13	Area 4 North
1102	305728.44	1996897.38	Area 4 North
1103	305894.03	1996837.62	Area 4 North
1104	307115.28	1995911.13	Area 4 North
1105	306892.47	1996005.50	Area 4 North
1106	306663.28	1996066.38	Area 4 North
1107	306402.78	1996146.12	Area 4 North
1108	306096.56	1996260.88	Area 4 North
1109	305958.41	1996311.25	Area 4 North
1110	305716.12	1996364.37	Area 4 North
1111	305518.34	1996410.88	Area 4 North
1112	305265.25	1996485.00	Area 4 North

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
1113	305054.16	1996551.75	Area 4 North
1114	304865.37	1996595.75	Area 4 North
1115	304582.87	1996681.75	Area 4 North
1116	304276.16	1996703.00	Area 4 North
1117	304104.28	1996737.75	Area 4 North
1118	303840.78	1996820.00	Area 4 North
1119	303602.44	1996868.13	Area 4 North
1120	303385.00	1996949.88	Area 4 North
1121	303164.19	1996997.62	Area 4 North
1122	302913.56	1997064.75	Area 4 North
1123	302712.66	1997102.38	Area 4 North
1124	302729.53	1996582.50	Area 4 North
1125	303009.09	1996505.12	Area 4 North
1126	303166.38	1996464.53	Area 4 North
1127	303381.66	1996368.25	Area 4 North
1128	303546.03	1996287.50	Area 4 North
1129	303800.69	1996222.38	Area 4 North
1130	304085.97	1996115.88	Area 4 North
1131	304310.28	1996113.00	Area 4 North
1132	304563.06	1996060.25	Area 4 North
1133	304762.81	1996007.75	Area 4 North
1134	305004.88	1995935.63	Area 4 North
1135	305257.75	1995889.50	Area 4 North
1136	305426.03	1995846.75	Area 4 North
1137	305602.56	1995825.37	Area 4 North
1138	305845.72	1995712.75	Area 4 North
1139	306050.06	1995670.62	Area 4 North
1141	306561.59	1995512.75	Area 4 North
1144	302692.28	1996106.25	Area 4 North
1145	302915.97	1996000.87	Area 4 North
1146	303183.28	1995949.13	Area 4 North
1147	303462.22	1995903.63	Area 4 North
1148	303664.75	1995879.00	Area 4 North
1149	303851.59	1995840.00	Area 4 North
1150	304120.94	1995787.13	Area 4 North
1151	304355.53	1995719.25	Area 4 North
1152	304647.81	1995658.62	Area 4 North
1153	304891.25	1995617.50	Area 4 North
1154	305149.84	1995545.37	Area 4 North
1155	305427.66	1995488.87	Area 4 North
1157	303940.97	1995310.87	Area 4 South
1158	303706.41	1995383.37	Area 4 North
1159	303382.41	1995426.25	Area 4 North
1159	304515.72	1998237.00	Area 4 North
1160	303151.88	1995455.25	Area 4 North

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
1161	302890.19	1995522.50	Area 4 North
1162	302706.41	1995566.88	Area 4 North
1163	300921.75	1996256.00	Area 4 North
1164	300073.34	1995831.75	Area 4 North
1165	299821.03	1995790.50	Area 4 North
1166	299900.53	1996973.50	Area 4 North
1167	299760.34	1997113.38	Area 4 North
1168	299192.62	1997033.50	Area 4 North
1169	298395.19	1996734.75	Area 4 North
1170	298584.81	1997041.00	Area 4 North
1171	298869.44	1997197.38	Area 4 North
1172	307692.00	1997045.88	Area 4 North
1173	307959.69	1997116.00	Area 4 North
1174	308151.34	1997150.87	Area 4 North
1175	308648.53	1997238.00	Area 4 North
1176	309185.91	1997334.75	Area 4 North
1177	309454.81	1997380.88	Area 4 North
1178	309161.41	1998027.63	Area 4 North
1179	308692.91	1997908.13	Area 4 North
1180	308313.97	1997782.75	Area 4 North
1181	308136.63	1997545.38	Area 4 North
1182	307947.00	1997357.65	Area 4 North
1183	310061.16	1996458.87	Area 4 North
1184	309779.63	1996952.12	Area 4 North
1185	309686.16	1997382.38	Area 4 North
1186	307990.00	1999663.63	Area 4 North
1187	307677.66	1999631.00	Area 4 North
1188	307365.25	1999635.37	Area 4 North
1189	307050.09	1999619.25	Area 4 North
1190	306750.28	1999586.37	Area 4 North
1191	306485.16	1999565.75	Area 4 North
1192	306221.03	1999544.63	Area 4 North
1193	305985.03	1999530.63	Area 4 North
1194	306164.94	1999359.75	Area 4 North
1195	306027.44	1999056.00	Area 4 North
1196	305979.34	1998780.62	Area 4 North
1197	305854.06	1998587.63	Area 4 North
1198	305063.28	1998532.50	Area 4 North
1199	304922.22	1998638.50	Area 4 North
1200	304575.00	1998665.12	Area 4 North
1204	305248.16	2004322.25	Area 4 North
1205	304898.78	2003692.37	Area 4 North
1206	305807.28	2004303.75	Area 4 North
1207	308194.41	2003756.63	Area 4 North
1219	304286.66	2004637.25	Area 4 North

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
1220	304036.81	2004549.50	Area 4 North
1221	303828.34	2003616.75	Area 4 North
1222	304268.87	2003513.62	Area 4 North
1223	304683.19	2003348.87	Area 4 North
1224	304370.00	2004016.25	Area 4 North
1225	308119.72	2000565.87	Area 4 North
1226	308087.09	2000782.12	Area 4 North
1227	308207.62	2001131.12	Area 4 North
1228	308203.25	2001592.87	Area 4 North
1229	308575.78	2000821.75	Area 4 North
1230	308543.44	2000661.63	Area 4 North
1231	308991.41	2000820.75	Area 4 North
1232	309048.28	2000577.75	Area 4 North
1233	309553.59	2000941.50	Area 4 North
1234	309587.63	2000759.75	Area 4 North
1235	309606.34	2000461.62	Area 4 North
1236	310130.09	2000725.75	Area 4 North
1237	309186.84	2002319.75	Area 4 North
1238	309650.97	2002358.63	Area 4 North
1239	310068.66	2002361.13	Area 4 North
1240	310539.13	2002383.00	Area 4 North
1241	310362.81	2001974.13	Area 4 North
1242	310131.72	2002044.62	Area 4 North
1243	309905.59	2002064.50	Area 4 North
1244	309720.41	2002118.00	Area 4 North
1245	308849.06	2002430.37	Area 4 North
1246	308640.53	2002412.25	Area 4 North
1247	308443.03	2002396.37	Area 4 North
1248	308266.41	2002407.25	Area 4 North
1249	306758.75	2002330.88	Area 4 North
1250	306888.09	2001985.63	Area 4 North
1251	307656.53	2000791.87	Area 4 North
1729	295329.69	2003457.63	Area 4 North
1730	295327.50	2003709.25	Area 4 North
1731	295350.09	2003997.63	Area 4 North
1732	295366.50	2004259.63	Area 4 North
1736	291478.22	2002236.75	Area 4 North
1737	291044.78	2003183.63	Area 4 North
1738	294760.94	2002988.63	Area 4 North
1739	294746.37	2002813.25	Area 4 North
1740	294736.50	2002618.75	Area 4 North
1748	295822.38	2002742.25	Area 4 North
1749	296218.59	2002800.88	Area 4 North
1750	296485.47	2003830.63	Area 4 North
1751	296760.13	2004060.00	Area 4 North

Table 14.2-1 (Continued)

Sample Site	Easting	Northing	Resource Area
1754	297411.69	1997495.37	Area 4 North
1756	307426.22	2003252.50	Area 4 North
1757	306681.87	2002710.00	Area 4 North
1759	300861.97	1995478.50	Area 4 North
1760	301027.97	1995840.00	Area 4 North
1761	300997.66	1996090.88	Area 4 North
1762	308232.97	2001950.37	Area 4 North
1795	302440.72	2001475.63	Area 4 North
1796	303577.62	2000024.50	Area 4 North
1799	292278.87	2000018.88	Area 4 North
1800	294759.25	1999928.62	Area 4 North
1801	295382.87	1999922.75	Area 4 North
1802	298375.81	1999915.62	Area 4 North
1803	302555.09	1995599.25	Area 4 North
1804	302427.66	1996100.50	Area 4 North
1805	302564.94	1996663.12	Area 4 North
1806	302448.66	1997199.75	Area 4 North
1807	302551.72	1997691.00	Area 4 North
1808	302425.75	1998699.25	Area 4 North
1809	302443.91	1999325.75	Area 4 North
1810	302431.22	1995063.88	Area 4 South
6007	294364.28	2003212.25	Area 4 North
199-A	298567.34	1994574.50	Area 4 South
659-A	304209.59	1989078.25	Area 4 South
DH-K	298813.34	1993031.63	Area 4 South

Table 14.2-2 Hydrologic Group and Family Classification of Each Soil Series Identified in the Pinabete Mine Plan Permit Area

Series	Taxonomic Classification of Soils	Hydrologic Group
Bacobi	Fine-loamy, mixed, superactive, mesic Typic Haplargids	C
Badlands	Miscellaneous land type	D
Beebe	Sandy, mixed, mesic Typic Torrifluvents	A
Doak	Fine-loamy, mixed, active, mesic Typic Haplargids	B
Farb	Loamy, mixed, calcareous, mesic Lithic Torriorthents	D
Fruitland	Coarse-loamy, mixed, superactive, calcareous, mesic Typic Torriorthents	B
Grieta	Fine-loamy, mixed, superactive, mesic Typic Calciargids	B
Jocity	Fine-loamy, mixed, superactive, calcareous, mesic Typic Torrifluvents	B
Mack	Fine-loamy, mixed, superactive, mesic Typic Calciargids	B
Mayqueen	Coarse-loamy, mixed, superactive, mesic Typic Haplargids	B
Monierco	Loamy, mixed, superactive, mesic, shallow Typic Haplargids	D
Nakai	Coarse-loamy, mixed, superactive, mesic Typic Haplocalcid	B
Natric	Miscellaneous land type	D
Persayo	Loamy, mixed, active, calcareous, mesic, shallow Typic Torriorthents	D
Razito	Sandy, mixed, mesic Typic Torripsamments	A
Rock Outcrop	Miscellaneous land type	D
Shiprock	Coarse-loamy, mixed, superactive, mesic Typic Haplargids	B
Stumble	Mixed, mesic Typic Torripsamments	A
Trail	Sandy, mixed, mesic Typic Torrifluvent	A

Table 14.2-3 Pinabete Mine Plan Permit Area Laboratory Analysis Results

Lab ID	Soil series	Sample site	Soil horizon	Sample depth	pH s.u.	EC mmhos/cm	Saturation %	Ca meq/l	Mg meq/l	Na meq/l	Sar	Sand %	Silt %	Clay %	Texture USDA	$CaCO_3$ %	Sulfur total %	NP t/kt	ABP total S t/kt	SO4 %	Organic sulfur %	Pyritic sulfur %	AB pry. S t/kt	ABP pry. S t/kt	Boron sol. mg/kg	Se total mg/kg	Se sol. mg/kg
N/A	Avalon	#546	A	0-6	8.1	0.38	-	3.16	0.71	5.95	4.3	80	8	12	SL	1.7	-	-	-	-	-	-	-	-	-	-	-
N/A	Avalon	#546	Bw	6-14	8.2	0.26	-	1.85	0.48	0.50	0.5	72	12	16	SL	4.5	-	-	-	-	-	-	-	-	-	-	-
N/A	Avalon	#546	Bk1	14-23	8.0	0.28	-	1.54	0.62	0.92	0.9	65	15	20	SL	7.8	-	-	-	-	-	-	-	-	-	-	-
N/A	Avalon	#546	Bk2	23-45	8.3	0.69	-	1.03	0.51	5.24	5.8	62	17	21	SCL	20.0	-	-	-	-	-	-	-	-	-	-	-
0398S01646	Bacobi	#428	2Btb	12-21	8.1	0.76	36	1.7	0.63	6.20	6.0	68	12	20	SCL	3.7	0.01	32	31.3	.	.	.	.	.	0.3	<0.15	<0.015
0398S01669	Bacobi	#464	Bt	11-20	8.3	1.61	34	1.9	0.58	16.00	14.0	76	11	13	SL	2.6	0.01	20	20.2	.	.	.	.	.	0.4	<0.15	<0.015
N/A	Bacobi	#863	A	0-4	7.2	0.89	-	5.18	1.72	0.87	0.5	82	7	11	LS	1.2	-	-	-	-	-	-	-	-	-	-	-
N/A	Bacobi	#863	Bt	4-14	7.7	0.54	-	1.97	0.5	2.90	2.6	80	7	13	SL	2.1	-	-	-	-	-	-	-	-	-	-	-
N/A	Bacobi	#863	Btk	14-32	7.9	0.64	-	1.35	0.44	4.70	5.0	56	15	29	SCL	4.2	-	-	-	-	-	-	-	-	-	-	-
N/A	Bacobi	#863	Btk2	32-37	7.8	1.20	-	2.58	1.05	8.85	6.6	38	26	36	CL	18.1	-	-	-	-	-	-	-	-	-	-	-
0398S02023	Beebe Variant	#521	C3	28-60	7.0	0.50	23	1.2	0.18	4.50	5.0	92	2	6	S	2.6	0.03	14	12.9	.	.	.	.	.	<0.50	<0.15	<0.015
0398S02031	Beebe Variant	#525	C1	0-33	7.2	0.55	22	2.3	0.38	3.60	3.0	89	3	8	LS	3.9	0.06	34	32.0	.	.	.	.	.	<0.50	0.35	<0.015
0398S02032	Beebe Variant	#525	C2	33-60	7.3	0.86	30	2.9	0.56	7.90	6.0	71	16	13	SL	3.1	0.03	29	28.3	.	.	.	.	.	0.2	0.35	<0.015
0398S02033	Beebe Variant	#526	A	0-4	7.4	0.27	31	1.5	0.15	1.20	1.0	78	14	8	SL	1.4	0.01	13	13.0	.	.	.	.	.	<0.50	<0.15	<0.015
0398S02034	Beebe Variant	#526	C1	4-29	7.7	0.41	26	0.84	0.08	4.10	6.0	90	4	6	S	1.1	0.02	11	10.0	.	.	.	.	.	<0.50	<0.15	<0.015
0398S02035	Beebe Variant	#526	C2	29-40	7.6	0.59	27	1.1	0.12	6.20	8.0	86	7	7	LS	1.3	0.02	13	12.4	.	.	.	.	.	<0.50	<0.15	<0.015
0398S02036	Beebe Variant	#526	C3	40-60	7.6	1.03	27	1.8	0.22	11.00	11.0	92	3	5	S	1.4	0.02	13	11.9	.	.	.	.	.	<0.50	<0.15	<0.015
0398S02044	Beebe Variant	#533	A	0-4	8.0	1.45	30	1.3	0.15	17.00	20.0	67	18	15	SL	3.0	0.02	27	26.5	.	.	.	.	.	0.3	<0.15	<0.015
0398S02045	Beebe Variant	#533	C1	4-26	7.9	10.40	48	15	3.10	88.00	30.0	57	24	19	SL	2.2	0.09	21	17.7	.	.	.	.	.	0.3	0.40	0.220
0398S02046	Beebe Variant	#533	2Byb	26-37	8.3	15.70	32	19	11.00	130.00	33.0	77	11	12	SL	1.9	0.14	16	11.5	.	.	.	.	.	0.3	0.30	0.100
0398S02047	Beebe Variant	#533	2Cy	37-60	8.4	23.10	36	19	24.00	220.00	47.0	67	16	17	SL	3.0	0.20	26	19.5	.	.	.	.	.	0.4	0.30	0.150
0398S02167	Beebe Variant	#541	A	0-5	7.5	0.71	48	2.9	0.52	5.90	5.0	42	26	32	CL	2.6	0.02	25	24.0	.	.	.	.	.	0.2	<0.15	<0.015
0398S02168	Beebe Variant	#541	Bw	5-10	7.5	0.52	30	1.6	0.25	3.70	4.0	76	12	12	SL	1.8	0.02	17	16.3	.	.	.	.	.	<0.50	<0.15	<0.015
0398S02169	Beebe Variant	#541	C1	10-28	7.5	0.37	29	1.5	0.22	2.40	3.0	88	4	8	LS	1.5	0.02	13	11.9	.	.	.	.	.	<0.50	<0.15	<0.015
0398S02170	Beebe Variant	#541	C2	28-63	7.8	0.67	29	1.5	1.60	6.70	5.0	86	6	8	LS	1.4	0.01	14	13.3	.	.	.	.	.	<0.50	<0.15	<0.015
0398S02177	Beebe Variant	#550	A	0-4	7.5	1.22	29	4.8	0.26	7.80	5.0	64	16	20	SCL	3.8	0.02	35	34.8	.	.	.	.	.	0.3	0.60	<0.015
0398S02178	Beebe Variant	#550	C1	4-30	8.4	0.80	28	1.2	0.74	9.50	10.0	88	4	8	LS	3.4	0.03	29	27.8	.	.	.	.	.	<0.50	<0.15	<0.015
0398S02179	Beebe Variant	#550	C2	30-60	8.2	2.11	36	0.55	0.33	21.00	32.0	88	4	8	LS	1.7	0.02	17	16.0	.	.	.	.	.	0.2	0.25	0.160
0398S04441	Beebe Variant	#582	C1	0-40	7.7	8.44	26	21	3.20	93.00	27.0	84	6	10	LS	2.4	0.16	26	20.8	.	.	.	.	.	0.8	<0.15	<0.015
0398S04442	Beebe Variant	#582	C2	40-68	8.0	7.06	44	8.6	5.00	84.00	32.0	84	5	11	LS	2.9	0.11	30	26.1	.	.	.	.	.	0.4	0.25	0.070
0398S01673	Benally	#466	3C	22-60	8.4	2.75	45	1.7	0.38	29.00	28.0	78	9	13	SL	4.9	0.04	53	51.9	.	.	.	.	.	0.5	<0.15	0.060
0398S01732	Benally	#473	Btn	0-8	8.0	1.92	44	0.98	0.14	25.00	33.0	60	13	27	SCL	5.4	0.02	52	51.0	.	.	.	.	.	0.8	0.35	<0.015
0398S01733	Benally	#473	Btkyn	8-20	7.7	10.40	58	19	1.80	100.00	32.0	38	23	39	CL	2.9	0.84	29	2.7	.	.	.	.	.	0.9	0.70	0.100
0398S01734	Benally	#473	Cdy	20-60	7.8	5.31	84	7	0.85	67.00	34.0	29	22	49	C	4.7	0.13	48	43.7	.	.	.	.	.	0.8	<0.15	0.030
0398S02162	Benally	#537	Btnb	13-33	7.4	9.58	39	18	3.70	70.00	21.0	58	17	25	SCL	4.8	0.10	47	43.6	.	.	.	.	.	0.3	0.30	<0.015
0398S02163	Benally	#537	Bkyb	33-45	7.6	11.90	52	26	5.30	94.00	24.0	38	26	36	CL	6.0	0.26	61	52.9	.	.	.	.	.	0.5	0.65	0.310
0398S02164	Benally	#537	2Cy	45-60	8.2	18.40	42	18	7.80	160.00	45.0	60	16	24	SCL	5.0	0.26	47	39.0	.	.	.	.	.	0.5	0.35	0.040
0398S04452	Benally	#594	Btkn	0-10	8.2	2.77	31	5.3	0.49	31.00	18.0	75	6	19	SL	11.0	0.02	109	108.2	.	.	.	.	.	0.5	0.35	<0.015
0398S04537	Benally	#658	Btn	0-17	8.1	2.12	30	1.5	0.10	27.00	30.0	68	8	24	SCL	2.7	0.02	29	28.5	.	.	.	.	.	0.7	<0.15	<0.015

Table 14.2-3 (Continued)

Lab ID	Soil series	Sample site	Soil horizon	Sample depth	pH s.u.	EC mmhos/cm	Saturation %	Ca meq/l	Mg meq/l	Na meq/l	Sar	Sand %	Silt %	Clay %	Texture USDA	$CaCO_3$ %	Sulfur total %	NP t/kt	ABP total S t/kt	SO4 %	Organic sulfur %	Pyritic sulfur %	AB pry. S t/kt	ABP pry. S t/kt	Boron sol. mg/kg	Se total mg/kg	Se sol. mg/kg
0398S04538	Benally	#658	Btkn	17-28	7.7	13.30	32	24	4.10	120.00	33.0	72	6	22	SCL	4.3	0.06	39	37.1	.	.	.	.	.	1.2	0.35	<0.015
0398S04539	Benally	#658	2C	28-50	8.0	8.13	26	13	2.40	68.00	24.0	90	2	8	S	1.5	0.03	13	12.3	.	.	.	.	.	0.8	0.25	<0.015
0398S04540	Benally	#658	2Ck	50-60	8.4	5.30	40	2.8	0.65	57.00	44.0	84	6	10	LS	4.1	0.03	32	30.8	.	.	.	.	.	0.6	<0.15	<0.015
N/A	Blancot	- No Sample Taken -																									
0398S02041	Doak	#531	A	0-5	7.6	1.04	33	4.5	0.90	4.70	3.0	63	18	19	SL	5.9	0.03	51	50.4	.	.	.	.	.	0.4	0.25	<0.015
0398S02042	Doak	#531	Bt	5-21	7.4	3.18	41	21	2.50	22.00	6.0	48	26	26	SCL	5.5	0.08	56	53.9	.	.	.	.	.	1.1	0.55	<0.015
0398S02043	Doak	#531	Bky	21-42	7.3	7.20	43	54	6.50	40.00	7.0	38	32	30	CL	3.7	0.12	36	31.9	.	.	.	.	.	0.5	0.35	0.040
0398S02048	Doak	#534	A	0-4	8.1	4.01	37	3.1	0.81	21.00	15.0	59	23	18	SL	4.6	0.03	42	40.7	.	.	.	.	.	1.0	<0.15	<0.015
0398S02049	Doak	#534	Bt	4-23	7.4	5.01	40	22	3.70	26.00	7.0	46	31	23	L	6.1	0.03	60	58.6	.	.	.	.	.	0.4	0.35	<0.015
0398S02050	Doak	#534	C	23-60	7.5	5.21	35	14	3.20	35.00	12.0	57	22	21	SCL	6.1	0.03	60	59.1	.	.	.	.	.	0.4	0.35	0.040
N/A	Fajada	#1051	C	0-12	7.8	0.32	28	1.53	0.17	1.40	1.5	84	3	13	S	1.4	-	-	-	-	-	-	-	-	-	-	-
N/A	Fajada	#907	A	0-4	7.2	0.76	27	4.28	1.2	1.08	0.7	78	11	11	SL	1.4	-	-	-	-	-	-	-	-	-	-	-
N/A	Fajada	#907	Bw	4-18	7.5	0.44	28	1.85	0.5	1.60	1.5	83	6	11	SL	2.4	-	-	-	-	-	-	-	-	-	-	-
N/A	Farb	- No Sample Taken -																									
0398S00785	Fruitland	#199	AB	0-13	7.6	0.53	29	1.9	0.36	1.50	1.0	75	10	15	SL	3.5	0.02	32	30.9	.	.	.	.	.	<0.50	<0.15	<0.015
0398S00786	Fruitland	#199	C	13-64	7.2	4.44	31	26	3.90	18.00	5.0	75	7	18	SL	3.8	0.02	33	32.3	.	.	.	.	.	<0.50	<0.15	<0.015
0398S00952	Fruitland	#200	A	0-10	7.5	2.54	29	11	1.0	16	6.7	70	17	13	SL	3.0	0.02	27	26.6	.	.	.	.	.	<0.50	<0.15	<0.015
0398S00953	Fruitland	#200	Btk	10-29	7.5	0.58	43	2.4	0.13	3.1	2.7	55	22	23	SCL	1.7	0.03	16	15.2	.	.	.	.	.	<0.50	<0.15	<0.015
0398S00954	Fruitland	#200	Bk	29-60	7.6	1.15	25	1.9	0.10	8.6	8.6	90	5	5	S	1.4	0.02	13	12.1	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01458	Fruitland	#410	Btn	0-5	8.3	0.93	48	2.9	1.30	9.90	7.0	82	4	14	SL	5.3	0.01	49	48.9	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01459	Fruitland	#410	2Bk	5-29	8.3	5.64	34	3.4	1.20	57.00	38.0	91	1	8	S	2.3	0.03	15	14.4	.	.	.	.	.	0.3	0.25	0.080
0398S01460	Fruitland	#410	2Ck	29-34	8.4	7.11	46	3.5	2.50	77.00	45.0	93	1	6	S	2.9	0.06	23	21.2	.	.	.	.	.	0.5	0.25	0.080
0398S01462	Fruitland	#413	A	0-8	7.5	0.41	24	2.6	0.27	0.60	1.0	96	1	3	S	1.3	0.01	11	10.2	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01463	Fruitland	#413	C	8-26	7.5	0.29	27	1.3	0.32	1.50	2.0	78	7	15	SL	1.3	0.01	11	10.7	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01464	Fruitland	#413	Btkb	26-50	8.4	1.00	30	1.3	0.57	10.00	10.0	86	4	10	LS	2.9	0.01	24	23.6	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01465	Fruitland	#413	2Btnb	50-60	8.2	2.65	47	1.5	0.50	31.00	31.0	61	19	20	SCL	6.9	0.03	65	64.0	.	.	.	.	.	<0.50	<0.15	<0.015
0398S02012	Fruitland	#507	2Ck	39-60	7.7	7.52	46	14	6.30	5.30	2.0	67	18	15	SL	2.6	0.07	26	23.4	.	.	.	.	.	1.0	<0.15	0.060
0398S04447	Fruitland	#586	C1	0-19	7.8	1.16	26	1.7	0.26	14.00	14.0	81	6	13	SL	2.7	0.03	29	28.0	.	.	.	.	.	0.3	<0.15	<0.015
0398S04448	Fruitland	#586	C2	19-42	8.0	10.00	40	19	4.50	97.00	28.0	88	5	7	LS	2.1	0.17	22	16.8	.	.	.	.	.	1.5	<0.15	0.040
0398S04449	Fruitland	#586	C3	42-60	8.1	7.95	34	12	4.80	90.00	31.0	90	4	6	S	2.6	0.12	27	23.1	.	.	.	.	.	0.4	<0.15	0.130
0398S04516	Fruitland	#595	Ck	10-35	7.9	1.96	23	1.7	0.20	17.00	18.0	85	5	10	LS	5.4	0.04	51	49.4	.	.	.	.	.	<0.50	<0.15	<0.015
0398S04517	Fruitland	#595	C	35-60	8.2	2.36	25	0.95	0.25	22.00	28.0	94	2	4	S	2.6	0.04	26	24.7	.	.	.	.	.	0.3	<0.15	<0.015
0398S04610	Fruitland	#634	2Btk	8-19	7.8	0.55	22	1.8	0.21	4.30	4.3	76	6	18	SL	10.0	0.02	98	97.1	.	.	.	.	.	0.2	<0.15	<0.015
0398S04611	Fruitland	#636	C	0-15	7.6	0.37	21	1.8	0.15	1.80	1.8	82	6	12	SL	3.0	0.01	30	30.1	.	.	.	.	.	<0.50	<0.15	<0.015
0398S04612	Fruitland	#636	Ck	15-23	7.9	0.92	26	0.86	0.15	7.80	11.0	78	8	14	SL	4.6	0.02	47	46.4	.	.	.	.	.	0.2	<0.15	<0.015
0398S04613	Fruitland	#636	C	23-60	8.3	0.69	23	0.44	0.34	6.10	9.8	89	2	9	LS	2.1	0.03	21	20.2	.	.	.	.	.	<0.50	<0.15	<0.015
0398S04547	Fruitland	#663	Bw	3-18	7.9	0.51	21	0.7	0.05	3.30	5.4	86	4	10	LS	3.3	0.01	25	24.5	.	.	.	.	.	<0.50	<0.15	<0.015
0398S04548	Fruitland	#663	Ck	18-37	7.6	5.77	30	16	1.55	56.00	19.0	76	6	18	SL	6.1	0.07	60	57.9	.	.	.	.	.	0.6	0.30	<0.015
0398S04549	Fruitland	#663	C	37-60	7.7	5.35	23	13	1.45	51.00	19.0	92	3	5	S	3.2	0.06	27	24.7	.	.	.	.	.	0.3	<0.15	<0.015

Table 14.2-3 (Continued)

Lab ID	Soil series	Sample site	Soil horizon	Sample depth	pH s.u.	EC mmhos/cm	Saturation %	Ca meq/l	Mg meq/l	Na meq/l	Sar	Sand %	Silt %	Clay %	Texture USDA	$CaCO_3$ %	Sulfur total %	NP t/kt	ABP total S t/kt	SO4 %	Organic sulfur %	Pyritic sulfur %	AB pry. S t/kt	ABP pry. S t/kt	Boron sol. mg/kg	Se total mg/kg	Se sol. mg/kg
N/A	Gilco	#1224	A	0-5	8.1	0.68	-	2.6	0.38	3.45	2.8	67	14	19	SL	2.3	-	-	-	-	-	-	-	-	-	-	-
N/A	Gilco	#1224	C1	5-30	7.8	6.00	-	19.34	3.24	45.87	13.7	74	8	18	SL	2.5	-	-	-	-	-	-	-	-	-	-	-
N/A	Gilco	#1224	C2	30-75	8.0	8.00	-	12.09	3.29	78.54	28.3	86	5	9	LS	1.5	-	-	-	-	-	-	-	-	-	-	-
N/A	Grieta	#741	A	0-4	-	0.51	-	1.97	0.68	1.08	0.9	61	20	19	CL	-	-	-	-	-	-	-	-	-	-	-	-
N/A	Grieta	#741	Bt	4-15	-	0.36	-	1.43	0.27	1.60	1.7	56	17	27	CL	-	-	-	-	-	-	-	-	-	-	-	-
N/A	Grieta	#889	A	0-6	7.7	0.48	-	2.77	0.57	0.87	0.7	82	6	12	FSL	1.5	-	-	-	-	-	-	-	-	-	-	-
N/A	Grieta	#889	Bt	6-20	7.7	0.48	-	1.39	0.44	2.74	2.9	73	7	20	SCL	3.8	-	-	-	-	-	-	-	-	-	-	-
N/A	Grieta	#889	Btk	20-35	8.0	0.80	-	0.68	0.22	7.39	11.0	59	20	21	SCL	21.9	-	-	-	-	-	-	-	-	-	-	-
N/A	Huerfano	#1153	A/E	0-2	8.2	2.35	39	0.86	0.41	26.60	33.4	50	16	34	C	10.8	-	-	-	-	-	-	-	-	-	-	-
N/A	Huerfano	#1153	Btn	2-8	8.7	1.80	73	1.12	0.37	20.90	24.2	46	23	31	C	13.1	-	-	-	-	-	-	-	-	-	-	-
N/A	Huerfano	#1153	By	8-20	8.1	7.00	117	19.35	2.61	85.67	25.8	7	54	39	C	16.3	-	-	-	-	-	-	-	-	-	-	-
N/A	Huerfano	#994	Btn	0-4	8.5	0.88	47	0.43	0.17	8.49	15.5	47	20	33	C	5.7	-	-	-	-	-	-	-	-	-	-	-
N/A	Huerfano	#994	By	4-10	8.0	3.00	69	19.92	2.58	61.03	18.2	24	39	37	C	19.9	-	-	-	-	-	-	-	-	-	-	-
0398S02027	Jocity	#524	Bw	0-16	7.2	0.71	27	2.1	0.23	6.50	6.0	74	13	13	SL	2.8	0.02	26	24.9	.	.	.	.	.	2.4	<0.15	<0.015
0398S02028	Jocity	#524	C1	16-27	7.4	2.72	36	5.1	0.67	33.00	20.0	59	19	22	SCL	2.9	0.03	29	28.1	.	.	.	.	.	0.7	0.25	0.020
0398S02029	Jocity	#524	C2	27-41	7.3	4.16	83	10	1.40	46.00	19.0	20	34	46	C	2.1	0.07	22	20.0	.	.	.	.	.	0.4	0.35	0.120
0398S02030	Jocity	#524	C3	41-60	7.2	5.96	60	28	3.70	57.00	14.0	22	38	40	C	5.0	0.19	50	43.7	.	.	.	.	.	0.4	0.40	0.080
0398S02037	Jocity	#529	C	0-9	8.1	8.95	37	7.3	0.96	94.00	46.0	59	26	15	SL	3.4	0.05	30	28.7	.	.	.	.	.	1.0	<0.15	<0.015
0398S02038	Jocity	#529	Bynb	9-15	7.8	16.50	38	34	5.40	130.00	29.0	48	34	18	L	2.0	0.13	39	35.0	.	.	.	.	.	1.0	<0.15	<0.015
0398S02039	Jocity	#529	C1	15-32	7.0	11.90	43	35	6.50	85.00	19.0	48	32	20	L	3.3	0.14	33	29.1	.	.	.	.	.	0.7	0.50	<0.015
0398S02040	Jocity	#529	C3	32-50	7.4	4.84	31	33	4.80	33.00	8.0	67	19	14	SL	1.9	0.06	19	17.1	.	.	.	.	.	0.3	<0.15	<0.015
0398S02165	Jocity	#540	C	0-13	8.1	1.98	30	1.5	0.57	26.00	26.0	68	19	13	SL	7.3	0.02	92	91.2	.	.	.	.	.	0.2	<0.15	<0.015
0398S02166	Jocity	#540	Btknb	13-22	7.9	12.30	53	23	2.40	100.00	30.0	42	32	26	L	6.4	0.30	65	56.0	.	.	.	.	.	0.4	0.30	<0.015
N/A	Jocity	N/A	A	0-5	8.2	0.65	-	1.18	0.13	5.44	6.7	74	8	18	SL	2.1	-	-	-	-	-	-	-	-	-	-	-
N/A	Jocity	N/A	C1	5-44	7.9	3.90	25	10.33	1.41	31.24	12.9	60	16	24	SL	2.1	-	-	-	-	-	-	-	-	-	-	-
N/A	Jocity	N/A	C2	44-91	8.3	2.00	27	1.84	0.36	15.61	14.9	61	13	26	SL	2.3	-	-	-	-	-	-	-	-	-	-	-
N/A	Mack	- No Sample Taken -																									
0398S00782	Mayqueen	#3	A	0-4	7.5	0.57	29	2.3	0.60	2.60	2.0	78	7	15	SL	6.0	0.02	55	54.2	.	.	.	.	.	<0.50	<0.15	<0.015
0398S00783	Mayqueen	#3	Bt	4-21	7.9	1.09	30	1.6	0.49	9.90	10.0	70	11	19	SL	6.3	0.02	55	54.0	.	.	.	.	.	<0.50	<0.15	<0.015
0398S00784	Mayqueen	#3	C	21-53	7.6	7.71	32	13	2.50	51.00	18.0	78	7	15	SL	4.2	0.07	37	34.6	.	.	.	.	.	<0.50	0.25	<0.015
0398S01743	Mayqueen	#484	A	0-11	7.3	0.39	24	3.1	0.29	0.63	0.0	88	5	7	LS	1.1	0.01	8	7.5	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01744	Mayqueen	#484	Bw	11-22	7.2	0.33	27	2.3	0.39	0.88	1.0	85	6	9	LS	2.2	0.01	13	13.0	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01745	Mayqueen	#484	Bt	22-31	7.3	0.32	29	2.1	0.57	0.81	1.0	83	5	12	LS	2.5	0.01	14	14.0	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01746	Mayqueen	#484	C	31-39	7.4	0.30	28	1.2	0.41	1.40	2.0	93	0	7	S	0.9	0.01	6	5.6	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01747	Mayqueen	#484	2Ck	39-60	7.7	0.74	25	0.58	0.24	6.50	10.0	90	6	4	S	2.8	0.02	18	16.9	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01986	Monierco	#502	Btk	0-10	7.2	0.40	29	1.9	0.28	2.40	2.0	70	11	19	SL	6.5	0.01	49	48.8	.	.	.	.	.	0.2	<0.15	<0.015
0398S01987	Monierco	#502	2Ck	10-20	7.7	1.17	41	0.84	0.24	12.00	17.0	25	42	33	CL	14.0	0.01	137	136.9	.	.	.	.	.	0.4	0.35	<0.015
0398S01642	Muff	#420	Btn	0-10	8.2	3.67	55	1.7	0.28	35.00	35.0	51	16	33	SCL	4.2	0.02	40	39.3	.	.	.	.	.	2.3	0.45	0.020
0398S01643	Muff	#420	Btyn	10-20	7.9	13.00	57	25	1.80	130.00	34.0	38	22	40	C	5.3	0.19	51	44.9	.	.	.	.	.	1.0	0.65	0.100

Table 14.2-3 (Continued)

Lab ID	Soil series	Sample site	Soil horizon	Sample depth	pH s.u.	EC mmhos/cm	Saturation %	Ca meq/l	Mg meq/l	Na meq/l	Sar	Sand %	Silt %	Clay %	Texture USDA	$CaCO_3$ %	Sulfur total %	NP t/kt	ABP total S t/kt	SO4 %	Organic sulfur %	Pyritic sulfur %	AB pry. S t/kt	ABP pry. S t/kt	Boron sol. mg/kg	Se total mg/kg	Se sol. mg/kg
0398S01644	Muff	#420	Cy	20-34	7.9	11.80	46	23	1.80	110.00	32.0	28	29	43	C	5.8	0.14	55	51.1	.	.	.	.	.	1.5	0.55	0.080
0398S01645	Muff	#420	Btnb	34-58	8.1	4.37	39	3.1	0.44	45.00	34.0	38	39	23	L	5.3	0.03	45	44.3	.	.	.	.	.	0.7	0.55	0.100
0398S01663	Muff	#444	Btn	0-8	7.8	5.11	47	7.7	0.66	39.00	19.0	38	24	38	CL	8.2	0.06	74	72.0	.	.	.	.	.	1.0	0.35	<0.015
0398S01664	Muff	#444	2Bky	8-15	7.8	11.20	53	22	2.00	100.00	29.0	26	34	40	C	5.1	1.98	50	-11.6	2	0	0	0	50.2	1.3	0.35	0.020
0398S01665	Muff	#444	2Cky	15-25	7.8	9.71	68	20	2.50	85.00	25.0	18	37	45	C	5.6	0.49	54	38.9	.	.	.	.	.	0.8	0.25	<0.015
0398S02173	Muff	#547	Btn	0-4	7.6	0.79	51	1.5	0.68	8.70	8.0	40	24	36	CL	2.6	0.02	26	25.5	.	.	.	.	.	0.3	<0.15	<0.015
0398S02174	Muff	#547	Btkyn	4-17	7.5	7.99	93	15	3.20	71.00	24.0	18	30	52	C	2.1	0.60	20	1.6	.	.	.	.	.	0.2	0.30	0.060
0398S02175	Muff	#547	C1	17-54	7.4	5.25	60	12	2.50	43.00	16.0	32	36	32	CL	3.5	0.09	33	29.8	.	.	.	.	.	<0.50	<0.15	0.040
0398S02176	Muff	#547	C2	54-60	7.7	2.80	30	3.4	0.78	29.00	20.0	70	14	16	SL	4.8	0.04	45	43.7	.	.	.	.	.	0.3	0.25	0.040
N/A	Patel	#1242	A	0-8	7.9	0.50	31	1.58	0.28	6.08	6.3	80	8	12	S	-	-	-	-	-	-	-	-	-	-	-	-
0398S01982	Persayo	#495	C	0-6	7.0	0.45	28	3.7	0.48	0.72	0.0	58	19	23	SCL	9.3	0.01	87	86.6	.	.	.	.	.	0.3	<0.15	<0.015
0398S02015	Persayo	#514	2Btkn	10-21	7.8	6.78	47	4.9	2.10	79.00	42.0	44	24	32	CL	7.0	0.04	157	155.6	.	.	.	.	.	1.2	0.40	<0.015
0398S02016	Persayo	#515	Btn	0-11	7.9	0.68	29	0.69	0.16	7.50	11.0	62	17	21	SCL	5.1	0.01	49	48.9	.	.	.	.	.	0.3	<0.15	<0.015
0398S02024	Persayo	#522	C	0-9	7.2	0.38	30	0.89	0.10	3.70	5.0	89	5	6	S	1.3	0.01	12	11.2	.	.	.	.	.	<0.50	<0.15	<0.015
0398S02025	Persayo	#522	Btnb	9-17	7.5	3.49	33	3.8	0.64	40.00	27.0	86	5	9	LS	2.0	0.03	16	14.9	.	.	.	.	.	0.2	<0.15	<0.015
0398S02026	Persayo	#522	2By	17-28	7.2	6.03	31	26	4.50	59.00	15.0	79	12	9	SL	3.4	0.20	27	20.6	.	.	.	.	.	0.8	<0.15	<0.015
0398S02184	Persayo	#560	C1	0-8	7.0	3.09	41	27	4.40	12.00	3.0	62	14	24	SCL	3.6	0.17	38	32.6	.	.	.	.	.	0.8	0.55	<0.015
0398S02185	Persayo	#560	C2	8-14	6.8	3.15	37	27	6.00	10.00	2.0	69	9	22	SCL	3.8	0.22	40	32.7	.	.	.	.	.	0.6	0.50	<0.015
N/A	Persayo	#616	A	0-4	7.9	0.69	-	4.32	0.62	1.84	1.2	66	13	21	SL	6.5	-	-	-	-	-	-	-	-	-	-	-
0398S01461	Razito	#411	2Cy	46-60	8.4	16.70	38	19	7.10	180.00	51.0	88	4	8	LS	3.2	0.30	28	18.1	.	.	.	.	.	0.2	0.25	0.050
0398S01647	Razito	#431	C	0-19	7.4	0.32	26	2.4	0.55	1.80	1.0	93	2	5	S	0.6	0.01	5	5.1	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01648	Razito	#431	2Btk	19-26	8.1	0.75	37	2.8	0.91	8.10	6.0	78	4	18	SL	6.9	0.01	44	44.2	.	.	.	.	.	0.5	<0.15	<0.015
0398S01649	Razito	#431	3Bky	26-36	7.6	7.31	68	19	4.90	66.00	19.0	51	19	30	SCL	11.0	0.15	107	102.7	.	.	.	.	.	1.3	0.60	0.050
0398S01651	Razito	#435	Btkb	29-39	8.1	1.12	31	3.5	0.97	12.00	8.0	83	7	10	LS	3.7	0.01	27	26.8	.	.	.	.	.	0.3	<0.15	<0.015
0398S01661	Razito	#454	Btb	35-45	7.5	0.30	36	1.5	0.34	1.90	2.0	61	14	25	SCL	2.9	0.01	25	24.5	.	.	.	.	.	0.3	<0.15	<0.015
0398S01662	Razito	#454	C	45-60	7.7	0.49	25	2.3	0.50	3.70	3.0	88	4	8	LS	1.7	0.01	13	12.4	.	.	.	.	.	0.2	<0.15	<0.015
0398S01727	Razito	#471	A	0-5	7.5	0.44	25	3.2	0.34	0.72	1.0	88	5	7	LS	1.3	0.01	9	8.9	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01728	Razito	#471	C	5-19	7.8	0.68	27	0.75	0.13	7.40	11.0	90	3	7	S	1.0	0.01	7	6.9	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01729	Razito	#471	2Btn	19-31	8.0	2.99	43	1.9	0.35	41.00	38.0	68	13	19	SL	5.4	0.02	48	47.8	.	.	.	.	.	0.6	0.45	<0.015
0398S01730	Razito	#471	2Cky	31-60	7.7	9.85	37	25	3.50	100.00	26.0	80	6	14	SL	1.4	0.14	10	5.6	.	.	.	.	.	0.6	0.55	0.060
0398S01731	Razito	#472	2Btkyn	18-31	7.7	11.60	47	23	2.20	110.00	31.0	53	15	32	SCL	4.1	0.95	44	14.3	.	.	.	.	.	1.1	0.40	<0.015
0398S01735	Razito	#477	2Btkn	31-46	8.4	5.58	34	1.7	0.62	62.00	58.0	85	3	12	LS	3.5	0.03	23	21.6	.	.	.	.	.	0.4	0.25	<0.015
0398S01736	Razito	#477	2Bck	46-60	8.1	10.40	31	19	4.40	110.00	32.0	88	1	11	LS	3.3	0.07	22	19.5	.	.	.	.	.	0.5	<0.15	0.020
0398S01988	Razito	#505	C1	0-46	7.3	0.43	30	1.2	0.12	3.30	4.0	90	5	5	S	1.2	0.02	14	12.9	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01989	Razito	#505	C2	46-60	7.4	1.82	34	6.1	0.68	14.00	8.0	83	9	8	LS	1.5	0.02	13	12.2	.	.	.	.	.	<0.50	<0.15	<0.015
0398S02171	Razito	#544	C1	0-31	7.3	0.29	30	1.7	0.45	1.40	1.0	90	2	8	S	1.4	0.01	12	11.2	.	.	.	.	.	<0.50	<0.15	<0.015
0398S02172	Razito	#544	C2	31-60	7.5	0.42	29	0.78	0.08	3.90	6.0	90	2	8	S	1.4	0.02	12	10.9	.	.	.	.	.	<0.50	<0.15	<0.015
0398S04450	Razito	#593	2Btkn	30-47	8.2	11.30	38	12	6.20	130.00	43.0	68	9	23	SCL	8.4	0.11	73	69.7	.	.	.	.	.	0.6	0.35	<0.015
0398S04451	Razito	#593	2C	47-60	8.7	7.40	39	3.1	1.60	86.00	56.0	87	6	7	LS	4.4	0.07	40	37.6	.	.	.	.	.	0.5	0.30	<0.015

Table 14.2-3 (Continued)

Lab ID	Soil series	Sample site	Soil horizon	Sample depth	pH s.u.	EC mmhos/cm	Saturation %	Ca meq/l	Mg meq/l	Na meq/l	Sar	Sand %	Silt %	Clay %	Texture USDA	$CaCO_3$ %	Sulfur total %	NP t/kt	ABP total S t/kt	SO4 %	Organic sulfur %	Pyritic sulfur %	AB pry. S t/kt	ABP pry. S t/kt	Boron sol. mg/kg	Se total mg/kg	Se sol. mg/kg
0398S04530	Razito	#647	A	0-4	7.4	0.24	21	1.7	0.10	0.15	0.2	92	2	6	S	0.5	0.01	5	5.0	.	.	.	.	.	<0.50	<0.15	<0.015
0398S04531	Razito	#647	C1	4-15	7.4	0.22	23	1.7	0.10	0.15	0.2	92	1	7	S	0.8	0.01	8	7.3	.	.	.	.	.	<0.50	<0.15	<0.015
0398S04532	Razito	#647	C2	15-42	7.5	0.26	25	1.3	0.15	0.70	0.8	94	1	5	S	1.2	0.01	9	8.8	.	.	.	.	.	<0.50	<0.15	<0.015
0398S04533	Razito	#647	C3	42-60	8.6	0.69	27	0.3	0.05	5.40	13.0	92	3	5	S	0.7	0.01	6	5.3	.	.	.	.	.	<0.50	<0.15	<0.015
0398S04536	Razito	#656	Btb	33-60	8.2	0.67	27	0.9	0.20	6.20	8.4	74	6	20	SCL	5.9	0.01	53	53.0	.	.	.	.	.	0.3	<0.15	<0.015
N/A	Redlands	#750	Btk	20-37	-	0.81	-	0.68	0.14	6.98	10.9	69	11	20	SCL	-	-	-	-	-	-	-	-	-	-	-	-
N/A	Redlands	#775	A	0-5	7.8	0.46	27	2.84	0.42	0.71	0.6	77	13	10	FSL	1.4	-	-	-	-	-	-	-	-	-	-	-
N/A	Redlands	#775	Bt1	5-12	7.8	0.35	32	1.89	0.34	1.08	1.0	77	8	15	SCL	2.7	-	-	-	-	-	-	-	-	-	-	-
N/A	Redlands	#775	Bt2	12-22	8.1	0.42	36	2.07	0.75	1.10	0.9	66	11	23	SCL	3.6	-	-	-	-	-	-	-	-	-	-	-
N/A	Redlands	#775	Btk	22-33	7.9	2.50	45	3.73	1.5	19.69	12.2	54	17	29	SCL	3.5	-	-	-	-	-	-	-	-	-	-	-
N/A	Redlands	#775	C	33-43	7.7	3.30	31	7.88	3.05	23.17	9.9	81	5	14	SL	1.8	-	-	-	-	-	-	-	-	-	-	-
N/A	Redlands	#864	A	0-6	7.5	0.71	30	4.28	1.09	1.08	0.7	73	13	14	FSL	1.9	-	-	-	-	-	-	-	-	-	-	-
N/A	Redlands	#864	Bt1	6-15	7.7	0.50	30	2.31	0.68	1.60	1.3	69	12	19	SL	2.7	-	-	-	-	-	-	-	-	-	-	-
N/A	Redlands	#864	Bt2	15-28	7.8	0.47	34	1.93	0.61	2.02	1.8	72	7	21	SCL	3.7	-	-	-	-	-	-	-	-	-	-	-
N/A	Redlands	#864	C	28-63	7.8	1.00	32	3.1	1.24	5.72	3.9	86	4	10	LS	2.6	-	-	-	-	-	-	-	-	-	-	-
0398S04437	Shiprock	#574	A	0-4	7.6	0.52	21	4	0.71	1.60	1.0	76	13	11	SL	2.2	0.01	21	20.8	.	.	.	.	.	<0.50	<0.15	<0.015
0398S04438	Shiprock	#574	Bt	4-11	7.6	0.40	24	2.2	0.44	3.50	3.0	79	8	13	SL	2.7	0.01	20	19.6	.	.	.	.	.	0.2	<0.15	<0.015
0398S04439	Shiprock	#574	Bkyb	11-30	8.1	1.14	47	2.1	0.40	14.00	13.0	46	27	27	SCL	7.9	0.01	149	148.4	.	.	.	.	.	0.8	<0.15	<0.015
0398S04440	Shiprock	#574	C	30-60	7.6	6.76	26	27	8.00	61.00	15.0	90	3	7	S	1.5	0.12	11	7.1	.	.	.	.	.	1.2	<0.15	<0.015
0398S01457	Shiprock	#400	2Bt	15-22	8.2	1.18	44	1.5	0.47	12.00	12.0	84	6	10	LS	6.3	0.02	58	56.9	.	.	.	.	.	<0.50	0.35	<0.015
0398S01652	Shiprock	#423	Bw	0-13	7.3	0.32	26	2.1	0.38	1.50	1.0	91	4	5	S	0.0	0.01	6	5.8	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01653	Shiprock	#423	Btk	13-19	8.0	0.85	32	2	0.58	8.80	8.0	83	6	11	LS	3.7	0.01	22	22.1	.	.	.	.	.	0.2	<0.15	<0.015
0398S01658	Shiprock	#451	Bw	0-26	7.4	0.37	28	2.3	0.30	1.60	1.0	86	6	8	LS	2.5	0.01	20	19.4	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01659	Shiprock	#451	Btkb	26-56	7.9	0.86	32	2.1	0.43	8.90	8.0	76	9	15	SL	3.7	0.01	26	26.0	.	.	.	.	.	0.4	<0.15	<0.015
0398S01660	Shiprock	#451	2Ck	56-60	7.7	1.50	34	1.8	0.39	15.00	15.0	73	9	18	SL	2.3	0.01	17	16.8	.	.	.	.	.	1.0	<0.15	<0.015
0398S01666	Shiprock	#456	Bw	0-17	7.8	0.52	27	1.2	0.59	4.40	5.0	92	3	5	S	0.6	0.01	5	4.8	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01667	Shiprock	#456	Btk	17-24	8.5	0.81	31	4.3	0.83	7.20	4.0	86	4	10	LS	3.6	0.01	26	25.8	.	.	.	.	.	0.2	<0.15	<0.015
0398S01668	Shiprock	#456	Bk	24-60	8.6	2.46	35	2.5	0.40	22.00	19.0	83	4	13	SL	3.4	0.02	24	23.4	.	.	.	.	.	0.5	<0.15	<0.015
0398S01737	Shiprock	#478	2Btk	16-26	8.1	0.78	32	0.94	0.30	9.20	12.0	75	11	14	SL	13.0	0.01	112	111.8	.	.	.	.	.	0.2	<0.15	<0.015
0398S01738	Shiprock	#478	2Bk	26-60	7.9	3.17	31	2.9	1.40	37.00	25.0	90	3	7	S	2.3	0.02	15	14.2	.	.	.	.	.	0.6	<0.15	<0.015
0398S01739	Shiprock	#481	Btn	0-8	8.1	1.34	30	0.88	0.19	20.00	27.0	83	5	12	LS	1.7	0.01	13	13.0	.	.	.	.	.	0.5	0.25	<0.015
0398S01740	Shiprock	#481	Bk	8-44	7.7	8.96	30	24	1.20	92.00	26.0	88	5	7	LS	1.3	0.18	8	2.8	.	.	.	.	.	0.6	0.40	0.040
0398S01741	Shiprock	#481	2Ck	44-60	8.0	5.95	40	4.5	0.69	64.00	40.0	88	3	9	LS	3.3	0.04	25	23.6	.	.	.	.	.	0.2	0.40	0.090
0398S01742	Shiprock	#482	Bkyn	0-17	7.6	6.93	26	24	2.20	65.00	18.0	83	5	12	LS	2.7	0.10	22	18.5	.	.	.	.	.	0.5	0.35	<0.015
0398S02180	Shiprock	#553	A	0-4	7.4	0.44	25	1.3	0.34	3.70	4.0	74	12	14	SL	4.1	0.01	37	37.1	.	.	.	.	.	<0.50	<0.15	<0.015
0398S02181	Shiprock	#553	Bw	4-9	7.8	0.54	26	1.3	0.22	5.10	6.0	82	6	12	SL	5.0	0.01	33	32.5	.	.	.	.	.	<0.50	<0.15	<0.015
0398S02182	Shiprock	#553	Btk	9-16	8.2	0.94	32	2.7	0.65	14.00	11.0	78	8	14	SL	8.5	0.02	64	63.2	.	.	.	.	.	0.3	<0.15	<0.015
0398S02183	Shiprock	#553	C	16-34	7.8	7.88	28	9.1	5.00	79.00	30.0	86	6	8	LS	1.8	0.03	15	14.2	.	.	.	.	.	0.8	0.30	<0.015
0398S04443	Shiprock	#583	Bw	0-11	7.6	0.46	22	3.3	0.59	1.30	0.9	83	10	7	LS	1.6	0.01	13	12.2	.	.	.	.	.	<0.50	<0.15	<0.015

Table 14.2-3 (Continued)

Lab ID	Soil series	Sample site	Soil horizon	Sample depth	pH s.u.	EC mmhos/cm	Saturation %	Ca meq/l	Mg meq/l	Na meq/l	Sar	Sand %	Silt %	Clay %	Texture USDA	$CaCO_3$ %	Sulfur total %	NP t/kt	ABP total S t/kt	SO4 %	Organic sulfur %	Pyritic sulfur %	AB pry. S t/kt	ABP pry. S t/kt	Boron sol. mg/kg	Se total mg/kg	Se sol. mg/kg
0398S04444	Shiprock	#583	Bt	11-22	7.8	0.50	25	1.8	0.39	5.20	5.0	84	5	11	LS	2.9	0.01	23	22.7	.	.	.	.	.	<0.50	<0.15	<0.015
0398S04445	Shiprock	#583	BCk	22-50	8.2	1.02	27	1.1	0.31	13.00	16.0	87	4	9	LS	3.8	0.02	35	34.8	.	.	.	.	.	0.3	<0.15	<0.015
0398S04446	Shiprock	#583	2Ck	50-61	8.0	3.67	25	3	1.30	44.00	30.0	92	3	5	S	2.3	0.04	19	17.9	.	.	.	.	.	0.5	<0.15	<0.015
0398S04541	Shiprock	#659	2Bk2	32-51	8.6	3.95	35	1.3	0.50	40.00	42.0	84	5	11	LS	4.2	0.03	33	32.5	.	.	.	.	.	0.7	0.30	0.030
0398S04542	Shiprock	#660	2Btk	12-27	8.4	1.50	36	5.3	1.84	17.00	9.1	74	8	18	SL	3.6	0.02	32	31.8	.	.	.	.	.	0.7	0.25	<0.015
0398S04543	Shiprock	#660	2Bk	27-60	7.8	7.02	27	24	4.05	48.00	13.0	88	4	8	LS	3.4	0.10	27	24.0	.	.	.	.	.	0.4	<0.15	<0.015
0398S04544	Shiprock	#662	Bw	0-12	7.5	0.34	22	1.9	0.15	0.45	0.5	86	6	8	LS	1.4	0.01	12	11.6	.	.	.	.	.	<0.50	<0.15	<0.015
0398S04545	Shiprock	#662	Btk	12-29	7.8	0.49	23	0.7	0.10	3.30	5.1	82	6	12	SL	2.6	0.01	21	20.8	.	.	.	.	.	0.2	<0.15	<0.015
0398S04546	Shiprock	#662	Bk	29-61	8.2	2.63	34	0.85	0.35	23.00	29.0	84	6	10	LS	5.6	0.02	50	49.2	.	.	.	.	.	0.5	<0.15	<0.015
N/A	Shiprock Variant	#739	A	0-6	7.6	0.60	29	3.39	0.68	1.04	0.7	73	14	13	SL	2.5	-	-	-	-	-	-	-	-	-	-	-
N/A	Shiprock Variant	#739	Bw	6-15	7.9	0.39	31	1.43	0.62	1.60	1.7	81	7	12	SL	4.3	-	-	-	-	-	-	-	-	-	-	-
N/A	Shiprock Variant	#739	Btk	15-33	8.0	0.63	33	1.07	0.26	4.70	5.8	74	11	15	SL	5.5	-	-	-	-	-	-	-	-	-	-	-
N/A	Shiprock Variant	#739	Bk	33-47	8.0	1.20	30	1.89	0.61	8.80	7.9	64	15	21	SCL	24.3	-	-	-	-	-	-	-	-	-	-	-
N/A	Shiprock Variant	#755	A	0-5	7.9	0.38	28	2.05	0.34	0.76	0.7	80	8	12	SL	4.9	-	-	-	-	-	-	-	-	-	-	-
N/A	Shiprock Variant	#755	Btk1	5-17	8.0	0.53	29	1.15	0.21	3.67	0.5	74	9	17	SCL	2.1	-	-	-	-	-	-	-	-	-	-	-
N/A	Shiprock Variant	#755	Btk2	17-22	8.1	0.61	29	0.84	0.16	5.21	7.4	74	10	16	SCL	6.7	-	-	-	-	-	-	-	-	-	-	-
N/A	Shiprock Variant	#755	Bk	22-31	8.3	0.91	34	0.44	0.15	8.09	14.9	50	23	27	SCL	35.0	-	-	-	-	-	-	-	-	-	-	-
N/A	Shiprock Variant	#776	A	0-5	7.7	0.49	29	2.81	0.48	1.18	0.9	80	9	11	FSL	3.6	-	-	-	-	-	-	-	-	-	-	-
N/A	Shiprock Variant	#776	Bt	5-14	7.8	0.46	32	2.73	0.66	1.08	0.8	76	10	14	Sl	1.2	-	-	-	-	-	-	-	-	-	-	-
N/A	Shiprock Variant	#776	Btk	14-28	8.0	0.51	33	1.03	0.31	3.72	4.5	76	9	15	SCL	3.2	-	-	-	-	-	-	-	-	-	-	-
N/A	Shiprock Variant	#776	Bk	28-35	8.2	0.50	31	2.65	0.34	1.76	1.4	65	14	21	SCL	25.5	-	-	-	-	-	-	-	-	-	-	-
0398S01654	Stumble	#447	2Cy	20-40	7.2	3.53	27	25	2.20	16.00	4.0	91	1	8	S	2.0	0.06	23	20.6	.	.	.	.	.	0.3	<0.15	<0.015
0398S01655	Stumble	#447	2Ck	40-54	8.0	0.75	29	1.2	0.74	6.80	7.0	93	2	5	S	0.7	0.02	9	8.1	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01983	Stumble	#497	Bw	0-11	7.1	0.40	29	2.7	0.41	1.30	1.0	85	6	9	LS	2.1	0.01	16	15.6	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01984	Stumble	#497	Bc	11-24	7.2	0.42	27	1.8	0.37	2.40	2.0	83	7	10	LS	2.7	0.01	21	20.6	.	.	.	.	.	<0.50	<0.15	<0.015
0398S01985	Stumble	#497	2Ck	24-44	7.7	1.24	30	0.59	0.15	12.00	20.0	83	6	11	LS	4.5	0.02	33	32.5	.	.	.	.	.	0.5	<0.15	<0.015
N/A	Stumble	#574	A	0-4	8.1	0.37	-	2.58	0.46	0.63	0.5	77	11	12	LS	8.1	-	-	-	-	-	-	-	-	-	-	-
N/A	Stumble	#574	Bk1	4-19	8.7	0.30	-	0.76	3.08	2.09	3.1	80	8	12	LS	4.2	-	-	-	-	-	-	-	-	-	-	-
N/A	Stumble	#574	Bk2	19-26	8.8	0.63	-	2.85	4.58	5.79	4.6	76	11	13	LS	7.4	-	-	-	-	-	-	-	-	-	-	-
N/A	Stumble	#574	Bk3-4	26-46	8.6	1.90	-	1.57	17.50	18.40	17.5	81	8	11	LS	2.9	-	-	-	-	-	-	-	-	-	-	-
0398S04514	Stumble	#579	C1	4-51	7.8	1.10	29	2.2	0.20	7.30	6.7	90	4	6	S	1.2	0.01	13	12.2	.	.	.	.	.	<0.50	<0.15	<0.015
0398S04515	Stumble	#579	C2	51-60	7.6	1.65	22	5.2	0.60	11.00	6.2	96	0	4	S	1.6	0.03	16	14.9	.	.	.	.	.	<0.50	<0.15	<0.015
0398S04529	Stumble	#646	2Ck	29-60	8.3	0.89	26	1.2	0.25	8.30	9.7	82	5	13	SL	6.1	0.03	61	59.9	.	.	.	.	.	0.3	<0.15	<0.015
N/A	Trail	- No Sample Taken -																									
N/A	Tsaya	- No Sample Taken -																									
N/A	Uffens	- No Sample Taken -																									

Table 14.2-4 OSM Topsoil and Topsoil Substitute Suitability Criteria for the Southwestern United States (OSM 1999)*

Parameter	Material quality		
	Good	Marginal	Unsuitable
pH	6.0-8.4	5.5-6.0	<5.5
Electrical conductivity (EC) (mmhos/cm) (1)	< 4.0	4.0-12.0	>12.0
Sodium Adsorption Ratio (SAR) (2)			
sl and coarser	<12.0	12.0-18.0	>18.0
l and cl	<10.0	10.0-16.0	>16.0
40% clay	<8.0	8.0-14.0	>14.0
Texture (3)	ls, sl, l, sil, with 35% c	s, lcs, cl, sicl, with 45% c	>45% c
Saturation percent (%)	25-80	25-80	<25 or >80
CaCO3 %	0-15	15-30	> 30
Coarse fragments (4)			
< 3 inch %	15	15-35	35
> 3 inch %	3	3-10	10
Erosion factor (5)	<0.37	<0.37	
Acid-base potential	+5 T CaCo3 Equiv./1000T	+0 T CaCo3 Equiv./1000T	< -5 T CaCo3 Equiv./1000T
Boron	5 ppm	5 ppm	>5 ppm
Selenium (total)		≤0.8 ppm	>0.8 ppm
Selenium (extractable)		≤0.15 ppm	>0.15 ppm

* These suitability criteria may be modified on a case-by-case basis if sufficient data are submitted to support the modifications and the submitted data technically represent the site-specific nature of the modification

1. When EC is less than 2.0, then SARs cannot be >18.
2. SAR values can be modified if adequate data is submitted to support proposed modification(s).
3. ls=loamy sand; lcs=loamy coarse sand; sl=sandy loam; l= loam; sil=silt loam; scl=sandy clay loam; s=sand; cl=clay loam; sicl=silty clay loam; cl=clay.

4. For topsoil substitutes/supplements, percentage can be increased if it is shown that the higher percentage will increase slope stability and/or vegetation establishment. Suitabilities will be determined on a site-specific basis.
5. For each material proposed to reclaim slopes ≥ 25% (4h:1v), a K factor must be determined from the results of appropriate physical and chemical analyses, as outlined in the National Soils Handbook (Soil Conservation Service 1983). Material suitability will be determined using the Revised Universal Soil Loss Equation (ARS 1990).

Table 14.2-5 Soil Mapping Units and Symbols Used for the Pinabete Mine Plan Permit Area

Soil Mapping Unit	Map Unit Symbol
Bacobi sandy loam, 0 to 15 % slopes	Bc
Bacobi and Monierco soils, 0 to 8 % slopes	BM
Badlands	BA
Beebe loamy sand, 0 to 3 % slopes	Bb
Doak sandy loam, 0 to 5 % slopes	Dk
Doak sandy loam, very hard, 0 to 3 % slopes	Dh
Farb sandy loam, 0 to 15 % slopes	Fb
Fruitland sandy loam, 0 to 15 % slopes	Fr
Grieta sandy loam, 0 to 8 % slopes	Gr
Jocity sandy loam, 0 to 3 % slopes	Jc
Jocity, very hard, 0 to 3 % slopes	Jh
Jocity-Fruitland sandy loams, 0 to 3 % slopes	Jf
Mack sandy loam, 0 to 3 % slopes	Mc
Mayqueen loamy sand, 0 to 8 % slopes	Mq
Mayqueen-Shiprock loamy sands, 0 to 8 % slopes	Ms
Monierco sandy loam, 0 to 15 % slopes	Mo
Nakai sandy loam, 0 to 5 % slopes	Nk
Natric soils, 0 to 8 % slopes	NA
Natric soils, overblown, 0 to 8 % slopes	NO
Persayo clay loam, 0 to 15 % slopes	Pr
Persayo, Farb, and Rock Outcrop soils, 0 to 50 % slopes	PF
Razito loamy sand, 0 to 8 % slopes	Rz
Razito loamy sand, moderately deep, 0 to 8 % slopes	Rm
Rock Outcrop	RO
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	Sp
Shiprock sandy loam, very hard, 0 to 8 % slopes	Sh
Stumble loamy fine sand, 0 to 15 % slopes	St
Trail, very hard, 0 to 8 % slopes	Th

Table 14.3-1 Area, Percent of Survey Area and Volume of Suitable Topdressing Material From Each Soil Mapping Unit Located in Pinabete Mine Plan Permit Area

Soil Mapping Unit	Area (ac)	% of Area	Topdressing Volume (bcy)
Bacobi sandy loam, 0 to 15 % slopes	9.2	0.2	25,335
Bacobi and Monierco soils, 0 to 8 % slopes	376.7	6.8	759,619
Badlands	1,538.5	27.6	0
Beebe loamy sand, 0 to 3 % slopes	135.2	2.4	981,876
Doak sandy loam, 0 to 5 % slopes	34.7	0.6	201,578
Doak sandy loam, very hard, 0 to 3 % slopes	22.5	0.4	145,099
Farb sandy loam, 0 to 15 % slopes	251.4	4.5	270,445
Fruitland sandy loam, 0 to 15 % slopes	60.3	1.1	333,292
Grieta sandy loam, 0 to 8 % slopes	58.4	1.1	133,386
Jocity sandy loam, 0 to 3 % slopes	66.6	1.2	105,536
Jocity, very hard, 0 to 3 % slopes	95.4	1.7	366,717
Jocity-Fruitland sandy loams, 0 to 3 % slopes	6.2	0.1	24,332
Mack sandy loam, 0 to 3 % slopes	33.2	0.6	267,432
Mayqueen loamy sand, 0 to 8 % slopes	52.5	0.9	417,490
Mayqueen-Shiprock loamy sands, 0 to 8 % slopes	20.4	0.4	112,235
Monierco sandy loam, 0 to 15 % slopes	28.6	0.5	74,721
Nakai sandy loam, 0 to 5 % slopes	27.0	0.5	54,532
Natric soils, 0 to 8 % slopes	1,620.8	29.1	0
Natric soils, overblown, 0 to 8 % slopes	223.6	4.0	313,472
Persayo clay loam, 0 to 15 % slopes	74.2	1.3	0
Persayo, Farb, and Rock Outcrop soils, 0 to 50 % slopes	185.7	3.3	35,909
Razito loamy sands, 0 to 8 % slopes	288.8	5.2	2,058,563
Razito loamy sand, moderately deep, 0 to 8 % slopes	93.3	1.7	364,235
Rock Outcrop	19.0	0.3	0
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	55.6	1.0	364,265
Shiprock sandy loam, very hard, 0 to 8 % slopes	126.5	2.3	304,522
Stumble loamy fine sand, 0 to 15 % slopes	57.0	1.0	313,811
Trail, very hard, 0 to 8 % slopes	7.3	0.1	13,825
Total	5,568.6	100.0	8,042,225

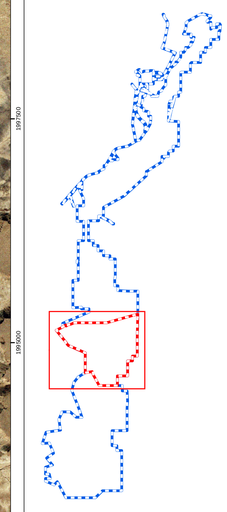
Table 14.3-2 Estimated Volume of Available Topdressing for Reclamation within the Pinabete Mine Plan Permit Area

	Area (acres)	Suitable in-situ topdressing volume (bcy)	Estimated handling loss volume (10%) (bcy)	Estimated available volume for reclamation (bcy)	Estimated replacement depth (inches)
Pinabete permit area	5,569	8,042,225	804,223	7,238,002	9.7

bcy – bank cubic yards

Legend

- Soil Sample Sites
- Map Unit Delineations
- Pinabete SMCRA Permit Area
- Mining Lease Area
- NA — Soil Map Unit
- 1248 — Soil Sample Site Number



Coordinate System:
NAD 1927 State Plane New Mexico West FIPS 3003
Projection: Transverse Mercator
Datum: North American 1927
Units: Foot US

N

0 400 800 1,200 1,600 Feet
1:7,200

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	GEO.	RE.
12-A	2/23/2012	MPO	Prepared for Submittal to OSM		CKA	

Exhibit 14.1-1

bhpbilliton
resourcing the future

BHP NAVAJO COAL COMPANY

Pinabete Mine Plan Permit Area
Soil Mapping Units

PREPARED BY: BCL	DRAWN BY: MPO	PAPER SIZE: ARCH E
APPROVED BY: CKA	DATE: 2/11/12	

Appendix 14.A

BHP Navajo Coal Company

Coal Lease Soil Resource Comprehensive Report

BHP Navajo Coal Company Coal Lease
Soil Resource
Comprehensive Report

Presented to

BHP Navajo Coal Company

December 2011

BHP Navajo Coal Company Coal Lease
Soil Resource
Comprehensive Report

Prepared by

Buchanan Consultants, Ltd.
220 West Main
Farmington, New Mexico

Presented to

BHP Navajo Coal Company

December 2011

EXECUTIVE SUMMARY

In December 2011, Buchanan Consultants, Ltd completed a Soil Resource Comprehensive Report (SRCR) for BHP Navajo Coal Company (BNCC). The report was completed to describe the soils and to provide an estimate of topdressing resources for the BNCC coal lease area. Two land conditions are represented in the report, baseline (lands undisturbed by mining) and 1993-status (land conditions in 1993 which includes pre-mine and mined areas). The SRCR was produced by combining three soil surveys submitted to BNCC in 1993, 1998 and 2008. The SRCR report has 41 mapping units: 32 are consociations, 6 are complexes and 3 are undifferentiated units. A total of 29 soil types were used to name the mapping units, 22 of the soil types were soil series and 7 were miscellaneous land types.

The area of the SRCR is approximately 33,371 acres and represents Areas 1, 2, 3, 4 North, 4 South and 5 of Navajo Mine. Area 1 has an area of approximately 4,764 ac, 14% of the SRCR area. The baseline topdressing volume was estimated to be 10,343,940 bcy and the 1993-status topdressing volume was estimated to be 2,049,705 bcy. Area 2 has an area of approximately 5,920 ac, 18% of the SRCR area. The baseline topdressing volume was estimated to be 6,304,399 bcy and the 1993-status topdressing volume was estimated to be 1,927,958 bcy. Area 3 has an area of approximately 4,953 ac, 15% of the SRCR area. The baseline topdressing volume was estimated to be 6,464,531 bcy and the 1993-status topdressing volume was estimated to be 5,810,624 bcy. Area 4 North has an area of approximately 4,728 ac, 14% of the SRCR area. The baseline and 1993-status topdressing volumes are the same and estimated to be 3,929,231 bcy. Area 4 South has an area of approximately 6,025 ac, 18% of the SRCR area. The baseline and 1993-status topdressing volumes are the same and estimated to be 14,098,931 bcy. Area 5 has an area of approximately 6,981 ac, 21% of the SRCR area. The baseline and the 1993-status topdressing volumes are the same and estimated to be 15,201,705 bcy.

The total estimated volumes of topdressing for the SRCR are for baseline 56,342,737 bcy and for 1993-status 43,018,154.

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INTRODUCTION

In December 2011, Buchanan Consultants, Ltd. completed the Soil Resource Comprehensive Report (SRCR) for BHP Navajo Coal Company (BNCC) to summarize past soil surveys into a composite report for the entire BNCC coal lease area. The primary objectives of the past surveys were to describe the soils of the BNCC lease area and to provide the location and an estimate of salvageable topdressing material for Navajo Mine. The topdressing material is used for reclamation of disturbed lands resulting from surface coal mining operations.

The soil resources for the BNCC lease area were determined by combining three soil surveys, all completed by BCL. The surveys were completed at various times for different areas of the mine. The first was submitted as part of BNCC's Permit Application Package in September 1993. The second as a soil survey for Navajo Mine submitted in November 1998. The third soil survey was submitted as the Navajo Mine Extension Project in March 2008.

The SRCR is to be used as a planning tool and not to define precise site-specific unit delineations. The intent is for it to be used in obtaining mining permits and for general planning in the mine operations. It provides a supplement to on-site investigations of the various soil types described in the survey. Soil resource information provided in the report is intended to identify and describe the kinds of soil within the BNCC lease area, extent of soil mapping units, and amount of topdressing and soil depth.

GENERAL NATURE OF THE SURVEY AREA

BNCC lease area is located within the Colorado Plateau physiographic province (Fenneman, 1931; Hunt, 1956). The Colorado Plateau has within its borders a wide diversity of topography, geologic materials, soils, and vegetation. The general terrain in the vicinity of the lease area is characterized by rough and broken topography, badlands, plateaus, and mesas, intermingled with escarpments, and valleys or washes. Many of the soils in the survey area are formed from alluvium and eolian sediments derived from shale and sandstone from the Fruitland formation. Some soils have a residual

component. Most of the soils in the survey area have been forming only since the late-Pleistocene and during the Holocene Era. It is very common to find buried soils that date back to the Pleistocene Era. The annual precipitation for the survey area averages approximately 6 inches and the mean annual air temperature near 51^{o} F (11^{o} C). Therefore, the survey is described as having an aridic moisture regime and a mesic temperature regime.

An order 3 soil survey of the Navajo Mine area was issued in November 1980 as the Soil Survey of San Juan County New Mexico, Eastern Part (USDA, 1980). This soil survey produced by the Natural Resources Conservation Service (NRCS) was presented at scales of 1:24,000 and 1:63,360. Many of the soil series names used in the SRCR are the same as those used in the 1980 soil survey. Additional soil series for the SRCR came from other NRCS soil surveys in Arizona, Colorado, New Mexico, and Utah. The soil series used in the SRCR represent the current correlation of soils for the BNCC lease area.

SOIL SURVEY PROCEDURES

The SRCR was created by combining previously completed soil surveys. In Areas 1 and 2 and parts of Area 3 the mapping units and associated soil series followed the 1980 NRCS soil survey. In the early 1990's much of these areas had been mined; therefore the soil survey completed in 1993 was based on air photo interpretation or the 1980 NRCS soil survey. In the other surveys (parts of Area 3 and Areas 4 and 5), transects were distributed in the unmined areas to provide a pattern for the location of soil test sites. Transects were oriented so that the major soil types were traversed. A combination of aerial photos from the National Aerial Photography Program (NAPP) and from BHP Navajo Coal Company (BNCC) was used to delineate major soil types. The NAPP photos were taken on September 24, 1991 at a scale of 1:15,840, the BNCC photos were taken on April 5, 1985 at a scale of 1:6,000 and on February 26, 1998 at a scale of 1:24,000.

Aerial photographs of each area were studied stereoscopically. This examination provided predictions about the types and boundaries of soils. Tentative soil delineations

were drawn on the photographs. Predictions of soil types and boundaries were then verified at test sites located in the field. As a group of transects and associated test sites were completed, delineations on aerial photographs were either verified or changed to reflect field observations. An attempt was made to place one or more test sites within each major map unit delineation. The miscellaneous areas were visited but few, if any test sites, were described or sampled. These areas are relatively easy to identify on aerial photographs and generally do not provide suitable topdressing material.

Soil test pits were positioned along transects or on unique landscapes representing the major soil types. The spacing of test pits was determined by the complexity of soils within an area. In complex areas, test pits were described at close intervals and in homogeneous areas they were more widely spaced. Generally, test pits were positioned at close intervals (approximately 500 ft apart) along transects in Areas 3 and 4 and were more widely spaced in Area 5. The wider spacing in Area 5 is a result of both the homogeneity of the soils and the scientist's familiarity with the soil types and associated landscapes. At each test site, a soil profile was excavated with a backhoe or with a hand auger. Excavations were completed to bedrock or a maximum depth of 60. At some test pit sites, a complete excavation was unnecessary because the soil type and its suitability for use as topdressing could be accurately predicted from surface characteristics. The natric soils are an example of these soil types. At excavated sites, a soil profile description was written or a record was made of depth of suitable topdressing, depth to bedrock, and soil type. Profile descriptions included depth, texture, consistence, structure, effervescence, color, visible salts, and quantity of coarse fragments for each soil horizon. Also included were soil type (series), depth of suitable topdressing, current vegetation, parent material, physiography, slope, aspect, degree of erosion, and any other information pertinent to pedon classification and topsoil/topdressing suitability determinations (Soil Survey Division Staff, 1993).

Soil samples were collected from selected soil profiles that represented either extensive soil components, soils that could not be classified in the field, or potential topdressing. Most samples were analyzed by Inter-Mountain Laboratories (IML). Samples from Area

5 were analyzed by Green Analytical Laboratories (GAL). The parameters measured included pH, electrical conductivity (EC), saturation percent (SP%), calcium, magnesium, sodium, sodium adsorption ratio (SAR), texture with percent sand, percent silt, and percent clay, percent carbonate, acid-base potential (ABP), hot-water-soluble boron, hot-water-soluble selenium, and total selenium. The methods of soil analysis used by IML and GAL are referenced in the original soils survey reports. Topdressing Suitability for the Southwestern United States (OSM, 1999) was used to evaluate the suitability of all soil samples, Table 1. It was beyond the scope of this soil survey to determine the suitability of topdressing (regolith) resources that may have existed below the depth of test site excavations. These deep regolith materials are expected to occur in some mapping units and they may be a resource of additional topdressing material.

One of the objectives of this report was to identify the soil resources available as topdressing material for the reclamation of disturbed areas on the BNCC lease area. To accomplish this objective soils were mapped at a large enough scale to produce mapping units of similar soil types. It is assumed that if similar soils can be mapped together, then characteristics of a few samples within the unit can be extrapolated for the entire unit. The assumption is valid for homogeneous areas or areas where small delineations can be made to maintain homogeneous components. The scale used in this survey allowed delineations of 0.5 acres. In areas of very heterogeneous soils, the delineations tend to be smaller and more samples are required to describe the soils than in homogeneous areas where the delineations tend to be larger. The available topdressing volume was determined for each map unit delineation for both the baseline and 1993-status conditions. The volume amount is expressed as bank cubic yards (bcy). Also provided is a description of each soil mapping unit, including the proportion of named components and inclusions.

After mapping was complete for an area, soil map unit delineations were adjusted and transferred from aerial photographs to orthophotographs. The delineations were then digitized using ArcGIS. The base map scale for the SRCR was 1:15,840. Enlargement

or reduction of the map scale for presentation does not provide additional mapping detail beyond the scale of the base map.

The location of each soil profile was plotted on orthophotograph soil maps. These profile locations are numbered within each respective area. Therefore, each different survey area has its own set of numbered profiles. Map unit delineations were based on soil profile data that had been plotted on orthophotographic maps.

Topdressing availability was calculated for each map unit delineation as a volume estimated from the product of mean depth of suitable material and the area. Mean depths less than 6 inches were entered as 0 inches because it is operationally unfeasible to remove surface soils less than 6 inches thick. Volumes were summed to provide the quantity of topdressing material available from each delineation for each map unit. A total volume of topdressing was produced for each of the separate soil survey areas. The total volumes of topdressing for all areas were combined to represent the total topdressing volume for the SRCR. The topdressing estimates are expected to vary by no more than 20 percent (Buchanan and Musslewhite, 2011).

RESULTS

The soils of the SRCR are highly complex and variable. In most cases, the geomorphic surfaces have been influenced by constructional and erosional processes, thus resulting in a high occurrence of buried and truncated soils. Nearly all of the soils were developed under the influence of erosion as indicated by the frequency of moderate and severely eroded surfaces. Additionally, many profiles were described with lithologic discontinuities. The location of each profile with northing and easting coordinates, soil type, depth of topdressing, and depth to bedrock is provided in each of the three soil surveys. The coordinate system used to designate each profile was the State Plane New Mexico West, North American Datum 1927.

Survey Area

The total area of the SRCR for both baseline and 1993-status is 33,370.7 ac, respectively Table 2 and Table 3. These tables also include the area, percent of area and topdressing volume for each soil mapping unit identified for baseline and 1993-status

Soil Series Classification

All of the soil series used in the SRCR are either Aridisols or Entisols and exist in an Aridic moisture regime and a Mesic temperature regime. Each series was classified to the family level (Soil Survey Staff, 2010) and each was assigned a hydrologic group (Soil Survey Staff, 2008), Table 4. Series descriptions for each soil are available from the NRCS website. Laboratory data for each major series are included with each of the respective soil surveys. Several series (Chipeta, Mesa, Redlands, Sogzie and Uffens) occur only as inclusions in the mapping units. These were not used to name map units nor sampled because of their limited extent. The laboratory data were used to classify soils and determine topdressing suitability. The soil series used for the SRCR are included in the Key to Soils, Table 5. This key provides a procedure to separate the various soil series used as soil components for the mapping units.

Several soil series names used in the 1980 NRCS soil survey were used in the 1993 soil survey for BNCC. In later surveys, these soil series were correlated to represent the most current soil series names used by the NRCS. Each subsequent soil survey also used the most current soil series name and soil classification nomenclature. The SRCR uses current series names to describe the soils of BNCC.

Map Units

A total of 41 different mapping units are used to describe the SRCR, 1993-status. Of these, 32 are consociations, 6 are complexes and 3 are undifferentiated units. Of the 33 soil series described for the SRCR 22 soil series and 7 miscellaneous types were used to name the mapping units. Each mapping unit names and map symbols are listed in Table 6.

The extent (area) and depth of topdressing for each map unit in the SRCR are available electronically from the detailed soil map, baseline, Exhibit 1 and 1993-status, Exhibit 2. Each map unit delineation, Exhibit 1 and Exhibit 2 represents an area on the landscape and consists of one or more soils for which the map unit is named. Map unit symbols were assigned to each delineation to identify the soil mapping unit name for both baseline and 1993-status.

One of the map units, named Natric soils, was comprised of several Natrargids and Natrigypsids. The Natrargids include Huerfano, Fajada, Muff, Patel and Uffens. The Natrigypsids include Hoskay and Benally. These sodium affected soils do not provide a source of topdressing because of EC and/or SAR that exceed the topsoil suitability guidelines, Table 1. Since none of these soil series provide a source of topdressing, there was no justification in separating them, therefore the Natric soils map unit was created.

Some of the Natric soils have a surface deposit of sandy eolian material suitable as a source of topdressing. A map unit, Natric soils, overblown phase, was created to differentiate these sources of topdressing from the unsuitable Natric soils map unit.

The map components used to name the majority of mapping units were phases of soil series. Phase criteria included surface texture, depth of suitable topdressing and slope.

Mapping Unit Descriptions for BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Bc - Bacobi sandy loam, 0 to 15 percent slopes. This map unit is on mesas and plateaus. Slopes are nearly level to moderately steep. Soils have formed from alluvium and eolian materials derived predominantly from sandstone and shale. The native vegetation is mainly galleta, alkali sacaton, shadscale, and broom snakeweed. This map unit is about 75 percent Bacobi, 15 percent Monierco, and 10 percent inclusions from adjacent mapping units. Included in this unit are small areas of Shiprock, Doak, Grieta, and Razito moderately deep soils. The Bacobi soils in this map unit are moderately deep and generally provide from 6 to 40 inches of topdressing material. Topdressing availability in this map unit is controlled by

depth to shale, siltstone, or sandstone bedrock. This map unit occupies 787.7 acres or 2.42 percent of the BNCC lease area, Table 3.

BM – Bacobi and Monierco soils, 0 to 8 percent slopes. This is an undifferentiated map unit of Bacobi and Monierco loamy sands, sandy loams and sandy clay loams. These soils have formed in alluvial and eolian material derived predominantly from sandstone and shale on mesas and plateaus. Bacobi soils occupy 30 to 50 percent of most delineations and Monierco soils 35 to 55 percent. The major inclusions (2 to 5 percent) are Avalon, Farb and Shiprock soils. The minor inclusions (less than one percent) are Fajada, Fruitland and Nakai soils. Bacobi (20 to 40 inches to bedrock) and Monierco (<20 inches to bedrock) soils generally provide from 5 to 40 inches of topdressing material. This map unit occupies 866.8 acres or 2.66 percent of the BNCC lease area, Table 3.

BA - Badlands. This miscellaneous area consists of barren shale uplands that are dissected by intermittent drainages and gullies. Also included are very steep to nearly vertical rock outcrops of sandstone and shale. This map unit is mostly void of vegetation except some atriplex species and annuals that occur on micro-sites with eolian and alluvial accumulations. The slopes range from 0 to 100 percent. Included in this map unit are small areas of Natric soils. Badlands are unstable, and most disturbances cause severe water erosion and a high soil blowing hazard. This unit has no usable topdressing material and occupies 5824.5 acres or 17.88 percent of the BNCC lease area, Table 3.

Bb - Beebe, loamy sand, 0 to 3 percent slopes. This map unit occurs on flood plains and channel bottoms. These soils have formed from either alluvium or eolian derived primarily from sandstone. Slopes are level to nearly level. Soils in this map unit are highly susceptible to frequent flooding. The vegetation is mainly alkali sacaton, galleta, black greasewood, and rabbitbrush. This map unit is over 80 percent Beebe and less than 20 percent inclusions. Included in this unit are small areas of Fruitland soils intermingled with Gilco, Jocity, and, to a lesser extent, Natric soils. The depth of suitable topdressing ranges from 0 to 60 inches. Topdressing availability is largely controlled by depth to sodium

affected horizons and proximity to ephemeral streams. This map unit occupies 297.9 acres or 0.91 percent of the BNCC lease area, Table 3.

Bl - Blancot sandy clay loam, 0 to 5 percent slopes. This map unit is on fans, valleys, terraces and mesas. Soils have formed in alluvium derived predominantly from sandstone and shale. This unit is 75 to 90 percent Blancot, sandy clay loam, and Blancot, sandy loam. Blancot soils are on fans and in upland valleys, and occur with inclusions on terraces and mesas. Included in this unit are areas of Doak sandy loam (5 percent) and small areas of Shiprock, Grieta, and deep Natric soils. These additional included areas individually make up less than 15 percent of the total acreage. The Blancot soils in this unit are deep and generally provide from 36 to 60 inches of topdressing material. These soils represent some of the most suitable topdressing resources in the survey area. This map unit occupies 92.0 acres or 0.28 percent of the BNCC lease area, Table 3.

Bh – Blancot sandy clay loam, very hard, 0 to 2 percent slopes. This map unit is on fans and in valleys. It occurs with inclusions on terraces and some valleys. Soils have formed in alluvium derived predominantly from sandstone and shale. This map unit is 80 percent Blancot sandy clay loam, very hard. Included in this map unit are small areas of Blancot sandy clay loams and sandy loams. Other included soils are Doak (10 to 15 percent), Shiprock (5 to 10 percent), Grieta (5 to 10 percent) and Natric soils. Included areas make up about 20 to 25 percent of the total acreage. The Blancot soils in this map unit have 40 inches of available topdressing because the lower horizons are very hard to extremely hard. These lower horizons generally have SAR values of 15 or higher. The cementation of these horizons is associated with sodium dispersed clay, which can be restrictive to root growth. This map unit occupies 124.7 acres or 0.38 percent of the BNCC lease area, Table 3.

Dst – Disturbed. This is a miscellaneous land type mapped as a consociation. These areas vary in nature but have the common feature of being disturbed by mining or associated activity. They can vary in size and degree of disturbance. They are identified in the 1993-status. Since 1993, some of these areas have been reclaimed. This map unit occupies 8,361.7 acres or 25.66 percent of the BNCC lease area, Table 3.

Dk - Doak sandy loam, 0 to 5 percent slopes. This map unit occurs on mesas, plateaus, fan remnants, and terraces as deep, well developed soils. Slopes are nearly level to gently sloping. These soils are similar to Shiprock soils. Shiprock is coarse-loamy and Doak is fine loamy. Doak soils were formed from alluvial and eolian sediments derived from sandstone and shale. The vegetation is mainly galleta, alkali sacaton, broom snakeweed, and atriplex species. In earlier surveys, Redlands Variant was used as a map unit. That map unit has been included with the Doak map unit. This map unit is about 80 percent Doak, 10 percent Shiprock and similar soils, and 10 percent Blancot and similar soils. The depth of suitable topdressing generally ranges from 24 to 60 inches and is controlled by depth to bedrock or highly contrasting substrata. These soils represent some of the most suitable topdressing resources in the survey area. This unit occupies 273.0 acres or 0.84 percent of the BNCC lease area, Table 3.

Dh – Doak sandy loam, very hard, 0 to 3 percent slopes. This map unit occurs on terraces and mesas. The soils are formed from eolian and alluvium deposits derived from sandstone and shale. These soils are similar to Doak soils except the subsoils are very hard to extremely hard. They have high levels of sodium, which are limiting to root growth. This map unit is over 70 percent Doak, very hard phase. The major inclusions are Doak and deep Natric soils. These soils are deep and the surface texture is loamy sands and sandy loams. Available topdressing material is limited to depths ranging from 10 to 20 inches. This map unit occupies 24.4 acres or 0.07 percent of the BNCC lease area, Table 3.

Fb - Farb sandy loam, 0 to 15 percent slopes. These shallow, nearly level to moderately steep soils are located on mesas, hills, ridges, and breaks. These soils are formed in residuum, colluvium, and alluvium derived from sandstone or shale. The current vegetation is primarily galleta, alkali sacaton, sand dropseed, broom snakeweed, and atriplex species. This map unit is about 80 percent Farb and similar soils, 10 percent Persayo and similar soils, 5 percent shallow Natric soils and similar soils, and 5 percent Rock Outcrop. The depth of suitable topdressing generally ranges from 0 to 20 inches. Topdressing availability is largely controlled by depth to bedrock. This map unit occupies 1,013.5 acres or 3.11 percent of the BNCC lease area, Table 3.

Fr - Fruitland sandy loam, 0 to 15 percent slopes. This map unit occurs on upland fans and on terraces. These soils are deep and well drained. They have formed in eolian and alluvial sediments derived predominantly from sandstone. The vegetation is largely alkali sacaton, sand dropseed, black greasewood, and atriplex species. This unit is about 75 percent Fruitland soils and 15 percent Shiprock, Sogzie, and similar soils. The remaining soils include Beebe, and other soils of minor extent. The depth of suitable topdressing ranges from 0 to 60 inches and is restricted by depth to bedrock or highly contrasting and limiting substrata. This map unit occupies 109.3 acres or 0.34 percent of the BNCC lease area, Table 3.

Fv - Fruitvale-Doak-Grieta sandy loams, 0 to 5 percent slopes. This complex of soils is on mesas and upland valleys with undulating slopes. These deep soils formed predominately in alluvium derived from mixed sources. The vegetation is mainly alkali sacaton, galleta, and atriplex species. This unit is nearly 60 percent Fruitvale and similar soils, 10 to 30 percent Doak, 10 – 30 percent Grieta and 5 to 10 percent Natric soils and similar soils. The components of this map unit are so intricately intermingled that it was not practical to map them separately at the scale used. The depth of suitable topdressing generally ranges from 24 to 60 inches and is restricted by depth to bedrock, gypsum or sodium affected substrata. This unit occupies 48.3 acres or 0.15 percent of the BNCC lease area, Table 3.

Gr - Grieta sandy loam, 0 to 8 percent slopes. This map unit is found on older stable landscapes where the soils have a well developed calcic layer and occur on mesas and plateaus. Slopes are level to moderately sloping. Soils have developed from both eolian and alluvium deposits derived from sandstone and shale. Vegetation is primarily galleta, alkali sacaton, and shadscale. Grieta soils occupy about 75 percent of the unit. Inclusions are Doak, Sogzie and soils from adjoining map units, Bacobi, Shiprock, and Monierco. The depth of suitable topdressing generally ranges from 10 to 60 inches. The depth of topdressing is controlled by depth to bedrock or highly limiting calcic substrata. This map unit occupies 177.9 acres or 0.55 percent of the BNCC lease area, Table 3.

Jc - Jocity sandy loam, 0 to 3 percent slopes. This map unit is on flood plains and alluvial fans. These soils are primarily formed in alluvium from mixed sources. The vegetation is mainly galleta, alkali sacaton, black greasewood, and atriplex species. This unit is about 75 percent Jocity and 5 percent Fruitland, Gilco, and similar soils. The remaining soils are inclusions from adjacent map units. The available topdressing from this unit is controlled by depth to sodium affected, skeletal textured substrata, and occasionally depth to bedrock and ranges from 0 to 60 inches of suitable material. This map unit occupies a total of 493.3 acres or 1.51 percent of the BNCC lease area, Table 3.

Jh – Jocity, very hard, 0 to 3 percent slopes. This map unit is found as deep alluvial deposits on stream terraces and flood plains. These soils are similar to those of the Jocity sandy loams and the Jocity-Gilco complex except they are sodium affected and the deposits are very hard to extremely hard when dry. The Jocity, very hard soils occupy 60 – 80 percent of the map unit. The included soils are Gilco (<15 percent) and deep Natric soils. The available topdressing from this unit is limited by sodium affected substratum and ranges from 0 to 16 inches of suitable material. This map unit occupies a total of 210.7 acres or 0.65 percent of the BNCC lease area, Table 3.

Jf - Jocity-Fruitland sandy loams, 0 to 3 percent slopes. This map unit is on flood plains and streams terraces on level to nearly level slopes. It is also associated with coppice dune areas located along ephemeral stream banks dominated by shrubs. This unit is susceptible to occasional flooding. The native vegetation is mainly alkali sacaton, galleta, black greasewood, and atriplex species. This unit is about 60 percent Jocity soils and 30 percent Fruitland sandy loam soils. The remaining areas of this unit are inclusions of Razito moderately deep soils intermingled with Beebe soils. The depth of topdressing ranges from 0 to 60 inches for these soils and is restricted by depth to sodium affected substrata or to bedrock. This map unit occupies 143.5 acres or 0.44 percent of the BNCC lease area, Table 3.

Jg - Jocity-Gilco complex, 0 to 3 percent slopes. This map unit is found as deep alluvial deposits on flood plains. The soils range in texture from Sandy to Fine-loamy and are formed from recent alluvium along drainages. These are some of the youngest soils in the

survey area. This unit is 35 to 45 percent Gilco soils, 30 to 40 percent Jocity soils, and 15 percent Blancot, Fruitland, and similar soils. Jocity soils average more than 18 percent clay in the control section and Gilco averages less than 18 percent clay. The components of this map unit are so intricately intermingled that it was not practical to map them separately at the scale used. Included soils consist mainly of Fruitland, Stumble, and Blancot, each generally averaging less than 5 percent of a delineation. When the soils are not sodium affected, they provide a highly suitable source of topdressing. The depth of topdressing ranges from 0 to 60 inches for these soils. This map unit occupies 235.0 acres or 0.72percent of the BNCC lease area, Table 3.

Mc – Mack sandy loam, 0 to 3 percent slopes. This map unit is located on stable mesas as a deep soil having well developed calcic horizons formed in alluvium derived from sandstone and shale. The substratum is gravely or fine-loamy, which distinguishes these soils from Grieta soils which have coarse-loamy substrata. This map unit is over 80 percent Mack soils having sandy loam and loamy sand surfaces. The included soils are Doak (10 to 15 percent) and Grieta (5 to 10 percent). The depth of suitable topdressing ranges from 40 to 60 inches. Topdressing suitability is limited by depth to bedrock or limiting substratum. This map unit occupies 187.8 acres or 0.58 percent of the BNCC lease area, Table 3.

Mq - Mayqueen loamy sand, 0 to 8 percent slopes. These deep and very deep soils are on stabilized dunes, mesas and valleys. This map unit is primarily formed from stabilized eolian material derived primarily from sandstone. The vegetation is mainly galleta, sand dropseed, alkali sacaton, and atriplex species. The Mayqueen soils occupy over 80 percent of the unit. The major included soils are Razito, Shiprock, and Sogzie, approximately 5 percent each. The depth of suitable topdressing generally ranges from 20 to 60 inches and is controlled by depth to bedrock and highly contrasting, limiting subsurface horizons. This map unit occupies 63.0 acres or 0.19 percent of the BNCC lease area, Table 3.

Ms – Mayqueen-Shiprock loamy sands, 0 to 8 percent slopes. This map unit is on mesas and plateaus and consists of deep soils well suited for topdressing material. This unit is 40 to 60 percent Mayqueen and 30 to 40 percent Shiprock. The major included soils are

Razito, 5 percent, with lesser amounts of Bacobi, Blancot, Doak, Grieta, and Stumble. The depth of available topdressing ranges from 20 to 60 inches. This map unit occurs on 281.1 acres or 0.86 percent of the BNCC lease area, Table 3.

Mh – Mayqueen-Shiprock loamy sands, very hard, 0 to 8 percent slopes. This map unit is on mesas and plateaus. The soils consist of soils very similar to the Mayqueen-Shiprock complex except they are sodium affected and the dry consistence of the subsurface is very hard or extremely hard. The Mayqueen very hard soils occupy 35 to 45 percent of the map unit and Shiprock very hard occupy 30 to 40 percent of the map unit. Inclusions are few and mostly consist of soils from associated map units, Mayqueen, Shiprock and Grieta. The depth of suitable topdressing is limited by the dry consistence of the subsurface and averages 20 inches. This map unit occupies 8.6 acres or 0.03 percent of the BNCC lease area, Table 3.

Mo - Monierco sandy loam, 0 to 15 percent slopes. These shallow well drained soils are on mesas, ridges, and plateaus. They formed in alluvial and eolian materials overlying sedimentary rock on nearly level to moderately steep slopes. The current vegetation is mainly galleta, alkali sacaton, and shadscale. This unit is nearly 75 percent Monierco soils, 15 percent Bacobi soils, and 5 percent Persayo, Farb and similar soils. The remaining soils are inclusions from adjacent map units. The depth of suitable topdressing generally ranges from 0 to 20 inches and is primarily controlled by depth to bedrock. This unit occupies 927.0 acres or 2.85 percent of the BNCC lease area, Table 3.

Nk – Nakai sandy loam, 0 to 5 percent slopes. This map unit occurs on stable terraces and alluvial fans. Nakai soils are derived from eolian and alluvial material derived from sandstone and shale. The Nakai soils occupy over 80 percent of the map unit. Included are similar soils which are primarily Avalon and Grieta soils. The depth of suitable topdressing ranges from 10 to 20 inches and is primarily controlled by depth to bedrock or a calcic horizon. This unit occupies 49.5 acres or 0.15 percent of the BNCC lease area, Table 3.

NA – Natric soils, 0 to 8 percent slopes. This is an undifferentiated map unit of Natrargids and Natragypsids that are shallow, moderately deep and deep. These Natric soils occur on mesas, plateaus, alluvial fans and in valleys. They are derived primarily from alluvium or directly from shale. In most delineations, they lack vegetation except for sparsely distributed salt tolerant grasses, forbs and shrubs. Most of the components do not provide a source of topdressing; therefore, they were combined to form a single undifferentiated map unit. The Natric soils in this map unit are primarily: Huerfano, Muff, Fajada, Patel, Benally, Uffens and Hoskay. There are few inclusions in this mapping unit except at the boundary of other map delineations. These soils are not suitable as sources of topdressing because they are highly sodium affected with Natric horizons having SAR values ranging from 15 to over 50. This map unit occupies 7,448.4 acres or 22.86 percent of the total BNCC lease area, Table 3.

NO – Natric soils overblown, 0 to 8 percent slopes. This map unit is similar to the Natric soils map unit except the surface textures of these soils are sands and loamy sands that originate from recently deposited eolian material. In most cases, the eolian sands are less than 20 inches deep. When the eolian sands covering the Natric soils were greater than 20 inches deep, the soils were mapped as Razito, very hard soils. The Natric soils of this unit include Fajada, Uffens, Benally, Huerfano and Patel. Inclusions are Razito very hard, Trail, Blancot, Doak and Shiprock soils. Soils of this unit do provide a source of topdressing that ranges from 0 to 20 inches of material. This map unit occupies 550.2 acres or 1.69 percent of the total BNCC lease area, Table 3.

Pr - Persayo clay loam, 0 to 15 percent slopes. This map unit is on mesas, uplands, and ridges. Slopes cover a wide range of classes from level to strongly sloping. These shallow, well drained soils have formed in residuum and alluvium derived from carbonaceous shale, siltstone, and sandstone. Vegetation is mainly alkali sacaton, galleta, and atriplex species. This unit is about 75 percent Persayo, 15 percent Huerfano and similar soils, and 10 percent Patel and similar soils. The depth of topdressing in this unit ranges from 0 to 20 inches and is controlled by depth to bedrock and sodium affected strata. This map unit occupies 443.1 acres or 1.36 percent of the BNCC lease area, Table 3.

PF - Persayo, Farb, and Rock Outcrop soils, 0 to 50 percent slopes. This undifferentiated map unit is on hills, ridges, and mesas. Slopes range from nearly level to very steep. These soils formed in residuum derived mainly from sandstone and shale. The vegetation is primarily galleta, alkali sacaton, and atriplex species. This unit is about 35 to 45 percent Persayo and similar soils, 30 to 40 percent Farb and similar soils, and 15 to 25 percent Rock Outcrop and Badlands. The components of this map unit are so intricately intermingled it was not practical to map them separately at the scale used. Salvageable topdressing depth in this unit ranges from 0 to 20 inches. Topdressing availability is severely limited because of complex, steep slopes and depth to bedrock. This map unit occupies 240.4 acres or 0.74 percent of the BNCC lease area, Table 3.

Pnd – Pond. This is a miscellaneous land type mapped as a consociation. These areas consist of water catchment structures constructed to catch surface runoff. They may contain water at various times of the year or they may be dry for various lengths of time. This map unit occupies 11.0 acres or 0.03 percent of the BNCC lease area, Table 3.

Rz - Razito loamy sand, 0 to 8 percent slopes. This unit consists of deep, excessively drained soils on mesas and backslopes formed in eolian sands. The dominant landform for these soils are wind oriented, longitudinal sand ridges. The vegetation is primarily Indian ricegrass, alkali sacaton, galleta, sand dropseed, broom snakeweed, and atriplex species. The Razito soils occupy over 75 percent of the unit. The major inclusion is Mayqueen soils occupying nearly 15 percent of the unit. These soils are similarly managed as Razito soils. Other inclusions are Shiprock, Sogzie, and Stumble soils. The available topdressing material generally ranges from 20 to 60 or more inches. This map unit occupies 1,017.4 acres or 3.12 percent of the BNCC lease area, Table 3.

Rm - Razito loamy sand, moderately deep, 0 to 8 percent slopes. This unit consists of moderately deep, excessively drained soils on mesas and backslopes formed in eolian sands. The dominant landform for these soils are wind oriented, longitudinal sand ridges. The vegetation is primarily Indian ricegrass, alkali sacaton, galleta, sand dropseed, broom snakeweed, and atriplex species. This unit is nearly 75 percent Razito loamy sand,

moderately deep. Stumble inclusions are Mayqueen, Shiprock and similar soils. Other inclusions are mainly dissimilar soils, such as Huerfano and Patel, from adjacent map units. The available topdressing material generally ranges from 20 to 40 inches and is controlled by depth to bedrock or sodium affected substrata that has a dry consistence of very hard or extremely hard. This unit occupies 564.6 acres or 1.73 percent of the BNCC lease area, Table 3.

Rcl – Reclaimed Land. This is a miscellaneous land type mapped as a consociation. These are areas that have been reclaimed and are represented in the 1993-status. They can vary greatly in size. Typically, the spoil has been graded and topdressing applied. They vary in age since reclamation was initiated. In some cases, the present day conditions may represent something other than reclaimed land. This unit occupies 8.2 acres or 0.03 percent of the BNCC lease area, Table 3.

RO - Rock Outcrop. This miscellaneous area consists primarily of exposures of barren sandstone on cliffs, breaks, bluffs and ridges. Slope ranges from 0 to 100 percent. This map unit is mostly void of vegetation; however, some atriplex species and annuals occur on micro sites with eolian and alluvial accumulations. Included in this unit are small areas of Farb, Persayo, and Huerfano soils. This map unit from a practical standpoint has no suitable topdressing material. This unit occupies 20.3acres or 0.06 percent of the BNCC lease area, Table 3.

Sp - Shiprock loamy sand-sandy loam, 0 to 8 percent slopes. The soils are formed in alluvium and eolian material derived from sandstone and shale. This map unit is on mesas and plateaus. The vegetation is mostly galleta, alkali sacaton, sand dropseed, broom snakeweed, rabbitbrush, and atriplex species. The unit is over 75 percent Shiprock soils. Included in this map unit are Grieta and Sogzie soils with minor areas of Doak and Mayqueen soils. These soils represent some of the most suitable sources of topdressing material. The depth of suitable topdressing generally ranges from 40 to 60 inches and is mainly controlled by depth to bedrock or highly contrasting, limiting substrata. This map unit occupies 501.7 acres or 1.54 percent of the BNCC lease area, Table 3.

Sh - Shiprock sandy loam, very hard, 0 to 8 percent slopes. This map unit occurs on mesas and terraces as deep, well developed soils. The soils and vegetation are similar to Shiprock soils but the substrata are very hard or extremely hard. Typically, the sodium levels in the substrata exceed the topsoil or topdressing suitability limits. Consistence is strongly associated with the sodicity and therefore is used to characterize this phase of Shiprock soils. Topdressing depth is limited by material that is either very hard or extremely hard. The map unit is about 70 percent Shiprock very hard soils with inclusions of Bacobi, Grieta, Mayqueen, Sogzie, and Razito. The depth of suitable topdressing generally ranges from 10 to 30 inches. This map unit occupies 234.8 acres or 0.72 percent of the BNCC lease area, Table 3.

Sb – Shiprock-Blancot complex, 0 to 8 percent slopes. This map unit is on fans, terraces and mesas. Soils have formed in alluvium derived predominantly from sandstone and shale. This unit is 40 to 50 percent Shiprock loamy sand and sandy loan and 30 to 40 percent Blancot soils. Shiprock soils occur on stable mesas and terraces whereas Blancot soils are associated with fans and stable terraces. Included in this unit are small areas of Doak, Mayqueen, and Grieta soils. Included areas make up less than 10 percent of the map unit. The Shiprock-Blancot soils are deep and provide 40 to 60 or more inches of available topdressing material. This unit occupies 33.2 acres of 0.10 percent of the BNCC lease area, Table 3.

SM - Shiprock, Mayqueen, and Bacobi sandy loams, 0 to 5 percent slopes. This undifferentiated map unit is on gently sloping areas of mesas, plateaus, and terraces. These soils formed in eolian and alluvial sediments derived from sandstone and shale. The vegetation is predominately galleta, alkali sacaton, sand dropseed, Indian ricegrass, broom snakeweed, and atriplex species. This map unit is about 25 to 45 percent Shiprock, 20 to 40 percent Mayqueen, 15 to 35 percent Bacobi, 5 percent Fruitvale, and 5 percent Natric soils. The components of this unit are so intricately intermingled and unpredictable in the landscape that it was not practical to map them separately at the scale used. The depth of suitable topdressing generally ranges from 10 to 60 or more inches and is mainly controlled

by depth to bedrock. This map unit occupies 1,345.4 acres or 4.13 percent of the BNCC lease area, Table 3.

St - Stumble loamy fine sand, 0 to 15 percent slopes. This map unit occurs on sides of valleys and alluvial fans. Soils have formed in sandy alluvium and eolian deposits derived from sandstone and shale. The current vegetation is predominately sand dropseed, galleta, Indian ricegrass, broom, snakeweed, rabbitbrush, and atriplex species. This unit is 80 percent Stumble, loamy fine sand. Included are limited areas of Razito and Mayqueen soils. The soils are sandy and generally provide 15 to 60 inches of suitable topdressing material. Depth of suitable topdressing is controlled by depth to bedrock or skeletal textured substrata. This unit occupies 155.8 acres or 0.48 percent of the BNCC lease area, Table 3.

Ts – Topdressing Stockpile. This is a miscellaneous land type mapped as a consociation. These areas consist of stockpiled topdressing removed from baseline areas which are represented in the 1993-status; since then, new stockpiles may have been created, some added to and some may have been removed. The stockpile material can vary greatly in volume and may exist for extended periods of time. The stockpile material, at some time will be used as topdressing for reclamation. This unit occupies 52.8 acres or 0.16 percent of the SRCR survey area, Table 3.

Tr – Trail loamy sand-sandy loam, 0 to 8 percent slopes. These soils are on flood plains and low river terraces. They have formed in sandy alluvium derived from sandstone and shale. Trail soils usually occur in higher positions in the landscape than the related Gilco soils. The map unit is over 80 percent Trail soils. Inclusions are Trail very hard, Gilco and, on steeper slopes, Razito soils. The depth of available topdressing ranges from 20 to 60 or more inches. The map unit occupies 36.1 acres or 0.11 percent of the BNCC lease area, Table 3.

Th – Trail, very hard, 0 to 8 percent slopes. This map unit is on eroded terraces which resemble the substratum of stable mesas or flood plains. Soils have formed from alluvium derived from sandstone and shale. The soils are sodium affected and are generally very hard

or extremely hard throughout the profile. The unit is 80 percent Trail very hard soils with inclusions of Stumble, Razito, and various Natric soils. The depth of available topdressing ranges from 6 to 24 inches. The map unit occupies 41.1 acres or 0.13 percent of the BNCC lease area, Table 3.

Ty - Tsaya loam, 0 to 15 percent slopes. This map unit is on nearly level to strongly sloping areas of mesas, hills, and ridges. These shallow soils formed in residuum derived mainly from sandstone. Vegetation is mostly atriplex species and annuals with sparse stands of alkali sacaton and galleta occurring in eolian accumulations. This map unit is about 60 percent Tsaya and similar soils and 10 percent Rock Outcrop. Included soils of limited extent are Chipeta clay, Patel clay, Huerfano, and Jocity. Soil materials in this map unit generally range in depth from 0 to 20 inches, but typically are not suitable for use as topdressing because of high rock content and sodium hazard. This map unit occupies 65.0 acres or 0.2 percent of the BNCC lease area, Table 3.

Topdressing Availability

The estimated topdressing volume available is presented for each mapping unit, by area and as baseline or 1993-status calculation, respectively Tables 7 - 12 and Tables 13 - 18. The total volume of available topdressing for SRCR is 56,372,737 bcy for baseline, Table 19, and 43,018,154 bcy for 1993-status, Table 20. The acreage and topdressing volume by area follows.

Area 1

The total area for Area 1 is 4,763.6 ac, 14.27% of the SRCR area, Table 19. The baseline topdressing volume was 10,343,940 bcy, Table 19 and the 1993-status topdressing volume is 2,049,705 bcy, Table 20.

Area 2

The total area for Area 2 is 5,919.7 ac, 17.74% of the SRCR area, Table 19. The baseline topdressing volume was 6,304,399 bcy, Table 19 and the 1993-status topdressing volume is 1,927,958 bcy, Table 20.

Area 3

The total area for Area 3 is 4,953.2 ac, 14.84% of the SRCR area, Table 19. The baseline topdressing volume was 6,464,531 bcy, Table 19 and the 1993-status topdressing volume is 5,810,624 bcy, Table 20.

Area 4 North

The total area for Area 4 North is 4,728.0 ac, 14.17% of the SRCR area, Table 19. The baseline and 1993-status topdressing volumes are the same 3,929,231 bcy, Tables 19 and 20.

Area 4 South

The total area for Area 4 South is 6,025.2 ac, 18.06% of the SRCR area, Table 19. The baseline and 1993-status topdressing volumes are the same 14,098,931 bcy, Tables 19 and 20.

Area 5

The total area for Area 5 is 6,981.1 ac, 20.92% of the SRCR area, Table 19. The baseline and 1993-status topdressing volumes are the same 15,201,705 bcy, Tables 19 and 20.

PRIME FARMLAND DETERMINATION

Investigation of Prime Farmland

Multiple investigations were conducted to determine whether lands within the BNCC coal lease area were classified as prime farmland. Norman Vigil, Acting State Conservationist from the NRCS was asked to determine if the survey area contained prime farmland and to write a letter regarding the investigation.

Results of Investigation

1. The area within the BNCC coal lease area has not been historically used as crop land.
2. The area within the BNCC coal lease area has an average annual precipitation of six inches and has no naturally sub-irrigated lands.

3. The area within the BNCC coal lease area has no soil mapping units that can be classified as prime farmland under the definition of prime farmland by the USDA-NRCS (7 CFR 657.5)
4. Letter from Norman Vigil, Acting State Conservationist USDA-NRCS that verifies there is no prime farmland within the BNCC coal lease area, attached.

Conclusion

Based on the conditions (1-4) discussed above, it is concluded there is no prime farmland within the BNCC coal lease area.

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Table 1. Topsoil and Topsoil Substitute Suitability Criteria for the Southwestern United States* (OSM, 1999)

Parameter	Material Quality		
	Good	Marginal	Unsuitable
pH	6.0-8.4	5.5-6.0	< 5.5
EC mmhos/cm (1)	< 4.0	4.0-12.0	> 12.0
SAR (2)			
sl and coarser	<12.0	12.0-18.0	> 18.0
l and cl	<10.0	10.0-16.0	> 16.0
40% clay	<8.0	8.0-14.0	> 14.0
Texture (3)	ls, sl, l, sil, with 35% c	s, lcs, cl, sicl, with 45% c	> 45% c
Saturation %	25-80	25-80	<25 or >80
CaCo3 %	0-15	15-30	30
Coarse Fragments (4)			
< 3 inch %	15	15-35	35
> 3 inch %	3	3-10	10
Erosion Factor (5)	< .37	< .37	
Acid-base potential	+5 T CaCo3 Equiv./1000T	+0 T CaCo3 Equiv./1000T	-5 T CaCo3 Equiv./1000T
Boron	5 ppm	5 ppm	>5 ppm
Selenium (Total)		≤ 0.8 ppm	> 0.8 ppm
Selenium (extractable)		≤ 0.15 ppm	> 0.15 ppm

* These suitability criteria may be modified on a case by case basis if sufficient data are submitted to support the modifications and the submitted data technically represent the site specific nature of the modification.

1. When EC is less than 2.0, then SAR's cannot be >18.

2. SAR values can be modified if adequate data is submitted to support proposed modifications.

Table 1. Continued

3. ls=loamy sand; lcs=loamy coarse sand; sl=sandy loam; l=loam; sil=silt loam; scl=sandy clay loam; s=sand; cl=clay loam; sicl=silty clay loam; cl=clay.

4. For topsoil substitutes/supplements, percentage can be increased if it is shown that the higher percentage will increase slope stability and/or vegetation establishment. Suitabilities will be determined on a site specific basis.

5. For each material proposed to reclaim slopes $\geq$ 25% (4h:lv), a K factor must be determined from the results of appropriate physical and chemical analyses, as outlined in the National Soils Handbook (SCS, 1983). Material suitability will be determined using the Revised Universal Soil Loss Equation (Renard, ARS, 1990).

Table 2. Baseline Calculations for Area, Percent of Area, and Topdressing Volume Available from Each Soil Mapping Unit for the BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Bacobi and Monierco soils, 0 to 8 % slopes	39,923,711	916.5	2.75	1,848,320
Bacobi sandy loam, 0 to 15 % slopes	35,176,502	807.5	2.42	2,690,387
Badlands	383,213,522	8,797.4	26.36	0
Beebe loamy sand, 0 to 3 % slopes	12,976,287	297.9	0.89	2,162,714
Blancot sandy clay loam, 0 to 5 % slopes	4,008,374	92.0	0.28	645,549
Blancot, sandy clay loam, very hard, 0 to 2 % slopes	5,454,115	125.2	0.38	656,514
Disturbed	9,455,809	217.1	0.65	0
Doak sandy loam, 0 to 5 % slopes	12,005,212	275.6	0.83	1,739,560
Doak sandy loam, very hard, 0 to 3 % slopes	1,063,092	24.4	0.07	157,495
Farb sandy loam, 0 to 15 % slopes	62,283,499	1,429.8	4.28	1,096,433
Fruitland sandy loam, 0 to 15 % slopes	4,763,238	109.3	0.33	579,664
Fruitvale-Doak-Grieta sandy loams, 0 to 5 % slopes	2,103,667	48.3	0.14	289,470
Grieta sandy loam, 0 to 8 % slopes	64,531,887	1,481.4	4.44	3,538,648
Jocity-Fruitland sandy loams, 0 to 3 % slopes	6,250,624	143.5	0.43	718,413
Jocity-Gilco complex, 0 to 3 % slopes	10,235,246	235.0	0.70	1,739,491
Jocity sandy loam, 0 to 3 % slopes	26,209,391	601.7	1.80	378,848
Jocity, very hard, 0 to 3 % slopes	17,555,609	403.0	1.21	1,190,572

Table 2. Continued

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Mack sandy loam, 0 to 3 % slopes	8,607,348	197.6	0.59	1,593,953
Mayqueen-Shiprock loamy sands, 0 to 8 % slopes	39,008,926	895.5	2.68	4,936,315
Mayqueen-Shiprock loamy sands, very hard, 0 to 8 % slopes	373,102	8.6	0.03	23,031
Mayqueen loamy sand, 0 to 8 % slopes	2,742,780	63.0	0.19	487,670
Monierco sandy loam, 0 to 15 % slopes	40,380,576	927.0	2.78	1,967,805
Nakai sandy loam, 0 to 5 % slopes	2,794,751	64.2	0.19	129,387
Natric soils, 0 to 8 % slopes	387,997,898	8,907.2	26.69	0
Natric soils, overblown, 0 to 8 % slopes	24,776,469	568.8	1.70	751,441
Persayo clay loam, 0 to 15 % slopes	19,300,433	443.1	1.33	0
Persayo, Farb, and Rock Outcrop soils, 0 to 50 % slopes	10,471,909	240.4	0.72	35,909
Razito loamy sand, 0 to 8 % slopes	24,995,057	573.8	1.72	2,089,627
Razito loamy sand, moderately deep, 0 to 8 % slopes	65,975,201	1,514.6	4.54	10,164,405
Rock Outcrop	883,746	20.3	0.06	0
Shiprock-Blancot complex, 0 to 8 % slopes	3,543,982	81.4	0.24	656,293
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	33,818,417	776.4	2.33	4,956,859
Shiprock sandy loam, very hard, 0 to 8 % slopes	19,044,906	437.2	1.31	1,048,171
Shiprock, Mayqueen, and Bacobi sandy loam, 0 to 5 % slopes	58,605,545	1,345.4	4.03	6,670,287
Stumble loamy fine sand, 0 to 15 % slopes	6,861,041	157.5	0.47	1,027,634

Table 2. Continued

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Trail loamy sand-sandy loam, 0 to 8 % slopes	1,617,528	37.1	0.11	294,550
Trail, very hard, 0 to 8 % slopes	1,789,472	41.1	0.12	77,323
Tsaya loam, 0 to 15 % slopes	2,830,283	65.0	0.19	0
Total	1,453,629,157	33,370.7	100.00	56,342,737

Table 3. 1993-status Calculations for Area, Percent of Area, and Topdressing Volume Available from Each Soil Mapping Unit for the BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Bacobi sandy loam, 0 to 15 % slopes	34,311,743	787.7	2.42	2,639,676
Bacobi and Monierco soils, 0 to 8 % slopes	37,755,970	866.8	2.66	1,747,962
Badlands	253,716,523	5,824.5	17.88	0
Beebe loamy sand, 0 to 3 % slopes	12,976,287	297.9	0.91	2,162,714
Blancot sandy clay loam, 0 to 5 % slopes	4,008,374	92.0	0.28	645,549
Blancot, sandy clay loam, very hard, 0 to 2 % slopes	5,431,747	124.7	0.38	653,821
Disturbed	364,236,134	8,361.7	25.66	0
Doak sandy loam, 0 to 5 % slopes	11,892,866	273.0	0.84	1,724,996
Doak sandy loam, very hard, 0 to 3 % slopes	1,063,092	24.4	0.07	157,495
Farb sandy loam, 0 to 15 % slopes	44,149,407	1,013.5	3.11	648,678
Fruitland sandy loam, 0 to 15 % slopes	4,763,238	109.3	0.34	579,664
Fruitvale-Doak-Grieta sandy loams, 0 to 5 % slopes	2,103,667	48.3	0.15	289,470
Grieta sandy loam, 0 to 8 % slopes	7,749,226	177.9	0.55	559,311
Jocity sandy loam, 0 to 3 % slopes	21,489,498	493.3	1.51	320,578
Jocity, very hard, 0 to 3 % slopes	9,179,111	210.7	0.65	816,332
Jocity-Fruitland sandy loams, 0 to 3 % slopes	6,250,624	143.5	0.44	718,413
Jocity-Gilco complex, 0 to 3 % slopes	10,235,246	235.0	0.72	1,739,491

Table 3. Continued

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Mack sandy loam, 0 to 3 % slopes	8,180,820	187.8	0.58	1,514,967
Mayqueen loamy sand, 0 to 8 % slopes	2,742,780	63.0	0.19	487,670
Mayqueen-Shiprock loamy sands, 0 to 8 % slopes	12,243,755	281.1	0.86	1,549,364
Mayqueen-Shiprock loamy sands, very hard, 0 to 8 % slopes	373,102	8.6	0.03	23,031
Monierco sandy loam, 0 to 15 % slopes	40,380,576	927.0	2.85	1,967,805
Nakai sandy loam, 0 to 5 % slopes	2,156,531	49.5	0.15	99,839
Natric soils, 0 to 8 % slopes	324,452,854	7,448.4	22.86	0
Natric soils, overblown, 0 to 8 % slopes	23,966,379	550.2	1.69	726,438
Persayo clay loam, 0 to 15 % slopes	19,300,433	443.1	1.36	0
Persayo, Farb, and Rock Outcrop soils, 0 to 50 % slopes	10,471,909	240.4	0.74	35,909
Pond	479,069	11.0	0.03	0
Razito loamy sand, 0 to 8 % slopes	44,318,615	1,017.4	3.12	7,022,864
Razito loamy sand, moderately deep, 0 to 8 % slopes	24,592,121	564.6	1.73	2,052,318
Reclaimed Land	356,614	8.2	0.03	0
Rock Outcrop	883,746	20.3	0.06	0
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	21,854,778	501.7	1.54	3,258,317
Shiprock sandy loam, very hard, 0 to 8 % slopes	10,229,297	234.8	0.72	558,415
Shiprock-Blancot complex, 0 to 8 % slopes	1,447,643	33.2	0.10	268,082

Table 3. Continued

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Shiprock, Mayqueen, and Bacobi sandy loam, 0 to 5 % slopes	58,605,545	1,345.4	4.13	6,670,287
Stumble loamy fine sand, 0 to 15 % slopes	6,786,856	155.8	0.48	1,015,041
Topdressing stockpile	2,300,812	52.8	0.16	0
Trail loamy sand-sandy loam, 0 to 8 % slopes	1,572,409	36.1	0.11	286,334
Trail, very hard, 0 to 8 % slopes	1,789,472	41.1	0.13	77,323
Tsaya loam, 0 to 15 % slopes	2,830,283	65.0	0.20	0
Total	1,453,629,157	33,370.7	100.00	43,018,154

Table 4. Family Classification of Each Soil Series and Hydrologic Group Identified in the BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Series	Taxonomic Classification of Soils	Hydrologic Group
Avalon	Fine-loamy, mixed, superactive, mesic Typic Haplocalcid	B
Bacobi	Fine-loamy, mixed, superactive, mesic Typic Haplargids	C
Badlands	Miscellaneous land type	D
Beebe	Sandy, mixed, mesic Typic Torrifluvents	A
Benally	Fine-loamy, mixed, active, mesic Typic Natrigypsids	D
Blancot	Fine-loamy, mixed, superactive, mesic Ustic Haplargids	B
Chipeta	Clayey, mixed, calcareous, mesic, shallow Typic Torriorthents	D
Doak	Fine-loamy, mixed, active, mesic Typic Haplargids	B
Fajada	Fine-loamy, mixed, superactive, mesic Typic Natrargids	D
Farb	Loamy, mixed, calcareous, mesic Lithic Torriorthents	D
Fruitland	Coarse-loamy, mixed, superactive, calcareous, mesic Typic Torriorthents	B
Fruitvale	Fine-loamy, mixed, active, mesic Typic Argigypsids	B
Gilco	Coarse-loamy, mixed, superactive, calcareous, mesic Typic Torrifluvents	B
Grieta	Fine-loamy, mixed, superactive, mesic Typic Calciargids	B
Hoskay	Fine, mixed, superactive, mesic Vertic Natrigypsids	D
Huerfano	Loamy, mixed, superactive, mesic, shallow Typic Natrargids	D
Jocity	Fine-loamy, mixed, superactive, calcareous, mesic Typic Torrifluvents	B
Mack	Fine-loamy, mixed, superactive, mesic Typic Calciargids	B
Mayqueen	Coarse-loamy, mixed, superactive, mesic Typic Haplargids	B
Mesa	Finy-loamy, mixed, superactive, mesic Typic Calciargids	B
Monierco	Loamy, mixed, superactive, mesic, shallow Typic Haplargids	D
Muff	Fine-loamy, mixed, superactive, mesic Typic Natrargids	D
Nakai	Coarse-loamy, mixed, superactive, mesic Typic Haplocalcid	B
Patel	Fine, mixed, active, mesic Typic Natrargids	D

Table 4. Continued

Series	Taxonomic Classification of Soils	Hydrologic Group
Persayo	Loamy, mixed, active, calcareous, mesic, shallow Typic Torriorthents	D
Razito	Sandy, mixed, mesic Typic Torripsamments	A
Redlands	Fine-loamy, mixed, superactive, mesic Typic Haplargid	B
Rock Outcrop	Miscellaneous land type	D
Shiprock	Coarse-loamy, mixed, superactive, mesic Typic Haplargids	B
Sogzie	Coarse-loamy, mixed, superactive, mesic Typic Calciargids	B
Stumble	Mixed, mesic Typic Torripsamments	A
Trail	Sandy, mixed, mesic Typic Torrifluvent	A
Tsaya	Loamy-skeletal, mixed, superactive, calcareous, mesic Lithic Torriorthents	D
Turley	Fine-loamy, mixed, acrive, calcareous, mesic Typic Torriorthent	D
Uffens	Fine-loamy, mixed, superactive, mesic Typic Natrargids	D

Table 5. Key to Soils of the BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

DIAGNOSTIC EPIPEDON OR SUBSURFACE HORIZONS LACKING

ENTISOL

Less than 35% rock fragments, loamy fine sand or coarser in all subhorizons to 100 cm, lithic or paralithic contact.	**Psamments**
Deeper than 25 cm, slope less than 25% and an irregular decrease in organic matter with depth or remains above 0.2% o.m. to 125 cm	**Fluvents**
Other Entisols	**Orthents**

Psamments

All are Typic Torripsamments

Typic Torripsamment (>100 to Lithic contact)

Eolian or Alluvial

Rock fragments - 0 to 5% throughout — Razito

Eolian or Alluvial

Gravelly substratum, rock fragments

5 to 35% in some horizons — Stumble

Fluvents

All are Typic Torrifluvents (>100 cm to lithic contact)

Sandy (loamy fine sand or coarser)

ESP - 20 to 70% upper 50 cm

Color - 7.5YR to 10 YR — Beebe

Table 5. Continued

Sandy (loamy fine sand or coarser)	
ESP - <20% upper 50 cm	
Color - 2.5YR to 7.5YR	Trail
Coarse-loamy (<18% clay but not sandy)	
Salinity - 0 to 16 dS/m	
Sodic - <13 SAR	Gilco
Fine-loamy (18 to 35% clay)	
Salinity - 0 – 2 dS/m but can be 30	
Sodic – 0 – 10 SAR but can be 35	Jocity

Orthents

All are Torriorthents

Lithic contact with 50 cm	**Lithic Torriorthents**
Lithic contact >50 cm	**Typic Torriorthents**

Lithic Torriorthents

Loamy-skeletal	
Rock fragments – 35 to 80	
Clay content – 18 to 35%	Tsaya
Loamy (Coarse-loamy <18% clay)	Farb
Loamy (Fine-loamy 18 – 35% clay)	Persayo
Clayey (Clayey >35% clay)	Chipeta

Table 5. Continued

Typic Torriorthents

Coarse-loamy (<18% clay)	Fruitland
Fine-loamy (18 – 35% clay)	Turley

DIAGNOSTIC SUBSURFACE HORIZON PRESENT

ARIDISOL

Gypsic or Petrogypsic horizon	**Gypsids**
Argillic or Natric horizon	**Argid**
Calcic horizon	**Calcid**

Gypsids

Natric horizon

Fine (>35% clay)	Hoskay
Fine-loamy (18% - 35% clay)	Benally

Argillic horizon

Fine-loamy (18 – 35% clay)	Fruitvale

Argids

Natric horizon	**Natrargids**
Calcic horizon	**Calciargids**
Other argids	**Haplargids**

Table 5. Continued

Natrargids	
Paralithic contact < 50 cm	Huerfano
Paralithic contact 50 – 100 cm	
Fine-loamy (By present)	Fajada
Fine-loamy (By lacking)	Muff
Fine	Patel
Paralithic contact >100 cm	
Fine-loamy (By lacking)	Uffens
Calciargids	
Coarse-loamy	Sogzie
Fine-loamy	
Substratum - Fine-loamy	Mack
Substratum – Coarse-loamy	Grieta
Substratum – Loamy-skeletal	Mesa
Haplargids	
Lithic or Paralithic <50 cm	Monierco
Lithic or paralithic 50 to 100 cm	Bacobi (Kiki)
Lithic or paralithic >100 cm	
Coarse-loamy (Bk lacking)	Mayqueen
Coarse-loamy (Bk present)	Shiprock
Fine-loamy (Bk lacking)	Blancot
Fine-loamy	
(Bk & Bt present less than 25 cm)	Doak
Fine-loamy	
(Bk & Bt present more than 25 cm)	Redlands

Table 5. Continued

Calcids		
	Coarse-loamy	Nakai
	Fine-loamy	Avalon

Table 6. Soil Mapping Units and their Associated Map Unit Symbol for the BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Soil Mapping Unit	Map Unit Symbol
Bacobi sandy loam, 0 to 15 % slopes	Bc
Bacobi and Monierco soils, 0 to 8 % slopes	BM
Badlands	BA
Beebe loamy sand, 0 to 3 % slopes	Bb
Blancot sandy clay loam, 0 to 5 % slopes	Bl
Blancot, sandy clay loam, very hard, 0 to 2 % slopes	Bh
Disturbed	Dst
Doak sandy loam, 0 to 5 % slopes	Dk
Doak sandy loam, very hard, 0 to 3 % slopes	Dh
Farb sandy loam, 0 to 15 % slopes	Fb
Fruitland sandy loam, 0 to 15 % slopes	Fr
Fruitvale-Doak-Grieta sandy loams, 0 to 5 % slopes	Fv
Grieta sandy loam, 0 to 8 % slopes	Gr
Jocity sandy loam, 0 to 3 % slopes	Jc
Jocity, very hard, 0 to 3 % slopes	Jh
Jocity-Fruitland sandy loams, 0 to 3 % slopes	Jf
Jocity-Gilco complex, 0 to 3 % slopes	Jg

Table 6. Continued

Soil Mapping Unit	Map Unit Symbol
Mack sandy loam, 0 to 3 % slopes	Mc
Mayqueen loamy sand, 0 to 8 % slopes	Mq
Mayqueen-Shiprock loamy sands, 0 to 8 % slopes	Ms
Mayqueen-Shiprock loamy sands, very hard,0 to 8 % slopes	Mh
Monierco sandy loam, 0 to 15 % slopes	Mo
Nakai sandy loam, 0 to 5 % slopes	Nk
Natric soils, 0 to 8 % slopes	NA
Natric soils, overblown, 0 to 8 % slopes	NO
Persayo clay loam, 0 to 15 % slopes	Pr
Persayo, Farb, and Rock Outcrop soils, 0 to 50 % slopes	PF
Pond	Pnd
Razito loamy sand, 0 to 8 % slopes	Rz
Razito loamy sand, moderately deep, 0 to 8 % slopes	Rm
Reclaimed Land	Rcl
Rock Outcrop	RO
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	Sp
Shiprock sandy loam, very hard, 0 to 8 % slopes	Sh
Shiprock-Blancot complex, 0 to 8 % slopes	Sb
Shiprock, Mayqueen, and Bacobi sandy loam, 0 to 5 % slopes	SM

Table 6. Continued

Soil Mapping Unit	Map Unit Symbol
Stumble loamy fine sand, 0 to 15 % slopes	St
Topdressing stockpile	Ts
Trail loamy sand-sandy loam, 0 to 8 % slopes	Tr
Trail, very hard, 0 to 8 % slopes	Th
Tsaya loam, 0 to 15 % slopes	Ty

Table 7. Baseline Calculations for Area, Percent of Area, and Topdressing Volume Available from Each Soil Mapping Unit Located in Area 1, BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Bacobi and Monierco soils, 0 to 8 % slopes	5,808,845	133.4	2.80	268,928
Badlands	32,811,427	753.2	15.81	0
Disturbed	9,455,809	217.1	4.56	0
Doak sandy loam, 0 to 5 % slopes	154,114	3.5	0.07	19,978
Doak sandy loam, very hard, 0 to 3 % slopes	22,804	0.5	0.01	3,378
Farb sandy loam, 0 to 15 % slopes	11,792,949	270.7	5.68	291,184
Grieta sandy loam, 0 to 8 % slopes	54,809,789	1,258.3	26.41	2,875,822
Jocity sandy loam, 0 to 3 % slopes	3,997,486	91.8	1.93	49,352
Jocity, very hard, 0 to 3 % slopes	4,267,861	98.0	2.06	6,491
Mayqueen-Shiprock loamy sands, 0 to 8 % slopes	13,327,054	305.9	6.42	1,686,448
Nakai sandy loam, 0 to 5 % slopes	1,389,522	31.9	0.67	64,330
Natric soils, 0 to 8 % slopes	30,865,867	708.6	14.88	0
Natric soils, overblown, 0 to 8 % slopes	1,088,324	25.0	0.52	33,590
Razito loamy sands, 0 to 8 % slopes	1,302,314	29.9	0.63	120,585
Razito loamy sand, moderately deep, 0 to 8 % slopes	15,718,667	360.9	7.58	2,280,177
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	11,765,254	270.1	5.67	1,670,376

Table 7. Continued

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Shiprock sandy loam, very hard, 0 to 8 % slopes	5,229,753	120.1	2.52	290,542
Shiprock-Blancot complex, 0 to 8 % slopes	3,350,642	76.9	1.61	620,489
Trail loamy sand-sandy loam, 0 to 8 % slopes	341,960	7.9	0.16	62,270
Total	207,500,443	4,763.6	100.00	10,343,940

Table 8. Baseline Calculations for Area, Percent of Area, and Topdressing Volume Available from Each Soil Mapping Unit Located in Area 2, BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Bacobi and Monierco soils, 0 to 8 % slopes	4,188,529	96.2	1.62	193,913
Badlands	144,454,421	3,316.2	56.03	0
Doak sandy loam, 0 to 5 % slopes	213,978	4.9	0.08	27,738
Farb sandy loam, 0 to 15 % slopes	10,301,824	236.5	4.00	254,366
Grieta sandy loam, 0 to 8 % slopes	1,972,872	45.3	0.77	103,515
Jocity sandy loam, 0 to 3 % slopes	7,211,206	165.5	2.80	89,027
Jocity, very hard, 0 to 3 % slopes	7,119,650	163.4	2.76	637,253
Mack sandy loam, 0 to 3 % slopes	747,133	17.2	0.29	138,358
Mayqueen loamy sand, 0 to 8 % slopes	158,449	3.6	0.06	26,408
Mayqueen-Shiprock loamy sands, 0 to 8 % slopes	20,433,625	469.1	7.93	2,585,737
Nakai sandy loam, 0 to 5 % slopes	227,341	5.2	0.09	10,525
Natric soils, 0 to 8 % slopes	41,481,221	952.3	16.09	0
Natric soils, overblown, 0 to 8 % slopes	1,671,983	38.4	0.65	51,604
Razito loamy sand, 0 to 8 % slopes	7,808,300	179.3	3.03	1,132,685
Razito loamy sand, moderately deep, 0 to 8 % slopes	22,964	0.5	0.01	2,126
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	5,636,869	129.4	2.19	800,296

Table 8. Continued

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Shiprock sandy loam, very hard, 0 to 8 % slopes	4,013,613	92.1	1.56	222,979
Shiprock-Blancot complex, 0 to 8 % slopes	29,700	0.7	0.01	5,500
Trail loamy sand-sandy loam, 0 to 8 % slopes	108,629	2.5	0.04	19,781
Trail, very hard, 0 to 8 % slopes	59,865	1.4	0.02	2,587
Total	257,802,307	5,918.3	100.00	6,301,812

Table 9. Baseline Calculations for Area, Percent of Area, and Topdressing Volume Available from Each Soil Mapping Unit Located in Area 3, BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Bacobi and Monierco soils, 0 to 8 % slopes	4,242,846	97.4	2.01	248,809
Bacobi and Monierco soils, 0 to 8 % slopes	10,962,063	251.7	5.18	507,503
Badlands	66,642,003	1,529.9	31.51	0
Blancot sandy clay loam, very hard, 0 to 2 % slopes	5,454,115	125.2	2.58	656,514
Doak sandy loam, 0 to 5 % slopes	4,039,139	92.7	1.91	523,592
Grieta sandy loam, 0 to 8 % slopes	2,178,061	50.0	1.03	114,281
Jocity sandy loam, 0 to 3 % slopes	8,217,110	188.6	3.88	101,446
Jocity, very hard, 0 to 3 % slopes	2,012,276	46.2	0.95	180,111
Mack sandy loam, 0 to 3 % slopes	6,416,083	147.3	3.03	1,188,163
Mayqueen-Shiprock loamy sands, 0 to 8 % slopes	4,160,549	95.5	1.97	526,489
Mayqueen-Shiprock loamy sands, very hard, 0 to 8 % slopes	373,102	8.6	0.18	23,031
Natric soils, 0 to 8 % slopes	81,235,255	1,864.9	38.41	0
Natric soils, overblown, 0 to 8 % slopes	2,251,944	51.7	1.06	69,504
Razito loamy sand, 0 to 8 % slopes	6,088,674	139.8	2.88	883,234
Razito loamy sand, moderately deep, 0 to 8 % slopes	287,987	6.6	0.14	26,665
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	7,156,714	164.3	3.38	1,016,077

Table 9. Continued

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Shiprock sandy loam, very hard, 0 to 8 % slopes	1,102,067	25.3	0.52	61,226
Shiprock-Blancot complex, 0 to 8 % slopes	163,640	3.8	0.08	30,304
Trail loamy sand-sandy loam, 0 to 8 % slopes	201,306	4.6	0.10	34,172
Trail loamy sand-sandy loam, 0 to 8 % slopes	1,166,939	26.8	0.55	212,498
Trail, very hard, 0 to 8 % slopes	1,409,664	32.4	0.67	60,911
Total	211,518,692	4,855.8	100.00	6,215,722

Table 10. Baseline Calculations for Area, Percent of Area, and Topdressing Volume Available from Each Soil Mapping Unit Located in Area 4 North, BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Bacobi and Monierco soils, 0 to 8 % slopes	18,964,274	435.4	9.21	877,976
Bacobi and Monierco soils, 0 to 8 % slopes	72,780,243	1,670.8	35.34	0
Doak sandy loam, 0 to 5 % slopes	1,047,689	24.1	0.51	135,812
Doak sandy loam, very hard, 0 to 3 % slopes	1,040,288	23.9	0.51	154,117
Farb sandy loam, 0 to 15 % slopes	14,224,462	326.5	6.91	351,221
Grieta sandy loam, 0 to 8 % slopes	2,542,174	58.4	1.23	133,386
Jocity sandy loam, 0 to 3 % slopes	3,959,419	90.9	1.92	48,882
Jocity, very hard, 0 to 3 % slopes	4,097,109	94.1	1.99	366,717
Mack sandy loam, 0 to 3 % slopes	1,444,133	33.2	0.70	267,432
Mayqueen loamy sand, 0 to 8 % slopes	221,803	5.1	0.11	36,967
Mayqueen-Shiprock loamy sands, 0 to 8 % slopes	1,087,698	25.0	0.53	137,641
Nakai sandy loam, 0 to 5 % slopes	1,177,888	27.0	0.57	54,532
Natric soils, 0 to 8 % slopes	63,951,535	1,468.1	31.05	0
Natric soils, overblown, 0 to 8 % slopes	9,378,441	215.3	4.55	289,458
Razito loamy sand, 0 to 8 % slopes	3,093,769	71.0	1.50	448,787
Razito loamy sand, moderately deep, 0 to 8 % slopes	2,579,448	59.2	1.25	238,838

Table 10. Continued

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	1,161,744	26.7	0.56	164,939
Shiprock-Blancot complex, 0 to 8 % slopes	2,453,422	56.3	1.19	136,301
Trail loamy sand-sandy loam, 0 to 8 % slopes	426,514	9.8	0.21	72,402
Trail, very hard, 0 to 8 % slopes	319,944	7.3	0.16	13,825
Total	205,951,994	4,728.0	100.00	3,929,231

Table 11. Baseline Calculations for Area, Percent of Area, and Topdressing Volume Available from Each Soil Mapping Unit Located in Area 4 South, BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Bacobi and Monierco soils, 0 to 8 % slopes	12,685,079	291.2	4.83	907,478
Bacobi and Monierco soils, 0 to 8 % slopes	28,792,665	661.0	10.97	0
Beebe loamy sand, 0 to 3 % slopes	12,976,287	297.9	4.94	2,162,714
Blancot sandy clay loam, 0 to 5 % slopes	231,229	5.3	0.09	37,824
Doak sandy loam, 0 to 5 % slopes	4,328,847	99.4	1.65	659,104
Farb sandy loam, 0 to 15 % slopes	1,129,429	25.9	0.43	29,012
Fruitland sandy loam, 0 to 15 % slopes	4,549,346	104.4	1.73	540,054
Fruitvale-Doak-Grieta sandy loams, 0 to 5 % slopes	2,103,667	48.3	0.80	289,470
Grieta sandy loam, 0 to 8 % slopes	2,671,410	61.3	1.02	245,426
Jocity sandy loam, 0 to 3 % slopes	2,824,170	64.8	1.08	90,142
Jocity, very hard, 0 to 3 % slopes	58,713	1.3	0.02	0
Jocity-Fruitland sandy loams, 0 to 3 % slopes	6,250,624	143.5	2.38	718,413
Jocity-Gilco complex, 0 to 3 % slopes	8,104,807	186.1	3.09	1,375,816
Mayqueen loamy sand, 0 to 8 % slopes	2,362,528	54.2	0.90	424,295
Monierco sandy loam, 0 to 15 % slopes	3,956,747	90.8	1.51	183,867
Natric soils, 0 to 8 % slopes	82,333,592	1,890.1	31.37	0

Table 11. Continued

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Natric soils, overblown, 0 to 8 % slopes	9,005,639	206.7	3.43	255,933
Shiprock-Blancot complex, 0 to 8 % slopes	19,300,433	443.1	7.35	0
Trail loamy sand-sandy loam, 0 to 8 % slopes	10,471,909	240.4	3.99	35,909
Razito loamy sands, 0 to 8 % slopes	20,266,074	465.2	7.72	3,502,363
Razito loamy sand, moderately deep, 0 to 8 % slopes	3,154,160	72.4	1.20	303,240
Rock Outcrop	883,746	20.3	0.34	0
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	3,190,696	73.2	1.22	514,901
Shiprock sandy loam, very hard, 0 to 8 % slopes	6,246,051	143.4	2.38	337,123
Shiprock, Mayqueen and Bacobi sandy loam, 0 to 5 % slopes	5,516,704	126.6	2.10	564,786
Stumble loamy fine sand, 0 to 15 % slopes	6,233,222	143.1	2.37	921,060
Tsaya loam, 0 to 15 % slopes	2,830,283	65.0	1.08	0
Total	262,458,055	6,025.2	100.00	14,098,931

Table 12. Baseline Calculations for Area, Percent of Area, and Topdressing Volume Available from Each Soil Mapping Unit Located in Area 5, BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Bacobi and Monierco soils, 0 to 8 % slopes	18,248,577	418.9	6.00	1,534,100
Bacobi and Monierco soils, 0 to 8 % slopes	37,732,764	866.2	12.41	0
Blancot sandy clay loam, 0 to 5 % slopes	3,777,145	86.7	1.24	607,724
Doak sandy loam, 0 to 5 % slopes	2,221,445	51.0	0.73	373,337
Farb sandy loam, 0 to 15 % slopes	24,834,835	570.1	8.17	170,650
Fruitland sandy loam, 0 to 15 % slopes	213,893	4.9	0.07	39,610
Grieta sandy loam, 0 to 8 % slopes	357,581	8.2	0.12	66,219
Jocity-Gilco complex, 0 to 3 % slopes	2,130,439	48.9	0.70	363,675
Monierco sandy loam, 0 to 15 % slopes	36,423,829	836.2	11.98	1,783,938
Natric soils, 0 to 8 % slopes	88,130,428	2,023.2	28.98	0
Natric soils, overblown, 0 to 8 % slopes	1,380,138	31.7	0.45	51,351
Razito loamy sand, 0 to 8 % slopes	12,999,716	298.4	24.49	1,917,158
Razito loamy sand, moderately deep, 0 to 8 % slopes	17,648,185	405.1	33.24	1,398,173
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	4,907,139	112.7	1.61	790,270
Shiprock, Mayqueen and Bacobi sandy loam, 0 to 5 % slopes	53,088,841	1,218.8	17.46	6,105,500
Total	304,094,955	6,981.1	147.65	15,201,705

Table 13. 1993-status Calculations for Area, Percent of Area, and Topdressing Volume Available from Each Soil Mapping Unit Located in Area 1, BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Bacobi and Monierco soils, 0 to 8 % slopes	4,717,895	108.3	2.27	218,421
Badlands	1,963,151	45.1	0.95	0
Disturbed	174,526,113	4,006.6	84.11	0
Doak sandy loam, 0 to 5 % slopes	144,548	3.3	0.07	18,738
Doak sandy loam, very hard, 0 to 3 % slopes	22,804	0.5	0.01	3,378
Farb sandy loam, 0 to 15 % slopes	974,766	22.4	0.47	24,068
Jocity sandy loam, 0 to 3 % slopes	2,774,117	63.7	1.34	34,248
Jocity, very hard, 0 to 3 % slopes	11,323	0.3	0.01	1,014
Mayqueen-Shiprock loamy sands, 0 to 8 % slopes	3,833,524	88.0	1.85	485,106
Nakai sandy loam, 0 to 5 % slopes	773,965	17.8	0.37	35,832
Natric soils, 0 to 8 % slopes	7,101,619	163.0	3.42	0
Natric soils, overblown, 0 to 8 % slopes	667,462	15.3	0.32	20,601
Razito loamy sand, 0 to 8 % slopes	2,896,878	66.5	1.40	420,226
Razito loamy sand, moderately deep, 0 to 8 % slopes	936,161	21.5	0.45	86,682
Shiprock-Blancot complex, 0 to 8 % slopes	1,254,304	28.8	0.60	232,278
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	2,685,151	61.6	1.29	381,225

Table 13. Continued

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Shiprock sandy loam, very hard, 0 to 8 % slopes	609,003	14.0	0.29	33,833
Topdressing stockpile	1,310,819	30.1	0.63	0
Trail loamy sand-sandy loam, 0 to 8 % slopes	296,841	6.8	0.14	54,054
Total	207,500,443	4,763.6	100.00	2,049,705

Table 14. 1993-status Calculations for Area, Percent of Area, and Topdressing Volume Available from Each Soil Mapping Unit Located in Area 2, BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Bacobi and Monierco soils, 0 to 8 % slopes	3,216,566	73.8	1.25	148,915
Badlands	59,269,955	1,360.7	22.99	0
Disturbed	154,634,887	3,549.9	59.97	0
Doak sandy loam, 0 to 5 % slopes	146,645	3.4	0.06	19,010
Doak sandy loam, very hard, 0 to 3 % slopes	2,985,915	68.5	1.16	73,726
Jocity sandy loam, 0 to 3 % slopes	4,529,158	104.0	1.76	55,916
Jocity, very hard, 0 to 3 % slopes	3,119,119	71.6	1.21	279,180
Mack sandy loam, 0 to 3 % slopes	320,605	7.4	0.12	59,371
Mayqueen-Shiprock loamy sands, 0 to 8 % slopes	3,557,469	81.7	1.38	450,174
Mayqueen loamy sand, 0 to 8 % slopes	158,449	3.6	0.06	26,408
Nakai sandy loam, 0 to 5 % slopes	204,678	4.7	0.08	9,476
Natric soils, 0 to 8 % slopes	18,315,015	420.5	7.10	0
Natric soils, overblown, 0 to 8 % slopes	1,324,840	30.4	0.51	40,890
Pond	235,357	5.4	0.09	0
Shiprock-Blancot complex, 0 to 8 % slopes	2,102,507	48.3	0.82	304,993
Razito loamy sand, moderately deep, 0 to 8 % slopes	22,964	0.5	0.01	2,126

Table 14. Continued

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Shiprock-Blancot complex, 0 to 8 % slopes	29,700	0.7	0.01	5,500
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	2,924,044	67.1	1.13	415,142
Shiprock sandy loam, very hard, 0 to 8 % slopes	265,728	6.1	0.10	14,763
Topdressing stockpile	330,078	7.6	0.13	0
Trail loamy sand-sandy loam, 0 to 8 % slopes	108,629	2.5	0.04	19,781
Trail loamy sand-sandy loam, 0 to 8 % slopes	59,865	1.4	0.02	2,587
Total	257,862,172	5,919.7	100.00	1,927,958

Table 15. 1993-status Calculations for Area, Percent of Area, and Topdressing Volume Available from Each Soil Mapping Unit Located in Area 3, BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Bacobi and Monierco soils, 0 to 8 % slopes	10,857,235	249.2	5.03	502,650
Bacobi sandy loam, 0 to 15 % slopes	3,378,088	77.6	1.57	198,098
Badlands	53,177,745	1,220.8	24.65	0
Blancot sandy clay loam, very hard, 0 to 2 % slopes	5,431,747	124.7	2.52	653,821
Disturbed	35,075,135	805.2	16.26	0
Doak sandy loam, 0 to 5 % slopes	4,003,692	91.9	1.86	518,997
Grieta sandy loam, 0 to 8 % slopes	2,178,061	50.0	1.01	114,281
Jocity sandy loam, 0 to 3 % slopes	7,402,635	169.9	3.43	91,391
Jocity, very hard, 0 to 3 % slopes	1,892,847	43.5	0.88	169,421
Mack sandy loam, 0 to 3 % slopes	6,416,083	147.3	2.97	1,188,163
Mayqueen-Shiprock loamy sands, 0 to 8 % slopes	3,765,065	86.4	1.75	476,443
Mayqueen-Shiprock loamy sands, very hard, 0 to 8 % slopes	373,102	8.6	0.17	23,031
Natric soils, 0 to 8 % slopes	64,620,665	1,483.5	29.95	0
Natric soils, overblown, 0 to 8 % slopes	2,209,860	50.7	1.02	68,206
Pond	243,713	5.6	0.11	0
Razito loamy sand, 0 to 8 % slopes	2,959,671	67.9	1.37	429,335

Table 15. Continued

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Razito loamy sand, moderately deep, 0 to 8 % slopes	251,204	5.8	0.12	23,260
Reclamation	356,614	8.2	0.17	0
Shiprock-Blancot complex, 0 to 8 % slopes	163,640	3.8	0.08	30,304
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	6,986,004	160.4	3.24	991,840
Shiprock sandy loam, very hard, 0 to 8 % slopes	655,094	15.0	0.30	36,394
Stumble loamy fine sand, 0 to 15 % slopes	127,121	2.9	0.06	21,579
Topdressing stockpile	659,915	15.1	0.31	0
Trail loamy sand-sandy loam, 0 to 8 % slopes	1,166,939	26.8	0.54	212,498
Trail, very hard, 0 to 8 % slopes	1,409,664	32.4	0.65	60,911
Total	215,761,538	4,953.2	100.00	5,810,624

Table 16. 1993-status Calculations for Area, Percent of Area, and Topdressing Volume Available from Each Soil Mapping Unit Located in Area 4 North, BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Bacobi and Monierco soils, 0 to 8 % slopes	18,964,274	435.4	9.21	877,976
Badlands	72,780,242	1,670.8	35.34	0
Doak sandy loam, 0 to 5 % slopes	1,047,689	24.1	0.51	135,812
Doak sandy loam, very hard, 0 to 3 % slopes	1,040,288	23.9	0.51	154,117
Farb sandy loam, 0 to 15 % slopes	14,224,462	326.5	6.91	351,221
Grieta sandy loam, 0 to 8 % slopes	2,542,174	58.4	1.23	133,386
Jocity sandy loam, 0 to 3 % slopes	3,959,419	90.9	1.92	48,882
Jocity, very hard, 0 to 3 % slopes	4,097,109	94.1	1.99	366,717
Mack sandy loam, 0 to 3 % slopes	1,444,133	33.2	0.70	267,432
Mayqueen-Shiprock loamy sands, 0 to 8 % slopes	1,087,698	25.0	0.53	137,641
Mayqueen loamy sand, 0 to 8 % slopes	221,803	5.1	0.11	36,967
Nakai sandy loam, 0 to 5 % slopes	1,177,888	27.0	0.57	54,532
Natric soils, 0 to 8 % slopes	63,951,535	1,468.1	31.05	0
Natric soils, overblown, 0 to 8 % slopes	9,378,441	215.3	4.55	289,458
Razito loamy sand, 0 to 8 % slopes	3,093,769	71.0	1.50	448,787
Razito loamy sand, moderately deep, 0 to 8 % slopes	2,579,448	59.2	1.25	238,838

Table 16. Continued

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	1,161,744	26.7	0.56	164,939
Shiprock sandy loam, very hard, 0 to 8 % slopes	2,453,422	56.3	1.19	136,301
Stumble loamy fine sand, 0 to 15 % slopes	426,514	9.8	0.21	72,402
Trail, very hard, 0 to 8 % slopes	319,944	7.3	0.16	13,825
Total	205,951,993	4,728.0	100.00	3,929,231

Table 17. 1993-status Calculations for Area, Percent of Area, and Topdressing Volume Available from Each Soil Mapping Unit Located in Area 4 South, BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Bacobi sandy loam, 0 to 15 % slopes	12,685,079	291.2	4.83	907,478
Badlands	28,792,665	661.0	10.97	0
Beebe loamy sand, 0 to 3 % slopes	12,976,287	297.9	4.94	2,162,714
Blancot sandy clay loam, 0 to 5 % slopes	231,229	5.3	0.09	37,824
Doak sandy loam, 0 to 5 % slopes	4,328,847	99.4	1.65	659,104
Farb sandy loam, 0 to 15 % slopes	1,129,429	25.9	0.43	29,012
Fruitland sandy loam, 0 to 15 % slopes	4,549,346	104.4	1.73	540,054
Fruitvale-Doak-Grieta sandy loams, 0 to 5 % slopes	2,103,667	48.3	0.80	289,470
Grieta sandy loam, 0 to 8 % slopes	2,671,410	61.3	1.02	245,426
Jocity-Fruitland sandy loams, 0 to 3 % slopes	6,250,624	143.5	2.38	718,413
Jocity-Gilco complex, 0 to 3 % slopes	8,104,807	186.1	3.09	1,375,816
Jocity sandy loam, 0 to 3 % slopes	2,824,170	64.8	1.08	90,142
Jocity, very hard, 0 to 3 % slopes	58,713	1.3	0.02	0
Mayqueen loamy sand, 0 to 8 % slopes	2,362,528	54.2	0.90	424,295
Monierco sandy loam, 0 to 15 % slopes	3,956,747	90.8	1.51	183,867
Natric soils, 0 to 8 % slopes	82,333,592	1,890.1	31.37	0

Table 17. Continued

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Natric soils, overblown, 0 to 8 % slopes	9,005,639	206.7	3.43	255,933
Persayo clay loam, 0 to 15 % slopes	19,300,433	443.1	7.35	0
Persayo, Farb, and Rock Outcrop soils, 0 to 50 % slopes	10,471,909	240.4	3.99	35,909
Razito loamy sands, 0 to 8 % slopes	20,266,074	465.2	7.72	3,502,363
Razito loamy sand, moderately deep, 0 to 8 % slopes	3,154,160	72.4	1.20	303,240
Rock Outcrop	883,746	20.3	0.34	0
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	3,190,696	73.2	1.22	514,901
Shiprock sandy loam, very hard, 0 to 8 % slopes	6,246,051	143.4	2.38	337,123
Shiprock, Mayqueen and Bacobi sandy loam, 0 to 5 % slopes	5,516,704	126.6	2.10	564,786
Stumble loamy fine sand, 0 to 15 % slopes	6,233,222	143.1	2.37	921,060
Tsaya loam, 0 to 15 % slopes	2,830,283	65.0	1.08	0
Total	262,458,055	6,025.2	100.00	14,098,931

Table 18. 1993-status Calculations for Area, Percent of Area, and Topdressing Volume Available from Each Soil Mapping Unit Located in Area 5, BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

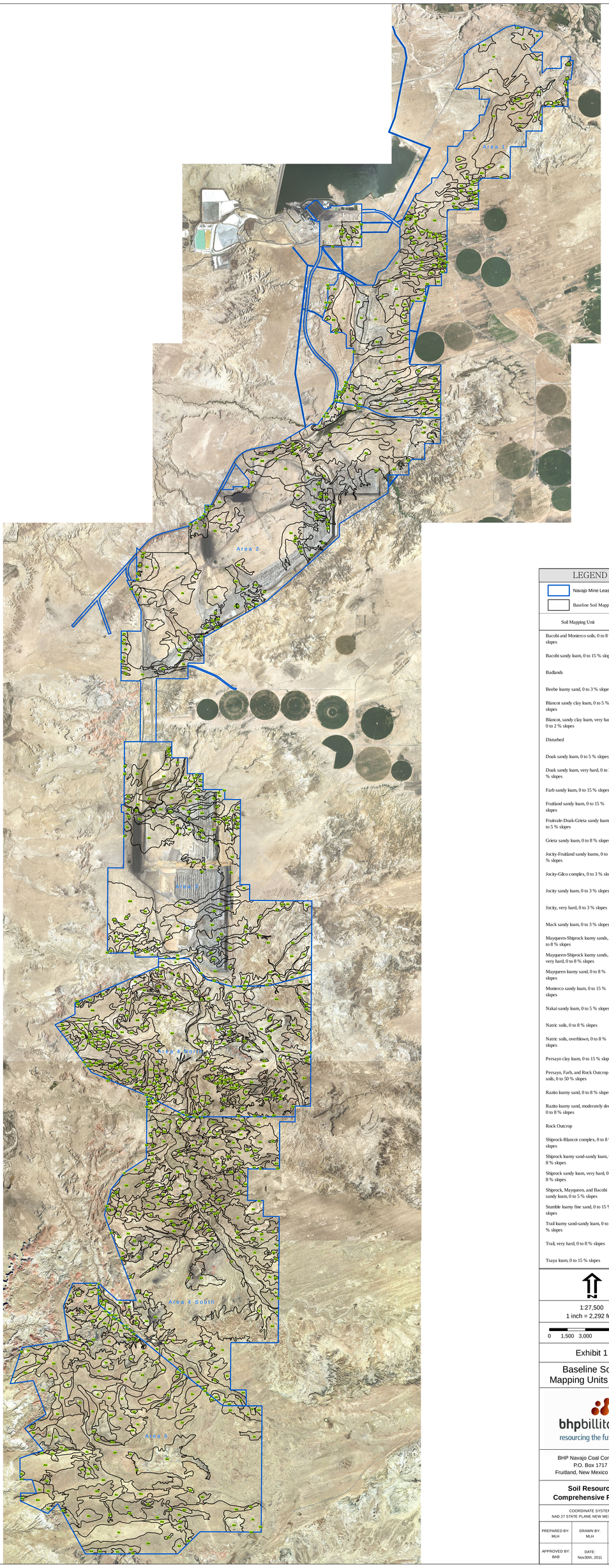
Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Bacobi sandy loam, 0 to 15 % slopes	18,248,576	418.9	6.00	1,534,100
Badlands	37,732,764	866.2	12.41	0
Blancot sandy clay loam, 0 to 5 % slopes	3,777,145	86.7	1.24	607,724
Doak sandy loam, 0 to 5 % slopes	2,221,445	51.0	0.73	373,337
Farb sandy loam, 0 to 15 % slopes	24,834,835	570.1	8.17	170,650
Fruitland sandy loam, 0 to 15 % slopes	213,893	4.9	0.07	39,610
Grieta sandy loam, 0 to 8 % slopes	357,581	8.2	0.12	66,219
Jocity-Gilco complex, 0 to 3 % slopes	2,130,439	48.9	0.70	363,675
Monierco sandy loam, 0 to 15 % slopes	36,423,829	836.2	11.98	1,783,938
Natric soils, 0 to 8 % slopes	88,130,428	2,023.2	28.98	0
Natric soils, overblown, 0 to 8 % slopes	1,380,138	31.7	0.45	51,351
Razito loamy sand, 0 to 8 % slopes	12,999,716	298.4	4.27	1,917,158
Razito loamy sand, moderately deep, 0 to 8 % slopes	17,648,185	405.1	5.80	1,398,173
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	4,907,139	112.7	1.61	790,270
Shiprock, Mayqueen and Bacobi sandy loam, 0 to 5 % slopes	53,088,841	1,218.8	17.46	6,105,500
Total	304,094,955	6,981.1	100.00	15,201,705

Table 19. Baseline Calculations for Area, Percent of Area, and Topdressing Volume Available from Each Area for the BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Area 1	207,500,443	4,763.6	14.27	10,343,940
Area 2	257,862,171	5,919.7	17.74	6,304,399
Area 3	215,761,538	4,953.2	14.84	6,464,531
Area 4 North	205,951,994	4,728.0	14.17	3,929,231
Area 4 South	262,458,055	6,025.2	18.06	14,098,931
Area 5	304,094,955	6,981.1	20.92	15,201,705
Total	1,453,629,157	33,370.7	100.00	56,342,737

Table 20. 1993-status Calculations for Area, Percent of Area, and Topdressing Volume Available from Each Area for the BHP Navajo Coal Company Coal Lease Soil Resource Comprehensive Report

Soil Mapping Unit	Area (Sq. Ft.)	Area (ac)	% of Area	Topdressing Volume (bcy)
Area 1	207,500,443	4,763.6	14.27	2,049,705
Area 2	257,862,172	5,919.7	17.74	1,927,958
Area 3	215,761,538	4,953.2	14.84	5,810,624
Area 4 North	205,951,993	4,728.0	14.17	3,929,231
Area 4 South	262,458,055	6,025.2	18.06	14,098,931
Area 5	304,094,955	6,981.1	20.92	15,201,705
Total	1,453,629,157	33,370.7	100.00	43,018,154



LEGEND

Navajo Mine Lease Boundary

Baseline Soil Mapping Units

Soil Mapping Unit	Map Unit Symbol
Bacobi and Monierco soils, 0 to 8 % slopes	BM
Bacobi sandy loam, 0 to 15 % slopes	Bc
Badlands	BA
Beebe loamy sand, 0 to 3 % slopes	Bb
Blancot sandy clay loam, 0 to 5 % slopes	Bl
Blancot, sandy clay loam, very hard, 0 to 2 % slopes	Bh
Disturbed	Dst
Doak sandy loam, 0 to 5 % slopes	Dk
Doak sandy loam, very hard, 0 to 3 % slopes	Dh
Farb sandy loam, 0 to 15 % slopes	Fb
Fruitland sandy loam, 0 to 15 % slopes	Fr
Fruitvale-Doak-Grieta sandy loams, 0 to 5 % slopes	Fv
Grieta sandy loam, 0 to 8 % slopes	Gr
Jocity-Fruitland sandy loams, 0 to 3 % slopes	Jf
Jocity-Gilco complex, 0 to 3 % slopes	Jg
Jocity sandy loam, 0 to 3 % slopes	Jc
Jocity, very hard, 0 to 3 % slopes	Jh
Mack sandy loam, 0 to 3 % slopes	Mc
Mayqueen-Shiprock loamy sands, 0 to 8 % slopes	Ms
Mayqueen-Shiprock loamy sands, very hard, 0 to 8 % slopes	Mh
Mayqueen loamy sand, 0 to 8 % slopes	Mq
Monierco sandy loam, 0 to 15 % slopes	Mo
Nakai sandy loam, 0 to 5 % slopes	Nk
Natric soils, 0 to 8 % slopes	NA
Natric soils, overblown, 0 to 8 % slopes	NO
Persayo clay loam, 0 to 15 % slopes	Pr
Persayo, Farb, and Rock Outcrop soils, 0 to 50 % slopes	PF
Razito loamy sand, 0 to 8 % slopes	Rz
Razito loamy sand, moderately deep, 0 to 8 % slopes	Rm
Rock Outcrop	RO
Shiprock-Blancot complex, 0 to 8 % slopes	Sb
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	Sp
Shiprock sandy loam, very hard, 0 to 8 % slopes	Sh
Shiprock, Mayqueen, and Bacobi sandy loam, 0 to 5 % slopes	SM
Stumble loamy fine sand, 0 to 15 % slopes	St
Trail loamy sand-sandy loam, 0 to 8 % slopes	Tr
Trail, very hard, 0 to 8 % slopes	Th
Tsaya loam, 0 to 15 % slopes	Ty

N

1:27,500
1 inch = 2,292 feet

0 1,500 3,000 6,000 Feet

Exhibit 1

Baseline Soil Mapping Units Map

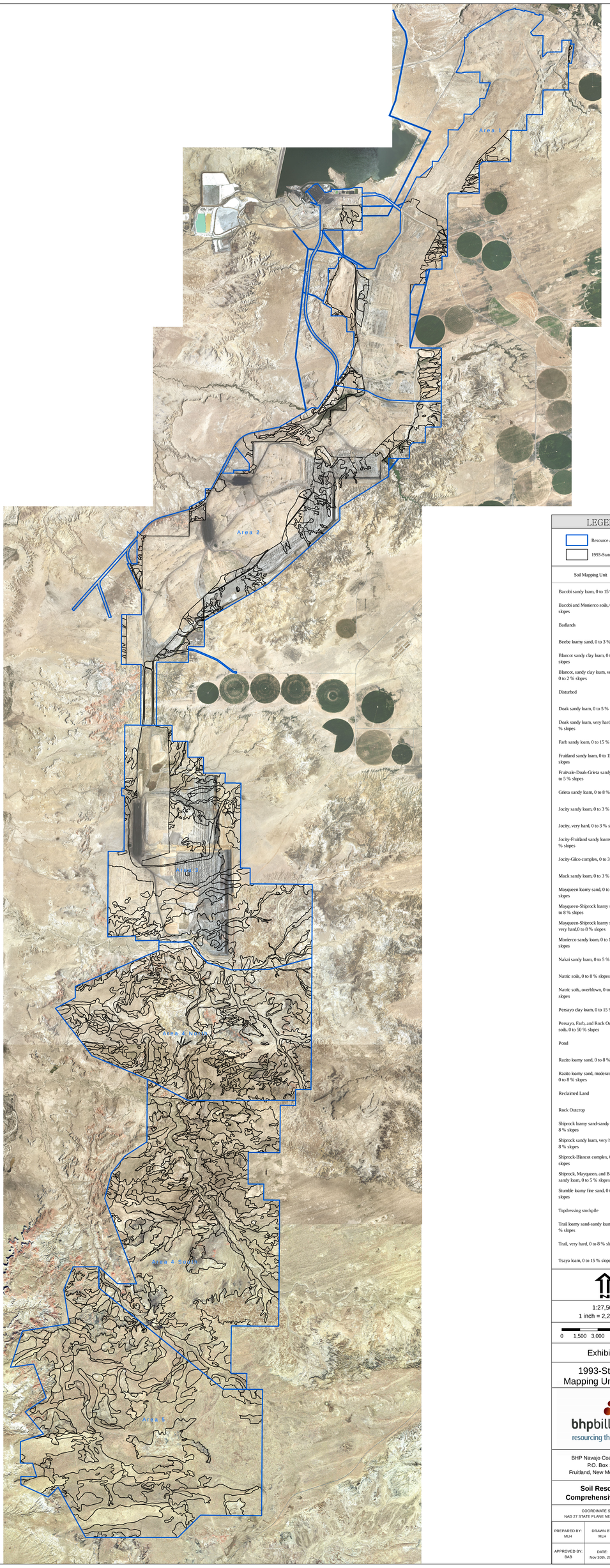
bhpbilliton
resourcing the future

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, New Mexico 87416

Soil Resource Comprehensive Report

COORDINATE SYSTEM:
NAD 27 STATE PLANE NEW MEXICO WEST

PREPARED BY: MLH	DRAWN BY: MLH	PAPER SIZE: 28" x 60"
APPROVED BY: BAB	DATE: Nov30th, 2011	



LEGEND

Resource Area Boundaries

1993-Status Mapping Units

Soil Mapping Unit	Map Unit Symbol
Bacobi sandy loam, 0 to 15 % slopes	Bc
Bacobi and Monierco soils, 0 to 8 % slopes	BM
Badlands	BA
Beebe loamy sand, 0 to 3 % slopes	Bb
Blancot sandy clay loam, 0 to 5 % slopes	Bl
Blancot, sandy clay loam, very hard, 0 to 2 % slopes	Bh
Disturbed	Dst
Doak sandy loam, 0 to 5 % slopes	Dk
Doak sandy loam, very hard, 0 to 3 % slopes	Dh
Farb sandy loam, 0 to 15 % slopes	Fb
Fruitland sandy loam, 0 to 15 % slopes	Fr
Fruitvale-Doak-Grieta sandy loams, 0 to 5 % slopes	Fv
Grieta sandy loam, 0 to 8 % slopes	Gr
Jocity sandy loam, 0 to 3 % slopes	Jc
Jocity, very hard, 0 to 3 % slopes	Jh
Jocity-Fruitland sandy loams, 0 to 3 % slopes	Jf
Jocity-Gilco complex, 0 to 3 % slopes	Jg
Mack sandy loam, 0 to 3 % slopes	Mc
Mayqueen loamy sand, 0 to 8 % slopes	Mq
Mayqueen-Shiprock loamy sands, 0 to 8 % slopes	Ms
Mayqueen-Shiprock loamy sands, very hard,0 to 8 % slopes	Mh
Monierco sandy loam, 0 to 15 % slopes	Mo
Nakai sandy loam, 0 to 5 % slopes	Nk
Natric soils, 0 to 8 % slopes	NA
Natric soils, overblown, 0 to 8 % slopes	NO
Persayo clay loam, 0 to 15 % slopes	Pr
Persayo, Farb, and Rock Outcrop soils, 0 to 50 % slopes	PF
Pond	Pnd
Razito loamy sand, 0 to 8 % slopes	Rz
Razito loamy sand, moderately deep, 0 to 8 % slopes	Rm
Reclaimed Land	Rcl
Rock Outcrop	RO
Shiprock loamy sand-sandy loam, 0 to 8 % slopes	Sp
Shiprock sandy loam, very hard, 0 to 8 % slopes	Sh
Shiprock-Blancot complex, 0 to 8 % slopes	Sb
Shiprock, Mayqueen, and Bacobi sandy loam, 0 to 5 % slopes	SM
Stumble loamy fine sand, 0 to 15 % slopes	St
Topdressing stockpile	Ts
Trail loamy sand-sandy loam, 0 to 8 % slopes	Tr
Trail, very hard, 0 to 8 % slopes	Th
Tsaya loam, 0 to 15 % slopes	Ty

1:27,500
1 inch = 2,292 feet

0 1,500 3,000 6,000 Feet

Exhibit 2

1993-Status
Mapping Units Map

bhpbilliton
resourcing the future

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, New Mexico 87416

Soil Resource Comprehensive Report

COORDINATE SYSTEM:
NAD 27 STATE PLANE NEW MEXICO WEST

PREPARED BY:	DRAWN BY:	PAPER SIZE:
MLH	MLH	28" x 60"
APPROVED BY:	DATE:	
BAB	Nov 30th, 2011	

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
6200 Jefferson NE, Room 305
Albuquerque, NM 87109
Phone: (505) 761-4400 **Fax:** (505) 761-4462
Web site: www.nm.nrcs.usda.gov

December 5, 2011

Mr. Mark Heil, GIS Director
Buchanan Consultants, Ltd.
P.O. Box 2549
Farmington, New Mexico 87499

Dear Mr. Heil:

Thank you for allowing the Natural Resources Conservation Service (NRCS) the opportunity to review the Navajo Mine Lease Boundary project in San Juan County, New Mexico. In review of the NRCS Soil Survey, there are no soil types within the project area that are described by the NRCS as prime farmland, farmland of local importance, farmland of statewide importance, unique farmland; or those farmlands that have previously been converted to non agricultural uses. With this acknowledged, the proposed project will not cause Prime or Unique Farmlands to be converted to nonagricultural uses. In addition, the NRCS soil survey does not identify hydric soils as occurring in the proposed project area. Hydric soils may identify potential areas of wetlands. If wetlands or waterways do exist, it is recommended that you contact the U.S. Army Corp of Engineers.

If you have any questions concerning soils information please contact Mr. Clarence Chavez, Soil Data Quality Specialist, at (505) 761-4435 or by email clarence.chavez@nm.usda.gov. Any questions concerning wetlands or other environmental impacts please contact Ms. Chanda Pettie, State Biologist, at (505) 761-4432 or by email chanda.pettie@nm.usda.gov.

Sincerely,

Rosalbert L. Garcia-Sr, Acting

for NORMAN VIGIL
Acting State Conservationist

cc:
Clarence Chavez, Soil Data Quality Scientist, NRCS, Albuquerque, NM
Chanda Pettie, State Wildlife Biologist, NRCS, Albuquerque, NM

Appendix 14.B

Key to Soils of the Pinabete Mine Plan Permit Area

DIAGNOSTIC EPIPEDON OR SUBSURFACE HORIZONS LACKING

ENTISOL

Less than 35% rock fragments, loamy fine sand or coarser in all subhorizons to 100 cm, lithic or paralithic contact.	**Psamments**
Deeper than 25 cm, slope less than 25% and an irregular decrease in organic matter with depth or remains above 0.2% o.m. to 125 cm	**Fluvents**
Other Entisols	**Orthents**

Psamments

All are Typic Torripsamments

Typic Torripsamment (>100 to Lithic contact)

Eolian or Alluvial

Rock fragments - 0 to 5% throughout — Razito

Eolian or Alluvial

Gravelly substratum, rock fragments

5 to 35% in some horizons — Stumble

Fluvents

All are Typic Torrifluvents (>100 cm to lithic contact)

Sandy (loamy fine sand or coarser)

ESP - 20 to 70% upper 50 cm

Color - 7.5YR to 10 YR — Beebe

Sandy (loamy fine sand or coarser)

ESP - <20% upper 50 cm

Color - 2.5YR to 7.5YR — Trail

Coarse-loamy (<18% clay but not sandy)

Salinity - 0 to 16 dS/m

Sodic - <13 SAR — Gilco

Fine-loamy (18 to 35% clay)

Salinity - 0 – 2 dS/m but can be 30

Sodic – 0 – 10 SAR but can be 35 — Jocity

Orthents

All are Torriorthents

Lithic contact with 50 cm — **Lithic Torriorthents**

Lithic contact >50 cm — **Typic Torriorthents**

Lithic Torriorthents

Loamy-skeletal

Rock fragments – 35 to 80

Clay content – 18 to 35% — Tsaya

Loamy (Coarse-loamy <18% clay) — Farb

Loamy (Fine-loamy 18 – 35% clay) — Persayo

Clayey (Clayey >35% clay) — Chipeta

Typic Torriorthents

Coarse-loamy (<18% clay) — Fruitland

Fine-loamy (18 – 35% clay) — Turley

DIAGNOSTIC SUBSURFACE HORIZON PRESENT

ARIDISOL

Gypsic or Petrogypsic horizon — **Gypsids**

Argillic or Natric horizon **Argid**

Calcic horizon **Calcid**

Gypsids

Natric horizon

Fine (>35% clay) Hoskay

Fine-loamy (18% - 35% clay) Benally

Argillic horizon

Fine-loamy (18 – 35% clay) Fruitvale

Argids

Natric horizon **Natrargids**

Calcic horizon **Calciargids**

Other argids **Haplargids**

Natrargids

Paralithic contact < 50 cm Huerfano

Paralithic contact 50 – 100 cm

Fine-loamy (By present) Fajada

Fine-loamy (By lacking) Muff

Fine Patel

Paralithic contact >100 cm

Fine-loamy (By lacking) Uffens

Calciargids

Coarse-loamy Sogzie

Fine-loamy	
Substratum - Fine-loamy	Mack
Substratum – Coarse-loamy	Grieta
Substratum – Loamy-skeletal	Mesa

Haplargids

Lithic or Paralithic <50 cm	Monierco
Lithic or paralithic 50 to 100 cm	Bacobi (Kiki)
Lithic or paralithic >100 cm	
Coarse-loamy (Bk lacking)	Mayqueen
Coarse-loamy (Bk present)	Shiprock
Fine-loamy (Bk lacking)	Blancot
Fine-loamy	
(Bk & Bt present less than 25 cm)	Doak
Fine-loamy	
(Bk & Bt present more than 25 cm)	Redlands

Calcids

Coarse-loamy	Nakai
Fine-loamy	Avalon

Appendix 14.C

Prime Farmland Determination Correspondence

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
6200 Jefferson NE, Room 305
Albuquerque, NM 87109
Phone: (505) 761-4400 **Fax:** (505) 761-4462
Web site: www.nm.nrcs.usda.gov

December 5, 2011

Mr. Mark Heil, GIS Director
Buchanan Consultants, Ltd.
P.O. Box 2549
Farmington, New Mexico 87499

Dear Mr. Heil:

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Sincerely,

Rosalbert L. Garcia-Sr, Acting

for NORMAN VIGIL
Acting State Conservationist

cc:
Clarence Chavez, Soil Data Quality Scientist, NRCS, Albuquerque, NM
Chanda Pettie, State Wildlife Biologist, NRCS, Albuquerque, NM