

SECTION 15

VEGETATION

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LIST OF REVISIONS DURING PERMIT TERM

REV. NUMBER	REVISION DESCRIPTION	DATE APPROVED
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SECTION 15 VEGETATION

~~BHP Navajo Coal~~[Navajo Transitional Energy](#) Company's (~~BNCCNTEC~~) Pinabete Mine Plan permit area (permit area) is located in northwestern New Mexico on Navajo Nation lands in San Juan County and encompasses approximately 5,569 acres of ~~BNCCNTEC~~'s mining lease. Elevations of the permit area range from 5,285 to 5,580 feet and the area is characterized by low rolling grasslands/shrublands interspersed with rocky cliffs and thinbreaks. Land uses in the permit area and adjacent areas include livestock grazing and residential areas.

The native vegetation of the permit area is characteristic of the Colorado Plateau salt-desert shrub ecosystem. Salt-desert shrub ranges occur in Utah, Nevada, western Colorado, northeastern Arizona, and northwestern New Mexico. This ecosystem contains a large number of salt-tolerant species and a significant shrub component. Common shrubs present include numerous species of saltbush (*Atriplex* spp.), rabbitbrush (*Chrysothamnus* spp. and *Ericameria* spp.), Mormon tea (*Ephedra* spp.), and snakeweed (*Gutierrezia sarothrae*). The grass community is generally dominated by the warm season species of galleta (*Pleuraphis jamesii*) and alkali sacaton (*Sporobolus airoides*) and the annual cheatgrass (*Bromus tectorum*). The only cool-season grass of any significance is Indian ricegrass (*Achnatherum hymenoides*). Prevalent forb species include globemallow (*Sphaeralcea* spp.), buckwheat (*Eriogonum* spp.), and Russian thistle (*Salsola tragus*).

The purpose of the baseline inventories was to document the vegetation communities and characteristics prior to disturbance and to establish suitable vegetation reference areas. Reference areas are not planned to be impacted by future mining activities, are of sufficient size to maintain natural ecological processes and are of similar characteristics to provide comparative standards to determine reclamation success. Further discussion on reclamation success is presented in Section 37 (Post-Reclamation Vegetation).

15.1 Baseline Vegetation Surveys

Several baseline vegetation inventories have been conducted within the permit area and the ~~BNCCNTEC~~ mining lease. Three previous studies are used to describe the vegetation in the permit area. Inventories in Area 4 North were conducted by Wood and Allred in 1987 ([Appendix 15.A](#)) and again by Ecosphere Environmental Services (Ecosphere) in 2004 ([Appendix 15.B](#)). Ecosphere also conducted a baseline vegetation inventory in 2007 for Areas 4 South and 5 ([Appendix 15.C](#)). The extent of these survey areas in relation to the permit area are presented on [Exhibit 15.1-1](#).

15.1.1 Baselines Surveys 1987

The detailed 1987 report and data collected in Area 4 North are provided in [Appendix 15.A](#). Seven vegetation communities were delineated (Alkali Wash, Arroyo Shrub, Badlands, Dunes, Saline Sands, Sands, and Thinbreaks). Vegetation characteristics were measured in each vegetation community and included: cover, frequency, composition/constancy, shrub density, and production. Cover data was

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collected using a 30-meter line intercept. Frequency was calculated by presence in ten 3-meter subplots along the 30-meter line transect. Shrub density was measured with a 30-meter long belt transect, using a width of 1 meter on either side of the line transect. Production was measured by harvesting ~~one~~1 square meter (m²) plot (10 meters by 10 centimeters) along the line transect.

15.1.2 Baseline Surveys 2004

In 2004, Area 4 North was sampled for cover, frequency, and shrub density. No production data was collected. The detailed report and data collected is provided in [Appendix 15.B](#). To remain consistent with Navajo Mine vegetation reporting, the two sand communities identified in 1987 were combined into one Sands community. Therefore, the 2004 survey used six vegetation communities (Alkali Wash, Arroyo Shrub, Badlands, Dunes, Sands, and Thinbreaks). Cover was measured with a 30-meter line intercept divided into six 5-meter intervals. Cover was also measured in five subplots of 0.5 by 0.5 meters along the line transect. Shrub density was measured using a 30-meter long belt transect with a width of ~~one~~1 meter along either side of the transect line.

15.1.3 Baseline Surveys 2007

Field work for the 2007 Areas 4 South and 5 baseline inventories occurred in the spring and fall. The inventories collected data on cover, frequency, constancy, shrub density, and production. The detailed report is provided in [Appendix 15.C](#). The 2007 survey used six vegetation communities (Alkali Wash, Arroyo Shrub, Badlands, Dunes, Thinbreaks, and Sands). Cover and frequency data were collected using a point intercept method (Barbour et.al. 1980; Knight 1978) along a 50-meter tape. Compared to the line intercept, the point intercept method resulted in higher coverage values. Shrub density was measured within a 2-meter wide by 50-meter long (100 m²) belt transect. Production transects consisted of 1-m² plot (10 centimeters x 10 meters).

15.2 Description of Vegetation Communities

The following [Pinabete Mine](#) vegetation community descriptions are based on data and analysis derived from the three baseline inventories. ~~Collectively, the baseline inventories encompass the entire extent of Area 4 North, Area 4 South and Area 5 and therefore the -conducted within- permit area, which are- as shown on [Exhibit 15.1-1](#). None of the baseline inventories encompass the entire extent of the permit area; however when combined, the entire permit area is included.~~

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Vegetation communities are categorized into the following six communities; Alkali Wash, Arroyo Shrub, Badlands, Dunes, Thinbreaks, and Sands (combined Sands and Saline Sands). Baseline vegetation communities are represented on [Exhibit 15.1-2](#). The proportion of the total permit area each vegetation community comprises is presented in [Table 15.2-1](#). The following subsections summarize each community type.

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15.2.1 Alkali Wash

The Alkali Wash vegetation community is associated with small ephemeral waterways or drainages. These areas are typically broad and level with occasional small, dense patches of galleta grass and alkali sacaton. Alkali Wash sites are typically located in washes and major drainages as well as at the base of Badlands. Terrain is nearly level to moderately sloping, ranging from 0 to 3%. The soils found in this community are shallow and unsuitable for salvage because of heavy clays and high sodic levels. Alkali Wash represents the largest community type in the permit area at 29.04% ([Table 15.2-1](#)).

Absolute vegetation cover in the Alkali Wash vegetation community was measured at 2.3% with 1.6% perennial vegetation and 0.7% annual vegetation cover in 1987 ([Table 15.2-2](#) and [Table 15.2-3](#)). In 2004, absolute cover was measured at 3.2% with forbs contributing 48.6% of relative cover ([Table 15.2-4](#) and [Table 15.2-5](#)). The 2007 baseline inventory measured absolute cover between 8.2% in the spring and 5.8% in the fall ([Table 15.2-6](#) and [Table 15.2-7](#)). Spring perennial absolute cover was 2.8%, which comprised 34.8% of relative cover. Fall perennial absolute cover was 2.0%, which comprised 33.9% of the relative cover. The greatest contributor to vegetation cover in the spring and fall was annual forbs with relative cover at 57.8% and 62.6%, respectively ([Table 15.2-7](#)).

The mean biomass production was 584.0 pounds per acre (lbs/acre) in 1987 ([Table 15.2-8](#)) and 156.9 lbs/acre in 2007 ([Table 15.2-6](#)). In 2007, the stocking rate was 0.8 Animal Unit Months per acre (AUMs/ac) ([Table 15.2-9](#)).

Mean shrub densities were 1,153 stems/acre in 1987 and 972 stems/acre in 2004. In 2007, mean shrub density was 540 stems/acre with broom snakeweed (*Gutierrezia sarothrae*) and 511 stems/acre without broom snakeweed ([Table 15.2-10](#)).

15.2.2 Arroyo Shrub

Arroyo Shrub vegetation communities are found on level or nearly level terrain (0 to 2% slopes) located along stream beds in major drainages, such as Pinabete Arroyo. The Arroyo Shrub community is the smallest vegetation type in the permit area comprising 5.34% ([Table 15.2-1](#)). The soils of this vegetation community are stratified sands and often have high sodium adsorption ratio values. Production is still high on the site because of the deep, well-drained soil and proximity to water.

Absolute cover averaged 4.3% in the 1987 inventory ([Table 15.2-2](#)) with perennial and annual vegetation contributing 3.6% and 0.7%, respectively ([Table 15.2-11](#)). In 2004, absolute cover was measured at 5.7% ([Table 15.2-4](#)) with shrubs comprising 61% of relative cover ([Table 15.2-12](#)). The 2007 inventory found that absolute cover in the Arroyo Shrub community varied from 19.5% in the spring to 12.1% in the fall ([Table 15.2-6](#) and [Table 15.2-13](#)). Spring perennial absolute cover was 9.3%, which comprised 47.6% of the relative cover. Perennial absolute cover in the fall was 7.3%, which comprised 59.9% of the relative

cover. Shrub cover contributed the highest relative cover (42.6%) in the fall, while annual forbs contributed the highest relative cover (40.6%) in the spring ([Table 15.2-13](#)).

Mean biomass production in 1987 was 1392.8 lbs/acre ([Table 15.2-8](#)) and in 2007, it was the highest of any community at 320.7 lbs/acre ([Table 15.2-6](#)). The stocking rate in 2007 was 1.5 AUMs/ac ([Table 15.2-9](#)).

Mean shrub densities were 2,978 stems/acre in 1987 and 1,619 stems/acre in 2004. In 2007, shrub density was the highest (without broom snakeweed) of all vegetation communities in the study area at 941 stems/acre. Mean shrub density was 1,101 stems/ac with broom snakeweed ([Table 15.2-10](#)).

15.2.3 Badlands

The Badlands vegetation community consists of exposed, weathered shales with steep to moderately undulating topography (10 to 60% slopes). These sites generally occur between plateau edges and major drainages. The Badlands have the least vegetation of any of the six communities. Plants, where they occur, are often located along the small relief channels of these barren areas. This vegetation community can abruptly shift to another vegetation community or gradually transition to Alkali Wash or Thinbreaks communities. Badlands are sparsely vegetated and cover data demonstrates few seasonal differences. The Badlands vegetation community accounts for 22.89% of the permit area ([Table 15.2-1](#))

Inventories in 1987 measured absolute cover in the Badlands vegetation community at 1.2% ([Table 15.2-2](#)), with annuals and perennials comprising 0.4% and 0.8%, respectively ([Table 15.2-14](#)). In 2004, absolute cover was measured at 1.1% ([Table 15.2-4](#)) with forbs comprising 62.5% and shrubs 28.3% of relative cover ([Table 15.2-15](#)). In 2007, absolute cover varied from 3.7% in the spring to 3.1% in the fall ([Table 15.2-6](#) and [Table 15.2-16](#)). Spring absolute perennial cover was 0.8%, which comprised 22.9% of the relative cover. Fall absolute perennial cover was 1.0%, which comprised 33.1% of relative cover. The greatest contributor to absolute cover in the spring and fall sampling was annual forbs with a relative cover of 66.7% and 65.4%, respectively ([Table 15.2-16](#)).

The mean biomass production was 394.8 lbs/acre in 1987 ([Table 15.2-8](#)) and 85.9 lbs/acre in 2007 ([Table 15.2-6](#)). The stocking rate in 2007 was 1.0 AUMs/acre ([Table 15.2-9](#)).

Mean shrub densities were 506 stems/acre in 1987 and 405 stems/acre in 2004. In 2007, mean shrub density was 520 stems/acre with broom snakeweed and 514 stems/acre without broom snakeweed ([Table 15.2-10](#)).

15.2.4 Dunes

Dunes form gently rolling terrain (0 to 5% slopes) located on the leeward side of ridges, bluffs, and plateaus. Soils within the Dunes vegetation community are deep and composed of well-drained eolian

sands. These deep sands allow for deep water availability. Since only deep-rooted perennial plants can exploit this water, Dunes have several unique plant species, such as canaigre dock (*Rumex hymenosepalus*) and sand sagebrush (*Artemisia filifolia*). The Dunes represent the second to the smallest vegetation community in the permit area covering 5.7% ([Table 15.2-1](#)).

Absolute cover of Dunes was -3.6% in 1987 ([Table 15.2-2](#)). All vegetative cover was perennial with the highest cover values for grasses at 2.5% ([Table 15.2-17](#)). In 2004, absolute cover was measured at 6.2% ([Table 15.2-4](#)) with forbs accounting for 50.3% of relative cover ([Table 15.2-18](#)). Absolute cover in 2007 varied from 20.3% in the spring to 15.0% in the fall due to seasonal changes in species composition, primarily higher spring annual forb cover ([Table 15.2-6](#) and [Table 15.2-19](#)). In 2007 spring and fall data collections, annual forbs contributed 50.6% and 37.5% of relative cover, respectively. Absolute perennial cover in the spring was 9.7% which comprised 48.1% of relative cover. Absolute perennial cover in the fall was 9.1% which comprised 60.5% of relative cover ([Table 15.2-19](#)).

Mean biomass production was 1223.5 lbs/acre in 1987 ([Table 15.2-8](#)) and 209.7 lbs/acre in 2007 ([Table 15.2-6](#)). The stocking rate in 2007 was 0.9 AUMs/acre ([Table 15.2-9](#)).

Mean shrub densities were 2,813 stems/acre in 1987 and 3,805 stems/acre in 2004. In 2007, mean shrub density was 730 stems/acre with broom snakeweed and 487 stems/acre without broom snakeweed ([Table 15.2-10](#)).

15.2.5 Sands

The Sands vegetation community contains moderately deep soils which can range from Saline to Calcareous sands. As with Dunes, the deeper penetration of rainwater into sandy soils allows for greater water availability and increases plant species diversity. The Sands vegetation community often transitions to and can be mixed with Thinbreaks. In years with high amounts of spring rainfall, the Sands vegetation community can display an abundance of annuals including scorpion weed (*Phacelia crenulata*), annual Townsend daisy (*Townsendia annua*), and *Cryptantha* species. The Sands vegetation community makes up 21.2% of the permit area ([Table 15.2-1](#)).

In 1987, vegetative cover was measured in the Sands and Saline Sands communities. The Sands sites had an absolute cover of 2.9% and the Saline Sands sites had 3.8% absolute cover. Absolute vegetative cover in Saline Sands was the second highest of the communities inventoried in 1987 ([Table 15.2-2](#)). In the Sands and Saline Sands sites, perennial grasses comprised the bulk of the relative cover, accounting for 62.4% and 87.3%, respectively ([Table 15.2-20](#)).

Sands and Saline Sands were combined into one community for inventories in 2004 and 2007. Absolute cover in the combined Sands community in 2004 was measured at 8.4% ([Table 15.2-4](#)). Forbs were the

dominant life form accounting for 61.1% of relative cover while shrubs comprised 22.2% ([Table 15.2-21](#)). In the 2007 inventories, absolute cover varied from 14.8% in the spring to 13.1% in the fall, even though the composition of annual forbs and perennial grasses changed more appreciably between the seasons ([Table 15.2-6](#) and [Table 15.2-22](#)). Relative cover of annual forbs in the spring and fall was 58.8% and 39.7%, respectively. Meanwhile, relative cover of perennial grasses in the spring and fall was 18.9% and 40.5%, respectively. Spring absolute perennial cover was 6.0%, which comprised 40.4% of relative cover. Fall absolute perennial cover was 7.9%, which comprised 59.9% of the relative cover ([Table 15.2-22](#)).

In 1987, mean biomass production was measured in Sands and Saline Sands community at 917.3 lbs/acre and 913.8 lbs/acre, respectively ([Table 15.2-8](#)). In 2007, the mean biomass production for the Sands community was 208.6 lbs/acre ([Table 15.2-6](#)) and the stocking rate was 1.1 AUMs/acre ([Table 15.2-9](#)).

In 1987, mean shrub density for the Sands and Saline Sands vegetation community was 6,301 stems/acre and 1,087 stems/acre, respectively. In 2004, shrub density was 648 stems/acre in the combined Sands community. In 2007, Sands mean shrub density was 1,108 stems/acre with broom snakeweed and 486 stems/acre without broom snakeweed ([Table 15.2-10](#)).

15.2.6 Thinbreaks

Thinbreaks topography includes exposed shale, siltstone, and sandstone outcrops and associated thin soils of the immediate adjacent area. These sites typically occur along ridges and rock outcrops between plateaus and major drainages or plateaus and Badlands, as well as butte and mesa tops. Slopes vary from 2 to 9%. The soil surface is usually covered with thin, broken fragments of sandstone. These are rocky areas, sometimes with loose rock and sometimes with large pieces of rock firmly embedded in the ground. Thinbreaks are typically upland habitats with surface rock as a unifying feature. Flat surface rocks allow for greater water runoff and for accumulation in crevices or fissures between rocks. Thinbreaks vegetation communities can abruptly shift to another vegetation community or gradually shift to Badlands or sandy soil types. The Thinbreaks vegetation community comprises 15.89% of the permit area ([Table 15.2-1](#)).

In 1987, Thinbreaks had an absolute cover value of 3.5% ([Table 15.2-2](#)), with perennial vegetation comprising 3.4% ([Table 15.2-23](#)). In 2004, absolute cover in this community was 2.1% ([Table 15.2-4](#)) with shrubs and forbs comprising 48.7% and 35.9% of relative cover, respectively ([Table 15.2-24](#)). In 2007, absolute cover varied from 4.4% in the spring to 4.8% in the fall ([Table 15.2-6](#) and [Table 15.2-25](#)). The greatest contributor to relative cover in the spring and fall was annual forbs with 57.7% and 58.5%, respectively. With a low vegetative component in the Thinbreaks community, there was little difference between cover values in spring and fall data. Spring perennial absolute cover was 1.7%, which comprised 38.0% of the relative cover. Fall perennial absolute cover was 1.9%, which comprised 40.5% of the relative cover. ([Table 15.2-25](#)).

The mean biomass production was 1048.9 lbs/acre in 1987 ([Table 15.2-8](#)) and 121.3 lbs/acre in 2007([Table 15.2-6](#)). The stocking rate in 2007 was calculated at 0.7 AUMs/acre ([Table 15.2-9](#)).

The mean shrub densities were 3,171 stems/acre in 1987 and 40 stems/acre in 2004. In 2007, shrub density was 511 stems/acre with broom snakeweed and 409 stems/acre without broom snakeweed ([Table 15.2-10](#)).

15.3 Endangered and Threatened Plant Species

~~Ecosphere conducted threatened, endangered and sensitive species (TES) surveys in 1987, and 2004, and 2007. Details of surveys are provided in Appendix 15.A, Appendix 15.B, and Appendix 16.BC. In 2012, Ecosphere conducted additional surveys. The purpose of the field surveys was to refresh the 1987 and 2004 occurrence data for threatened, endangered, and sensitive flora and fauna species and their potential habitat information within the Pinabete permit area. Details of the 2012 surveys are provided in Appendix 15.D. The detailed report is provided in Appendix 15.D. The 2012 surveys focused on species listed by the United States Fish and Wildlife Service and the Navajo Natural Heritage Program of the Navajo Nation Department of Fish and Wildlife as documented or having potential to occur in the permit area. Potential habitat in the permit area was evaluated and delineated using a combination of vegetation community types and soil survey map unit descriptions. All habitats were verified and observed using high-powered binoculars and a spotting scope. Field surveys were conducted between June 20 and July 2, 2012. Unique habitat or potential habitat was surveyed for TES flora presence/absence using teams consisting of two qualified botanists walking parallel transects about 20 feet apart. When TES flora species were found, their locations were digitally recorded with a handheld global positioning system unit.~~

There are no records of any previous occurrences of federally listed flora species occurring within the permit area. No potential habitat occurs within the permit area boundary for any federally listed threatened or endangered flora species listed for San Juan County. ~~Details of threatened and endangered species surveys are provided in Appendix 15.A, Appendix 15.B, and Appendix 16.B. Appendix 16.B.~~ No Navajo Nation threatened or endangered species, or potential habitats, have been identified within the ~~BNCNTEC~~ mining lease. Therefore, disturbance activities within the permit area would have no effects on any federally listed threatened or endangered flora species.

No Navajo Nation threatened or endangered species, or potential habitats, have been identified within the permit area. However, San Juan milkweed (*Asclepias sanjuanensis*), a Group 4 species on the Navajo Endangered Species List (NESL), has been recorded within the permit area. Group 4 refers to a species for which NNDFW does not currently have sufficient information to support this species being listed as threatened or endangered on the NESL (Navajo Nation 2008). There are no federal, state, or Navajo Nation protections for this species.

San Juan milkweed flowers in April and has mature fruits in mid- to late May. The characteristic habitat of this plant is sandy soil, sometimes occurring in piñon-juniper woodlands. In the permit area, this species occurs in the Dunes vegetation community. Further discussion on the occurrence of San Juan milkweed is provided in [Appendix 15.B](#). In 2004, San Juan milkweed was encountered at four widely dispersed locations in Area 4 North. Eight or more individual milkweed plants were encountered at each of these locations ([Appendix 15.B](#)). Seven widely scattered populations of San Juan milkweed were documented in the permit area during the 2012 surveys (Appendix 15.D). Generally, populations contained two to five individuals, with the largest population containing seven individuals.

Personnel

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