3. AFFECTED ENVIRONMENT

This chapter describes relevant existing environmental conditions for resources potentially affected by the Proposed Action and alternatives, as described in Chapter 2. In compliance with requirements contained in NEPA, and implementing regulations, and related guidance, the description of the affected environment focuses on those environmental resources potentially subject to impacts. The resources described include geological resources, paleontological resources, water resources, noise, visual resources, air quality, vegetation, wildlife, threatened and endangered and sensitive species, socioeconomics, environmental justice, land use, cultural resources, traffic and transportation, and health and safety.

The geographic scope of the affected environment depends on the potential impacts on each resource evaluated in this EA. In general, the term Project Area refers to the area where the proposed activities would occur including areas to be mined in Area III, areas proposed to be mined in Area IV North, associated mine activity related to these mining activities (e.g., train operations, haul trucks, etc., that occur in Areas I, II, III and IV North) and the proposed Burnham Road realignment. However, for some resources, the geographic extent of the area potentially affected by the proposed activities is larger than the Project Area and is described for those resources below.

3.1 Geological Resources

3.1.1 Definition of Resource

Geological resources are defined for this analysis as geology, soils, and paleontological resources. For geology, the geological resource assessment includes a larger area, as associated with the assessment of groundwater resources in Section 3.2.2. The target solid leasable mineral resource within the geology assessment area is coal. No other leasable or locatable minerals are present within the geological resources assessment area, nor are there economically viable fluid leasable minerals (natural gas or oil) or leases for these minerals located within the assessment area. Therefore, other than coal resources, no other minerals resource is discussed in this EA. The geological resources assessment area for soils and paleontological includes just the areas of proposed mining in Area III and Area IV North, and the proposed corridor of the Burnham Road realignment.

Coal mining is regulated by OSM under SMCRA and the BLM approves R2P2 to ensure mining achieves maximum recovery of mineral resources. Maximum economic recovery of the coal resource is determined by BLM under the R2P2 process. Paleontological resources include the fossilized remains of plants and animals. Federal protection for paleontological resources stems from the Antiquities Act of 1906 (Public Law [PL] 59-209; 16 United States Code [USC] 431 et seq.) and the Paleontological Resources Preservation Act of 2009, which requires protection of historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest, including paleontological resources on federally-administered lands. In general, “protections” pertain to issues of ownership, collection, and sale. The United States holds tribal lands in trust for tribes and BLM manages paleontological resources on tribal lands as a trust asset for tribes' economic benefits. While the Navajo Nation does not have a written policy for dealing with paleontological resources on their lands, these resources are generally

administered in accord with the principles and recommendations of the Assessment of Fossil Management on Federal and Indian Lands (USDI 2000).

No alluvial valley floors, as defined under SMCRA, 30 CFR 701.5 are present within or surrounding the geological resources assessment area.

3.1.2 Affected Environment

3.1.2.1 Geology

The assessment area for geology includes the Lowe Arroyo to the north, lands to 5 miles east of BNCC's coal lease boundary, the No Name Arroyo to the south, and the Chaco River to the west. Topography in this area is highly variable, and varies from flat valley bottoms and mesa tops to steep and eroded cliff faces associated with incised canyons and geologic outcrop areas. The mesa tops associated with the outcrop areas are local high points, with vistas of the Chuska Mountains to the west and badlands of the interior San Juan Basin to the east. Badlands are defined as an area of severe erosion, usually found in semiarid climates, and characterized by countless gullies, steep ridges, and sparse vegetation. The Proposed Action would be located on the western edge of the San Juan Basin, a near circular 100 mile wide structural depression located on the eastern flank of the Colorado Plateau physiographic unit. The San Juan Basin consists of near horizontal layers of sedimentary material deposited during shifting depositional environments of a shallow inland sea during the late Cretaceous to early Tertiary period. The deposited material consists of marine and non-marine coastal deposits (Stone et al. 1983). No major faults cut the geology assessment area, although minor low angle compaction faults and slumps up to eight feet in displacement are common within the Navajo Mine permit area. Seismically, the area is very stable with no historically recorded earthquakes of sufficient magnitude to damage structures.

The rock strata in the geology assessment area strike north-south. The average dip in the area is two degrees to the east. The target geologic formation for the Proposed Action is the lower 250 feet of the Fruitland Formation, the principal coal-bearing formation in San Juan Basin. The Fruitland Formation is overlain by the Kirtland Shale Formation and deposited above the Pictured Cliff Sandstone (PCS) and Lewis Shale formations. Kirtland Shale consists of inter-fingered siltstone, sandstone, and claystone beds. The Fruitland Formation contains interbedded sandy shale, carbonaceous shale, sandstone, and multiple coal layers. The sedimentary material was deposited by rivers in a swampy delta plain and back beach environment. The PCS consists of alternating sandstone, gray siltstone, and mudstone beds that inter-finger with the Lewis Shale Formation. The Lewis Shale Formation consists of silty marine shale with inter-bedded limestone, sandstones, and clays. Other surface material present within the geological resources assessment area includes Quaternary period alluvium and eolian sand deposits. Several deposits of Quaternary alluvial and eolian sands occur. These are important sources of topdressing material for reclamation from mining disturbance in the Navajo Mine.

Fruitland Formation coal seams are very lenticular in nature and most are only mineable in localized areas. Up to seven different mineable seams may occur within the geology assessment area. The seven mineable coal seams (greater than two feet thick, at least 6,000 Btu/lb., and having an aerial tent and stratigraphic position that makes the seam economically viable to mine) are shown in Table 3.1-1. Some of the coal seams in the permit area are water-bearing, though classifying these strata as aquifers is questionable due to their low permeability and production rates, and the naturally poor quality of their

water precluding use as a water source in the region. A description of groundwater hydrology is provided in Section 3.2.2.1 – Groundwater.

Table 3.1-1. Mineable Coal Seams in Area III and Area IV North

Coal Seam	Position	Characteristic	Average Mineable Thickness (feet)
2A	Directly over PCS	Split by Seam 2B	3.2
2B	Directly over PCS, bottom-most mineable coal seam	Becomes thicker to southwest and pinches out in Area III and along east boundary of Area IV North	2.0 to 11.0
3	8 to 27 feet above No. 2 coal seam	In the southwest portion of Area IV North, merges with No. 4 coal seam to form single seam	4.5
4	At, and up to 19 feet above No. 3 coal seam	Pinches out in the southwest portion of Area III and merges with No. 3 coal seam along western edge of Area IV North	6.0
5	13 to 23 feet above No. 4 coal seam	In western half of Area IV North	2.7
6A	9 to 54 feet above No. 4 coal seam	In southern portion of Area III, seam splits from No. 6B coal seam	2.3
6B	5 to 37 feet above No. 4 coal seam and 6 feet above No. 5 coal seam (as it exists)	Good quality coal seam in terms of thickness and coal grade in Area IV North and southern part of Area III	4.5
7	4 to 128 feet above No. 6 coal seam	Most consistent coal seam, extending from Area IV North through Area III	4.9
8A	4 to 25 feet above No. 7 coal seam	Extensive and widespread, pinches out along eastern boundary of Area IV North and splits from No. 8B coal seam in Area III	6.0
8B	16 feet above No. 8A coal seam in Area IV North and Area III	Exists throughout Area IV North and Area III	11.5

Characterization of the surface geological material for proposed mining in Area III and Area IV North was completed as part of the 2009 mine permit renewal (OSM 2009). The target coal seams for mining activities are located within the lower 250 feet of the Fruitland Formation. Overburden and interburden material is defined as the consolidated geologic strata from the geologic formations that lie above and between mineable coal seams (OSM 2009). A comprehensive sampling of overburden material within the adjacent Navajo Mine and proposed mining areas is Area III and Area IV North, was completed in 1987 to characterize the material for suitability for reclamation and to identify any potentially acid or toxic

forming materials. The findings for overburden sampling activities indicate that the overburden material is generally acceptable as reclamation rooting zone material. Two naturally occurring trace elements of concern—boron and selenium—have been detected in core samples of overburden material. However, elevated levels of the soluble forms are uncommon when averaged throughout the overburden and therefore is not considered a limiting factor for reclamation.

3.1.2.2 Soils

The United States Department of Agriculture (USDA) Soil Conservation service (now Natural Resources Conservation Service (NRCS) conducted an Order 3 soils survey in 1980 (NRCS 1980) and another Order 3 soil survey, entitled Soil Survey of Shiprock Area, Parts of San Juan County, New Mexico and Apache County, Arizona (NRCS 2001). Many of the soils in the survey area are formed from alluvium and eolian sediments derived from shale and sandstone. Some soils are formed in place and are considered residual. 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.

BNCC conducted Order 1 and 2 soil surveys between 1984 and 1989 within Area III and Area IV North. In addition, Buchanan Consultants conducted a pre-strip soil survey of the Area 4 North Boxcut area (Buchanan 2008). These surveys generally follow the taxonomic system utilized by the NRCS and focus on identification of soil mapping units and salvageable topdressing material within the survey area (topdressing refers to all unconsolidated material capable of supporting plant growth in the upper 60 inches of the native in-situ soil profile). Results of BNCC's soil surveys classify soils into Badlands, Natragrids, and potential topdressing sources. The three types of material each cover approximately one third of the geological resource assessment area (33 percent each). Badland soils are not suitable as topdressing material and Natragrids soils have limited suitability as topdressing material due to elevated concentrations of sodium. The topdressing material is utilized as cover material in post-mining reclaimed areas. Characterization of topdressing material quality and quantity was completed by BNCC in 1994 for the areas identified by the 1984 and 1989 soil studies as having soil types that are potentially suitable for topdressing material (BNCC 1994). The Buchanan Consultants pre-strip soil survey (Buchanan 2008) also evaluated the Area 4 North Boxcut area for potentially suitable topdressing material.

3.1.2.3 Paleontological Resources

The vertebrate faunas of the Fruitland Formation and Kirtland Formation represent the largest and most diverse Late Cretaceous faunas of the southern Western Interior (Hunt and Lucas 1992). Examples of fossils that can occur in the formations, include teeth and jaw fragments of Crocodilia sp. (*Crocodiles*), isolated occurrence of teeth, vertebra, and other bones related to Elasmosauridae (*Plesiosaurs*), Platecarpus sp. (*Mosasaur*), Tyrannosauridae (possibly *Albertosaur*, *Tyrannosaur*), Hadrosauridae (*Duck-billed*), and Ceratopsiudae (*Pentaceratops*), also abundant are Turtle (*Turtilia*) shell fragments—these are among the vertebrate species that have been documented from the region. Evidence of vertebrate soft tissue is uncommon to rare in the fossil record. Invertebrate fossils include several mollusk species. The majority of the invertebrate fossils are unionid bivalves, oysters, and non-marine gastropods, which are common in the Fruitland Formation (Hunt and Lucas 1992). Microfossils in the Fruitland Formation include unidentified fish teeth and gar scales, as well as molars and stingers of freshwater manta rays.

There are no regional classification systems that rank the geological resource assessment areas as containing common or rare paleontological resources—only geological formations are known or have potential to yield resources. However, comments received during the public workshops indicated this area in general is valued for its high diversity of paleontological resources, including dinosaur, crocodiles, sharks, small fish, reptiles, hadrosaur, mosasaurus, triceratopses, and allosaurus. Currently, there is a Memorandum of Understanding (MOU) between the Navajo Nation and the Museum of Northern Arizona, Flagstaff, Arizona for curatorial services regarding paleontological specimens collected from Navajo Nation land. Recent surveys within the Navajo Mine lease area in or near the geological resource assessment area (URS 2007a) confirm the literature described above. These surveys yielded crocodile teeth and fragmented scute plates, turtle shells, fish gar scale, fish teeth, brackish water ray stingers and teeth, plant fragments (including stems and leaves), crocodile teeth and bone fragments, dinosaur (plesiosaur) vertebra, hadrosaur bones, tyrannosaurus bones, unionid bivalves, freshwater gastropods, and numerous scattered petrified logs and stumps. These resources represent a mix of common fossils such as the petrified logs and stumps to more uncommon dinosaur fossils as determined by the population abundance of the particular animal.

3.2 Water Resources

3.2.1 Definition of Resource

For this analysis, water resources include surface water, including WUS and groundwater whose use, quality, or quantity may be affected by the proposed Project. Water resources in the arid environment in which the Navajo Mine is located, which receives about 5 inches of precipitation per year, are limited. Existing conditions for some of the water resources discussed in this section include the effects of past and current mining operations.

The water resources considered in this EA have been defined broadly to include the water resources that could be affected directly or indirectly by the proposed Project and alternatives. The groundwater resources include the Fruitland Formation that contains the coal seams to be mined, the Pictured Cliffs Sandstone (PCS) Formation that underlies the Fruitland Formation, and the unconsolidated alluvial deposits in the valleys of the San Juan River, Chaco River, and the Chaco tributaries, including Cottonwood Arroyo. The surface water resources include the San Juan River, the Chaco River, the named tributaries to the Chaco River, primarily Cottonwood and Lowe Arroyos, and unnamed ephemeral headwater and tributary channels that are located within the proposed Project Area.

Existing conditions in the Project Area reflect the comprehensive regulatory standards and requirements implemented for many years by operations at Navajo Mine under a variety of federal authorities. The CWA is the primary federal regulation that protects the nation’s waters including surface waters and wetlands. The USACE regulates fill in WUS under Section 404 of the CWA. The EPA regulates discharge of stormwater and pollutants into WUS under the NPDES program under Section 402 of the CWA. The Navajo Nation establishes and certifies compliance with water quality standards under Section 401 of the CWA. In addition, OSM, which regulates mining on tribal lands, sets requirements for characterizing water resources, for assessing the PHC of mining, and for hydrologic monitoring. In addition, OSM requires the restoration or replacement of any water supply that has been contaminated,

polluted, diminished, or interrupted by mining operations. The updated PHC analysis provides additional detail regarding the water resources in the Project Area (BNCC 2011a § 11.6).

3.2.2 Affected Environment

3.2.2.1 Groundwater

The geologic units bearing groundwater within and adjacent to the Project Area, and which could be affected by the Proposed Action, include:

- The alluvial groundwater of the Chaco River and Cottonwood Arroyo
- The coal seams of the Fruitland Formation
- The overburden of the Kirtland Shale and Fruitland Formations
- The Pictured Cliffs Sandstone (PCS), located below the Fruitland Formation

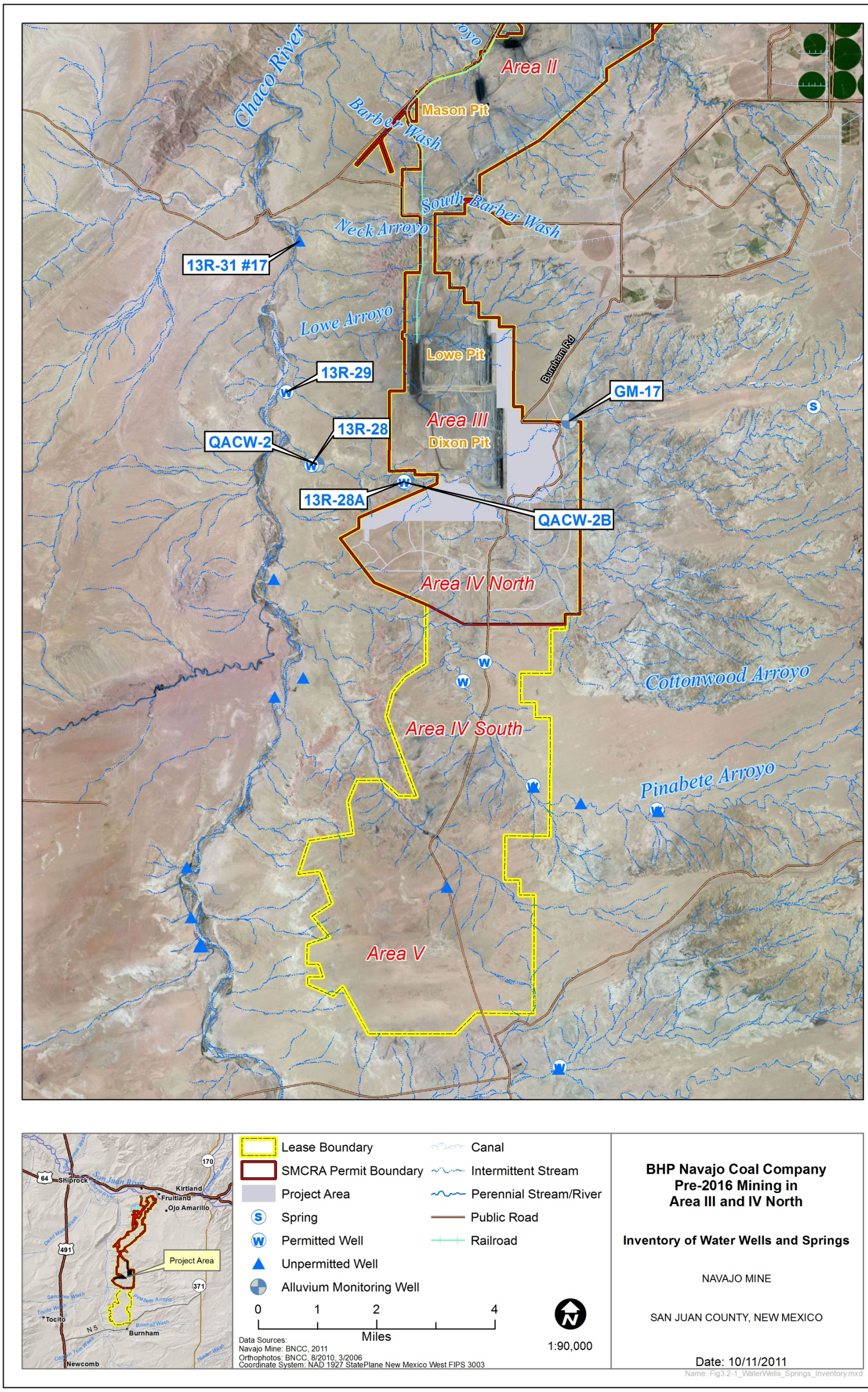
Additional information on the hydrogeology of these units is provided in Chapters 6 and 11 of the mine permit application package (BNCC 2011a), and in various technical reports and papers, including Thorn (1993), Stone et al. (1983), and Myers and Villanueva (1986).

3.2.2.1.1 Groundwater Use

Groundwater use in and surrounding the Project Area is extremely limited in extent and is derived from a few stock wells completed within the alluvium of Cottonwood Arroyo, Pinabete Arroyo, and the Chaco River. A regional study of the San Jan Basin by Stone et al. (1983) identified no water supply wells completed in the Fruitland Formation or the underlying PCS within several miles of BNCC's Navajo coal lease. This regional study included a conclusion that the Fruitland and Kirtland Formations and the underlying PCS are not important water supply aquifers in the San Juan Basin because they are both reservoirs for natural gas—generally have low yield—and have relatively high salinity. Nevertheless, both the Kirtland-Fruitland Formation and the PCS supply water to a few stock wells located near outcrops within portions of the San Jan Basin where recharge dilutes salinity (Stone et al. 1983).

An inventory of wells within and adjacent to the BNCC coal lease is included in Appendix 6.E of the mine permit application package (BNCC 2011a). There are no identified water wells within the area proposed for mining and reclamation activities. The inventory identifies two water wells, W-0644 and W-0618, along Cottonwood Arroyo approximately 0.2 miles and 1.4 miles, respectively, down valley from the Navajo Mine permit boundary (Figure 3.2-1). The inventory also identifies three wells along the Chaco River, W-0654, W-0342, and W-0519, approximately 0.75 miles, 3.3 miles, and 3.4 miles, respectively, down valley from the confluence with the Cottonwood Arroyo (Figure 3.2-1). Wells W-0654 and W-0519 are dug livestock wells completed in the Chaco River alluvium. The aquifer tapped by W-0342 is unknown, and Metric Corporation (1991) was unable to locate the well during its 1991 survey.

Figure 3.2-1. Inventory of Water Wells and Springs



The other wells and springs identified in the inventory are upgradient of the Navajo Mine permit area. Almost all of these wells are stock wells completed in the alluvium of the Chaco River or in main tributaries. No drinking water supply wells exist in the Project Area or the area that may be affected by the proposed Project.

3.2.2.1.2 Groundwater Quantity and Flow

Groundwater availability in the Fruitland coals and the PCS near BNCC's lease area is limited by the relatively low hydraulic conductivity of the coals and the PCS and by the low rates of recharge (BNCC 2011a § 11.6). Based on the previous mining experience at the Navajo Mine, the coals, the overburden, and the interburden in the Fruitland Formation do not yield much water during mining. The existing mining pits have generally remained dry except on rare occasions when surface flows are captured following precipitation events. Groundwater seeps are rarely observed within the mine pits as any groundwater in the Fruitland overburden and coals is typically consumed by evaporation along the highwall.

No springs or seeps have been observed during hydrologic investigations conducted within and adjacent to the proposed Project Area. Alluvial groundwater occurs within the valley bottom of Cottonwood and Pinabete Arroyos within the BNCC's lease area and along the Chaco River several miles west of the lease boundary. The alluvium provides limited stock water supply at several dug wells, although many of the wells are often dry. The background monitoring of Cottonwood Arroyo alluvial wells found that the alluvium is variably saturated and often does not yield sufficient water for sampling.

3.2.2.1.3 Groundwater Quality

Baseline water quality monitoring has been conducted by BNCC at three monitoring locations in the alluvium of Cottonwood Arroyo as shown in Figure 3.2-2. The baseline water quality monitoring results for the three Cottonwood alluvial wells are summarized in Appendix 6.G, Table 6.G-1 of the Mine Plan Revision (BNCC 2011a). The water quality results show the alluvium of Cottonwood Arroyo to be a sodium sulfate type with variable total dissolved solids (TDS) concentrations. Water within the Cottonwood alluvium is unsuitable for drinking water use because of naturally occurring high TDS, sulfate, iron, and manganese levels. The water in the alluvium of the mainstem of Cottonwood Arroyo has been used for stock watering when available. Water availability for livestock watering is often limited by the low saturated thickness in the aquifer. TDS and sulfate concentrations are also often above livestock use suitability criteria (Lardy and Stoltenow 2008).

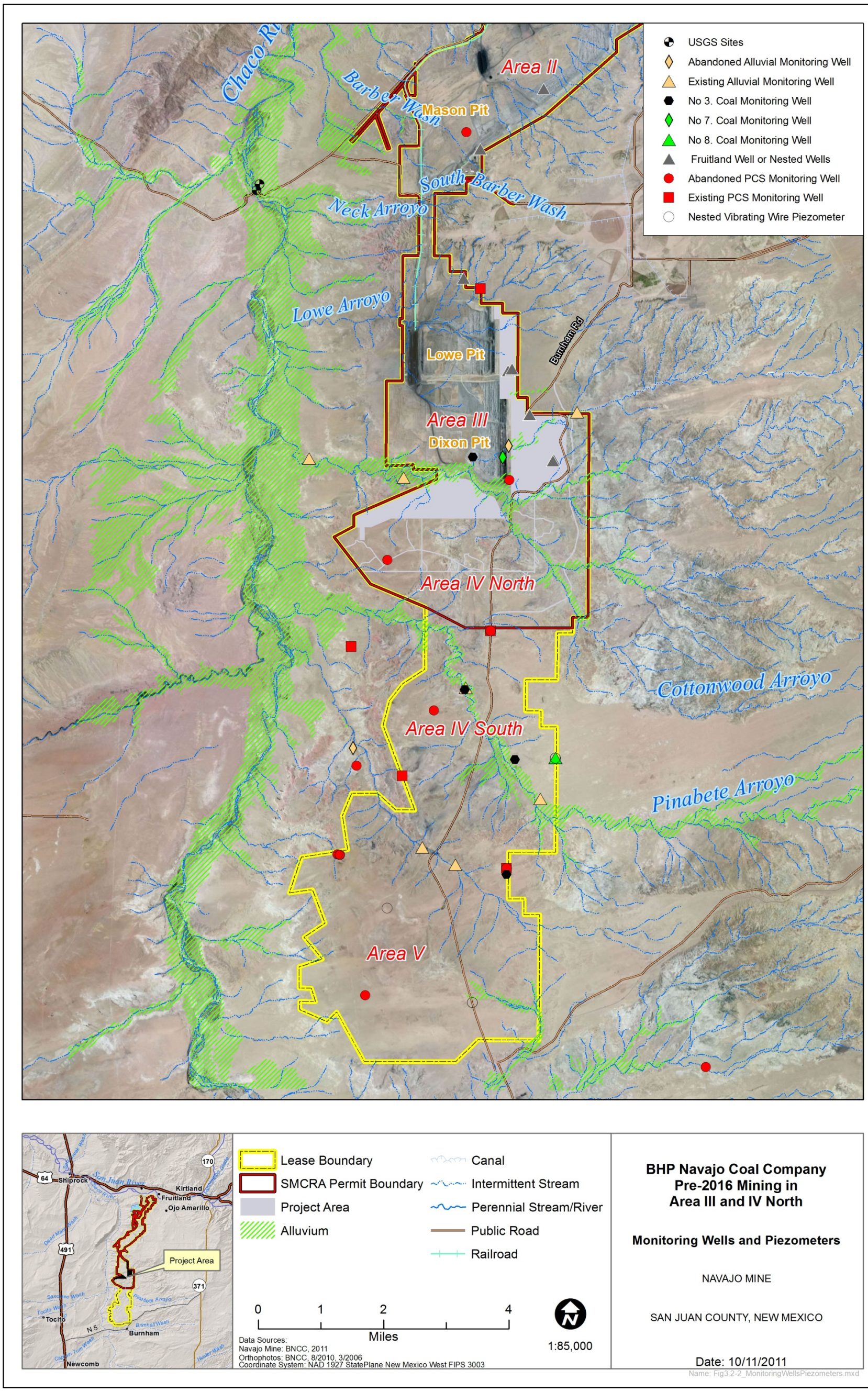
Information on baseline water quality for the Chaco River alluvium is provided in the reports by Myers and Villanueva (1986) and by Thorn (1993). Myers and Villanueva (1986) provide analysis results for 12 observation wells completed in the alluvium along the Chaco River and five observation wells completed in the alluvium of tributary washes or arroyos east and northeast of the Chaco River. This study found a general increase in TDS and sulfate concentrations in the downstream direction. Thorn (1993) reports water quality results for three wells completed in the alluvium of Chaco River. These results show the water quality to be a sodium-sulfate type. The results also show that the water quality is quite variable and unsuitable for drinking water use based on the EPA secondary drinking water standards due to elevated levels of TDS and sulfate. Water quality was generally within a suitable range for livestock watering, however, occasional exceedance of livestock use suitability criteria occurred with respect to TDS, sulfate, and chloride.

Information on the baseline water quality in the San Juan River alluvium is provided in the well inventory included in Appendix 6.E of BNCC (2011a). The available water quality information obtained from these wells and from other San Juan River alluvial wells in the vicinity as reported by Thorn (1993) show that water quality in San Juan River alluvium is also quite variable. The TDS and sulfate concentrations in all wells sampled are above the EPA drinking water use criterion. Water quality was generally within a suitable range for livestock watering, however, occasional exceedance of livestock use suitability criteria occurred with respect to TDS, sulfate, and chloride.

Water quality monitoring data from Fruitland Formation coal wells at the BNCC monitoring locations show that baseline groundwater in the coals is very saline. Baseline water quality measurements were obtained from 10 coal wells located within Areas II, III, and IV of the BNCC Navajo coal lease (BNCC 2011a, Appendix 6.G). The TDS concentrations in the coal water for BNCC's baseline monitoring exceed the Navajo Nation and EPA water quality criteria for drinking water use. The TDS concentrations also indicate that the coal water is a poor source for livestock use (Landry and Stoltenow 2008).

Information on background groundwater quality has also been obtained for the PCS at six locations within BNCC's lease boundary. Locations of monitoring wells, including the monitoring wells that have been abandoned, are shown in Figure 3.2-2. Water quality data for these PCS monitoring wells indicate a sodium-sulfate type with high TDS concentrations. The groundwater in the PCS within Areas IV North and South and V of the BNCC lease boundary is generally unsuitable for either domestic or livestock use due to poor water quality and low well yields (BNCC 2011a, Appendix 6.G). This is a common characteristic of water quality in the PCS.

Figure 3.2-2. Monitoring Wells and Piezometers



3.2.2.2 Surface Water

BNCC's Navajo Mine is located in the San Juan River Watershed. The San Juan River basin is within New Mexico, Arizona, Colorado, and Utah, and comprises drainage of 24,908 square miles within USGS Hydrologic Unit Code (HUC) 1408. Most of the lease area drains from east to west into the Chaco River—a tributary of the San Juan River. The Chaco River watershed comprises drainage of 4,563 square miles within the USGS HUC 14080106. BNCC holds New Mexico Office of the State Engineer (NMOSE) Permit Number 2838 and associated groundwater Permit Number SJ-2917, which provides BNCC a total diversionary right of 51,600-acre-feet annually, with a consumptive right of 39,000-acre-feet annually, for waters drawn from the San Juan River. The diversions under the water right are the source of water for Morgan Lake and for the water supplies used by BNCC for mining, coal processing, reclamation operations, and by APS for Power Plant Operations. Flow in the Chaco River is ephemeral, except for releases of water from Morgan Lake that provide perennial flow on the Chaco River downstream of the discharge point in the lower, northern reaches of the watershed near its confluence with the San Juan River.

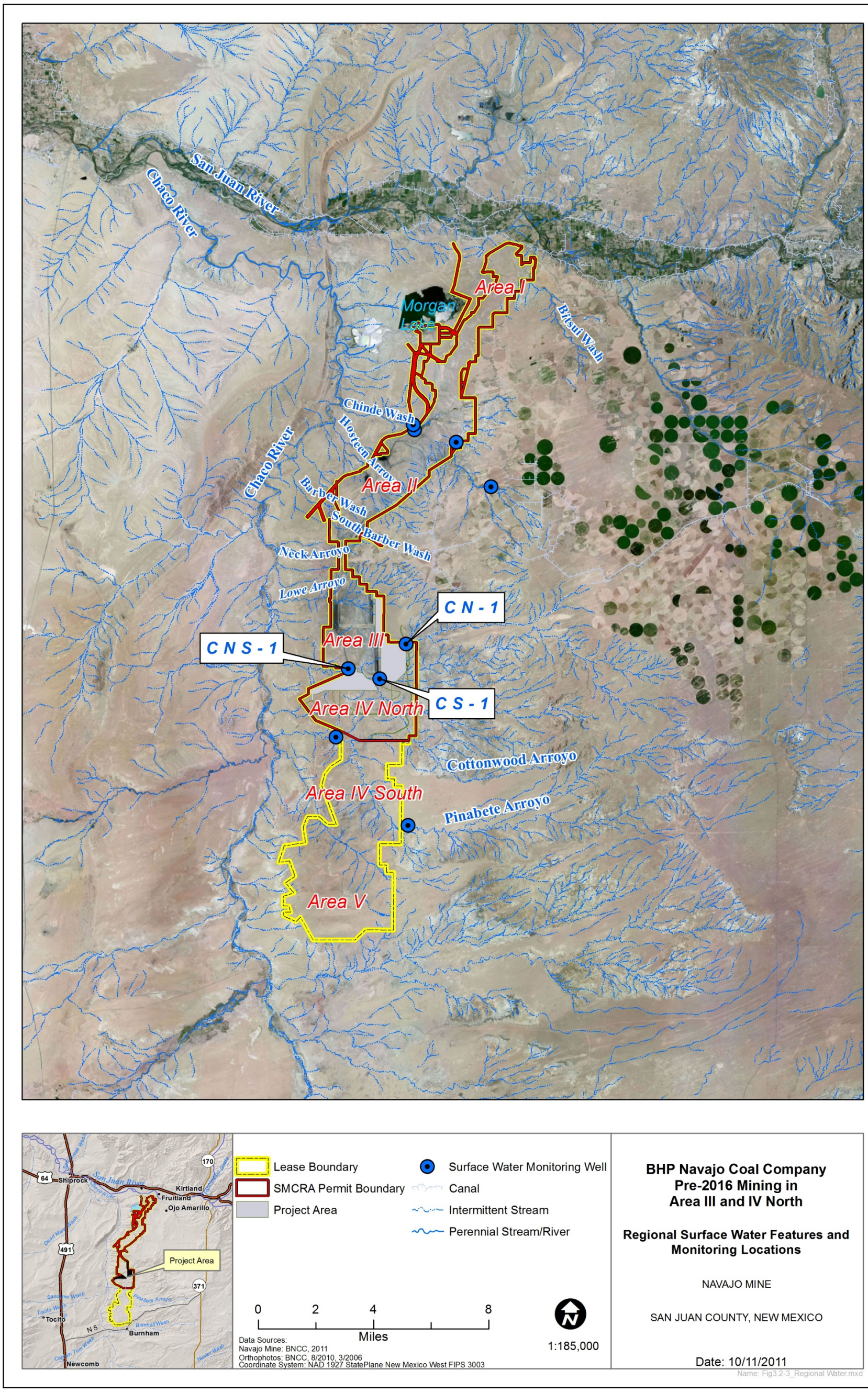
The surface water drainages within and adjacent to the Project Area include 8 named ephemeral streams that drain from east to west across the mine permit area and into the Chaco River, located west of the Navajo Mine. From south to north, the drainages include Pinabete Arroyo in Area IV South, Cottonwood Arroyo in Area IV North, Lowe Arroyo in Area III, Neck and South Barber Arroyos, Barber Wash, Hosteen Wash and Chinde Wash in Area II as shown in Figure 3.2-3. Bitsui Wash drains to the north into the San Juan River. Bitsui receives drainage from pre-SMCRA jurisdictional lands on the northern area of the mine lease but no drainage from the reclaimed areas or from sediment ponds within BNCC's Navajo Mine SMCRA permit area. Cottonwood Arroyo, Pinabete Arroyo, and Chinde Wash have the largest drainages of the Chaco River tributaries at 80.1, 55.5, and 46.3 square miles, respectively. The proposed Project Area includes Cottonwood Arroyo, its tributaries, and Lowe Arroyo.

Within and adjacent to the proposed Project Area, surface water use is limited to stock watering at ponds located outside of active mining areas. Stock water ponds were constructed to catch surface flows from some tributary drainage. One structure, the "Gilmore" pond, is located upstream of the Lowe Pit. There are no other private water rights in or near the Project Area. Comments received during the public workshops indicated concern about stock ponds being affected by coal dust.

3.2.2.2.1 Cottonwood and Lowe Arroyos

The primary surface water drainages that intermittently flow through the proposed Project Area are the Cottonwood and Lowe Arroyos. Cottonwood Arroyo is one of the largest of the Chaco River tributaries with a drainage area of approximately 80.1 square miles. Flow events in these drainages are primarily driven by localized precipitation events (e.g., snowmelt, thunderstorms). Cottonwood Arroyo is also seasonally influenced by irrigation activities in the NAPI lands just east of the mine lease area.

Figure 3.2-3. Regional Surface Water Features and Monitoring Locations



Cottonwood Arroyo is located between active mining in Area III and proposed mining in Area IV North. The arroyo exhibits flashy hydrology, typical of arid southwest environments, is characterized by wide variation in flow ranging from no discharge (dry channel) under typical conditions to peak discharge during and after storm events, followed by a recession to a low discharge over several hours. These rapidly varying flows can transport large amounts of sediment and cause extensive change in the shape of the channels. About 48 percent of the Cottonwood Arroyo watershed is occupied by sparsely vegetated badlands, which accounts for the high discharge and flow intensities observed in this stream (BNCC 2011a § 11.6). Peak flows along Cottonwood Arroyo from a 10-year, 6-hour event are predicted to be about 2,879 cubic feet per second (cfs). The Cottonwood Arroyo channel near its mouth with the Chaco River has a uniform flat gradient, yielding lower downcutting downgradient of the mine.

Lowe Arroyo lies immediately north of Cottonwood Arroyo and flows through Area III of the BNCC Navajo coal lease to the Chaco River. Lowe Arroyo has a drainage area of approximately 12.3 square miles, of which approximately 41 percent is located within the Area III. Peak flows from a 10-year, 6-hour event near the outlet would have been about 919 cfs prior to mining (BNCC 2011a). Lower flood flows currently occur due to interception of portions of the Lowe drainage by the Area III mine operations. The channel only flows in response to flow events. The Lowe Arroyo channel exhibits a relatively steep gradient where it encounters sandstone bedrock outcrops downstream of mining within Area III.

3.2.2.2.2 Ephemeral Tributaries

The Project Area also includes several ephemeral tributaries to Cottonwood Arroyo and Lowe Arroyo that are variable in width and depth. In addition, three small drainages along the southern portion of Area IV North drain into the Pinabete Arroyo, which flows into the Chaco River. These drainages typically have narrow, shallow channels that drain small watersheds with no adjacent riparian vegetation. The USACE's 404(b)(1) Alternatives Analysis describes the hydrologic and ecological functions of these intermittent and ephemeral systems (Appendix A).

Badlands, with sparse to no vegetation, are the dominant land type in the eastern portion of the proposed mining area. The tributaries that drain these badland formations are narrow and typically have deep, incised channels with little to no vegetation. After large precipitation events, these channels contain high sediment loads.

3.2.2.2.3 Water Quality

The NNEPA (2007) has identified designated uses of Cottonwood Arroyo as secondary human contact (direct contact to skin associated with recreation or cultural uses), fish consumption, aquatic and wildlife habitat, and livestock watering. Water quality was collected for a brief period between 1990 and 1999 on Cottonwood Arroyo. The moderately saline (median TDS ranged from 610 to 780 mg/L) sodium sulfate waters are alkaline with a moderate hardness (BNCC 2011a § 11.6). The median total selenium concentration at all sites of 0.0025 mg/l exceeds the chronic wildlife habitat standard of 0.002 mg/L. Levels of selenium were highest at the upstream, North fork of Cottonwood Arroyo. Suspended sediment concentrations are high, greater than 100,000 mg/L during storm runoff events and the sandy channel bed and bank materials are reworked by the larger flood events. A summary of the surface water monitoring data collected from Cottonwood Arroyo is included in Table 7.7 of the mine permit application package (BNCC 2011a).

During mining operations, water from disturbed areas is routed to NPDES sediment ponds for treatment prior to release. In general, the NPDES sediment ponds discharge only in response to extreme precipitation events.

3.2.2.2.4 Waters of the United States

Under Section 404 of the CWA, the USACE has jurisdiction over all WUS within the Project Area that contain a distinct channel (bed-and-bank) and ordinary high water mark (OHWM) as defined by the USACE (2008). In the Project Area, Cottonwood Arroyo, Lowe Arroyo, and several unnamed ephemeral channels are WUS. In 2009 and 2011, personnel from Ecosphere Environmental Services evaluated all streams within the Project Area to determine if the channel contained a defined bed-and-bank and OHWM. Depths and widths of channels were measured using features such as the top elevation of lateral and point bars, changes in particle size, and the presence/absence of vegetation. The results identified approximately 18 miles and 25 acres of ephemeral stream channels within the proposed Project Area as WUS (Appendix A). Ephemeral streams are those that flow only during or immediately after storm events and receive no flow from alluvium or springs. The USACE's 404(b)(1) Alternatives Analysis provides a detailed methodology and comprehensive analysis of WUS within the Project Area and describes the hydrologic and ecological functions of these intermittent and ephemeral systems (Appendix A). No wetlands or other special aquatic sites, as defined by the USACE are present within the Project Area.

3.3 Noise and Vibration

3.3.1 Definition of Resource

3.3.1.1 Noise

This section addresses the existing conditions in the affected environment with respect to noise and vibration. People define noise as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound can be caused by its pitch or its loudness. Pitch is the height or depth of a tone or sound, depending on the relative rapidity (i.e., frequency) of the vibrations by which it is produced. Higher pitched signals typically sound louder to humans than sounds with a lower pitch, because the human ear is more sensitive to higher pitched sounds. Loudness is the amplitude of sound waves combined with the reception characteristics of the ear. Amplitude may be compared with the height of an ocean wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales, which are used to describe noise in a particular location. A decibel (dB) is a unit of measurement that indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 dB represents a ten-fold increase in acoustic energy, while a 20 dB increase is 100 times more acoustic energy; a 30 dB increase is 1,000 times more acoustic energy, etc. There is a relationship between the subjective noisiness or loudness of a sound and its decibel level. Each 10 dB increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities (Bies and Hansen 2009). Technical terms for noise are defined in Table 3.3-1.

Table 3.3-1. Definition of Acoustical Terms

Term	Definitions
Decibel (dB)	A unit describing the amplitude, or loudness, of sound by comparing it to a given reference level on a logarithmic scale. The reference level in air is 20 micropascals (µPa), corresponding to 0 decibels.
Sound pressure level	Sound pressure is the sound force per unit area, usually expressed in micropascals (micronewtons per square meter), where 1 pascal is the pressure resulting from a force of 1 newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels. Sound pressure level is measured by a sound level meter.
Frequency (Hz)	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hertz (Hz) and 20,000 Hz. Infrasonic sound are below 20 Hz and ultrasonic sounds are above 20,000 Hz.
A-weighted sound level (dBA)	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent noise level (L_{eq})	The average A-weighted noise level during a given measurement period. The hourly L_{eq} is denoted as L_{eq} [h].
Day/Night Noise Level (L_{dn})	The average A-weighted noise level during a 24-hour day, obtained after the addition of a 10 dBA penalty for nighttime noise from 10:00 p.m. and 7:00 a.m.
L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 10%, 50%, or 90% of the time during the measurement period.
Ambient noise level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, time of occurrence, the tonal or informational content, as well as the prevailing ambient noise level.

There are several methods of characterizing sound. The most common is the dBA. All sound levels discussed in this section utilize the A-weighting scale. This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in

Table 3.3-2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This energy-equivalent sound/noise descriptor is termed L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration (Bies and Hansen 2009).

Table 3.3-2. Typical Noise Levels in the Environment

Common Outdoor Noise Source	Noise Level (dBA-L_{eq})	Common Indoor Noise Source
	120	
Jet flyover at 1,000 feet		Rock concert
	110	
Pile driver at 60 feet	100	
		Night club with live music
	90	
Large truck pass by at 50 feet		
	80	Noisy restaurant
		Garbage disposal at 3 feet
Gas lawn mower at 100 feet	70	Vacuum cleaner at 10 feet
Commercial/Urban area daytime		Normal speech at 3 feet
Suburban expressway at 300 feet	60	
Suburban daytime		Active office environment
	50	
Urban area nighttime		Quiet office environment
	40	
Suburban nighttime		
Quiet rural areas	30	Library
		Quiet bedroom at night
Wilderness area	20	
	10	Quiet recording studio
Threshold of human hearing	0	Threshold of human hearing

The scientific instrument used to measure noise is the sound level meter. Type 1 sound level meters—the most common type used for environmental noise measurements—can accurately measure noise levels to approximately 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways, airports, and rail lines. The accuracy of the predicted models is greater for receptors close to the noise source. The models are accurate to within approximately 3 dBA for receptors within about 500 feet from the noise source, but are less accurate at greater distances, primarily because of the unpredictable influences of atmospheric and terrain effects (ISO 1996).

Since the sensitivity to noise increases at night because excessive noise interferes with the ability to sleep, 24-hour descriptors were developed that incorporate artificial noise penalties added to quiet-time noise events. The most common of these is the Day/Night Average Sound Level, or L_{dn}, which is a measure of the cumulative 24-hour noise exposure, with a 10-dB penalty added to nighttime (10:00 p.m. – 7:00 a.m.) noise levels (Bies and Hansen 2009).

3.3.1.2 Vibration

Several methods are typically used to quantify the amplitude of vibration including peak particle velocity (PPV) and root mean square (RMS) velocity. PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. RMS velocity is defined as the average of the squared amplitude of the signal. PPV is typically used to evaluate vibration effects on buildings, while RMS is typically used to evaluate human response to vibration (FTA 2006).

The reaction of humans and effects on buildings from continuous levels of vibration is shown on Table 3.3-3. As discussed previously, annoyance is a subjective measure and vibrations may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying.

Table 3.3-3. Reaction of People and Damage to Buildings Resources from Continuous Vibration Levels

Vibration Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.006 to 0.019	Threshold of perception: Possibility of intrusion	Vibration unlikely to cause damage of any type
0.08	Vibrations readily perceptible	Recommended upper level of vibration to which ruins and ancient monuments should be subjected
0.10	Level at which continuous vibrations begin to annoy people	Virtually no risk of “architectural” damage to normal buildings
0.20	Vibrations annoying to people in buildings	Threshold at which there is a risk of “architectural” damage to normal dwellings such as plastered walls or ceilings.
0.40 to 0.60	Vibrations considered unpleasant by people subjected to continuous vibrations	Vibration at this level would cause “architectural” damage and possibly minor structural damage.

Source: Caltrans 2002

Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage. In high noise environments, which are more prevalent where ground-borne vibration approaches perceptible levels, this rattling phenomenon may also be produced by loud airborne environmental noise causing induced vibration in exterior doors and windows.

Construction and mining activities can cause vibration that varies in intensity depending on several factors. The use of pile driving, vibratory compaction equipment, and blasting typically generates the

highest construction- and mining-related ground-borne vibration levels. Because of the impulsive nature of such activities, the use of PPV has been routinely used to measure and assess ground-borne vibration from construction and mining activities (Caltrans 2002).

The two primary concerns with project-induced vibration—the potential to damage a structure and the potential to annoy people—are evaluated against different vibration limits. Studies have shown that the threshold of perception for the average person is a PPV in the range of 0.2 to 0.3 millimeters per second (0.008 to 0.012 inches per second). Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Vibration damage to buildings can be classified as cosmetic only, such as minor cracking of building elements, or may increase to the level of structural damage, which could threaten the integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary whether the vibrations are short-duration single events, such as from blasting, or continuous or repeated vibration events, such as from railroads or rail transit. The safe vibration limit from blasting is typically in the range of 2-inches per second, while the safe limit from continuous vibrations is typically 0.2 inches per second to prevent architectural damage to buildings (Caltrans 2002). Construction-induced vibration that can be detrimental to a building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

3.3.1.3 Applicable Noise Regulations

Federal, tribal, state, and local regulations and policies are established to limit noise exposure at noise sensitive land uses. Regulations vary widely among different jurisdictions throughout the country, with some states and counties having very restrictive noise ordinances, and others having no regulations on noise. Noise regulations from all levels of government that may apply to the project are described below.

3.3.1.3.1 Federal Regulations

U.S. Environmental Protection Agency

The EPA, pursuant to the Noise Control Act of 1972, established guidelines for acceptable noise levels for sensitive receivers such as residential areas, schools, and hospitals. The levels set forth are 55 dBA L_{dn} for outdoor use areas, and 45 dBA L_{dn} for indoor use areas and a maximum level of 70 dBA L_{dn} is identified for all areas in order to prevent hearing loss (EPA 1974). These provide guidance for local jurisdictions, but do not have regulatory enforceability. In the absence of applicable noise limits, the EPA levels can be used to assess the acceptability of project-related noise.

U.S. Department of Housing and Urban Development

The U.S. Department of Housing and Urban Development (HUD) has also established guidelines for acceptable noise levels for sensitive receivers such as residential areas, schools, and hospitals (24 CFR 51). The HUD noise levels include a two-pronged guidance, one for the desirable noise level and the other for the maximum acceptable noise level. The desirable noise level established by HUD conforms to the EPA guidance of 55 dBA L_{dn} for outdoor use areas of residential land uses and 45 dBA L_{dn} for indoor

areas of residential land uses. The secondary HUD standard establishes a maximum acceptable noise level of 65 dBA L_{dn} for outdoor use areas of residential areas.

Mine Safety and Health Administration

MSHA regulates noise levels in mining environments (30 CFR 62), similar to OSHA's regulation of noise levels in industrial environments. Both agencies are under the U.S. Department of Labor. MSHA regulations require that the time-averaged noise level of any work environment be limited to 90 dBA for any 8-hour period. Hearing protection can be used to bring the miner's noise exposure down to the permissible exposure level. Work environments exceeding 85 dBA for an 8-hour period require a hearing conservation program for workers. At no time shall a miner be exposed to a noise level exceeding 115 dBA (MSHA 2000).

3.3.1.3.2 Navajo Tribal Regulations

The Navajo Nation does not have any noise regulations or requirements that would be applicable to noise or vibration generated by the Project.

3.3.1.3.3 New Mexico State Regulations

The State of New Mexico does not have jurisdiction on the Navajo Nation, so any state-wide noise or vibration regulations would not apply to the Project.

3.3.1.3.4 Local Regulations

San Juan County does not have any noise regulations or ordinances that would be applicable to noise or vibration generated by the Project.

3.3.1.4 Applicable Vibration Regulations

The OSM regulates ground-borne vibrations and air blasts from blasting activities at mining operations (30 CFR 816.67), including requirements for seismographic recording during each blast. Maximum allowable airblasts and ground-borne vibrations are specified for nearby vibration-sensitive buildings, including dwellings, public buildings, schools, churches, community buildings, and institutional buildings. Allowable airblasts are limited to a maximum of 129 flat-response or linear decibels (dBL) at 6 Hz or lower and 133 dBL at 2 Hz or lower. Allowable ground-borne vibration levels are weighted based on distance from the blasting site, with maximum PPV of 1.25 in/sec PPV_{max} at distances of 0 feet to 300 feet, 1.00 in/sec PPV_{max} at distances of 301 feet to 5,000 feet, and 0.75 in/sec PPV_{max} at distances of 5,001 feet and beyond. An alternative blasting level criterion (Blasting Level Chart) uses the ground-vibration limits to determine maximum allowable ground vibration if seismograph records include both particle velocity and vibration-frequency levels.

3.3.2 Affected Environment

3.3.2.1 Existing Noise-Sensitive Land Uses

Some land uses are more sensitive to noise levels than others, due to the amount of noise exposure (in terms of both time and insulation from noise) and the types of activities typically involved. Residences, motels and hotels, schools, libraries, churches, hospitals, nursing homes, auditoriums, and parks and

outdoor recreation areas are more sensitive to noise than are commercial and industrial land uses. Workers at industrial and mining facilities are generally not included in discussions of noise-sensitive receptors, but are covered under worker protection programs, such as OSHA or MSHA regulations for noise exposure.

There are several isolated single-family residences within the vicinity of the proposed mining disturbance of Area IV North, the closest residence is 4,500 feet away (refer to Figure 3.3-1). Three of the residences are within one-mile of the edge of the disturbance area. There are four additional residences within one mile of the mining disturbance of Area III. The nearest structure is approximately 3,880 feet north of Area III.

A comment received at the public workshops indicated concern of nearby residents with noise and vibration from mining activities at night.

3.3.2.2 Ambient Noise Measurements

A series of noise measurements was conducted on February 23 and 24, 2011, to characterize typical noise levels generated by various mining activities, as well as to document ambient noise levels at nearby residences and in the areas surrounding the active mining area. Noise measurements were conducted in accordance with ANSI S12.9-1993(R2008), the standard for environmental noise measurements (ANSI 2008). Fourteen separate noise measurements were collected, which ranged in duration from 10 minutes to 70 minutes (refer to). Table 3.3-4 presents the results of the noise measurements. Average noise levels ranged from 33 dBA L_{eq} at a residence 4,500 feet from mining activities to 72 dBA L_{eq} at 75 feet from a fully loaded haul truck. Measurements were taken at three residences adjacent to local roads surrounding the mining area. At two of these residences (ID 1 and ID 11), mining vehicle pass-by's accounted for the major source of noise. Noise levels at these residences were 44 and 46 dBA L_{eq}. At the third residence (ID 13), the only source of noise was mining activity, which resulted in a noise level of 33 dBA L_{eq}. Highest noise generating activities from mining are usually associated with heavy machinery and earthmoving equipment movements, such as scrapers, excavators, bulldozers, or front-end loaders. The background ambient noise level, without mining noise, vehicle travel noise, or other sources is approximately 35 dBA

Table 3.3-4. Ambient Noise Measurements in Project Area

ID Number	Description of Location and Predominant Noise Source	Approximate Distance to Noise Source (feet)	Average Noise Level (dBA L_{eq})	Peak Noise Level (dBA L_{max})
1	Residence south of Area IV North (peak noise is vehicle pass-by)	14,000	46	72
2	Dozers on coal stockpile	350	46	56
3	Lowe Ramp 1 - water trucks, haul trucks, and bottom dump trucks	100	66	77
4	Dragline #1 with D11 dozer in distance	770	56	63
5	Scrapers, water trucks on stockpile	45	69	74
6	Dixon Ramp 2 - D11 dozers (2)	370	66	74

ID Number	Description of Location and Predominant Noise Source	Approximate Distance to Noise Source (feet)	Average Noise Level (dBA L_{eq})	Peak Noise Level (dBA L_{max})
7	In Dixon Pit – dragline with D11 dozer	730	62	69
8	Pre-strip 63 – East – haul trucks – empty	75	67	79
	Pre-strip 63 – East – haul trucks – fully loaded	200		80
9	Pre-strip 63 – West – haul trucks – fully loaded	75	72	84
	Pre-strip 63 – West – haul trucks – empty	200		77
10	Coal plant with power plant in distance	300	61	64
11	Near residence to east of Area 3 (peak noise is mining vehicle pass-by)	8,000	44	65
12	High wall by Lowe Pit – dozers and dragline	770	62	72
13	Near residence west of Area 3 – no audible noise sources	4,500	33	36
14	Near blasting area in Lowe Pit, Strip 59 – warning sirens	300	54	67
	Near blasting area in Lowe Pit, Strip 59 – blast	300	66	94

3.3.2.3 Vibration Measurements

As required by OSM blasting regulations, vibration levels are routinely measured by BNCC during blasting operations to ensure that airblasts and ground-borne vibrations are within allowable levels. A chart from a typical blast is provided in Figure 3.3-2 (BNCC 2010a). Blasts are typically audible for about 2 seconds. The blast shown in Figure 3.3-2 occurred on July 26, 2010, along Strip 61 in the Lowe Pit and represents an average blast routinely occurring at the mine. The seismograph was located at the nearest residence, approximately 5,539 feet from the blasting area. As shown in the chart, the maximum airblast was measured at 112 dBL and the maximum ground-borne vibration was measured at 0.18 in/sec PPV_{max}. Both of these measurements were within OSM-allowable levels.

Figure 3.3-1. Noise Sampling Locations and Area Residences

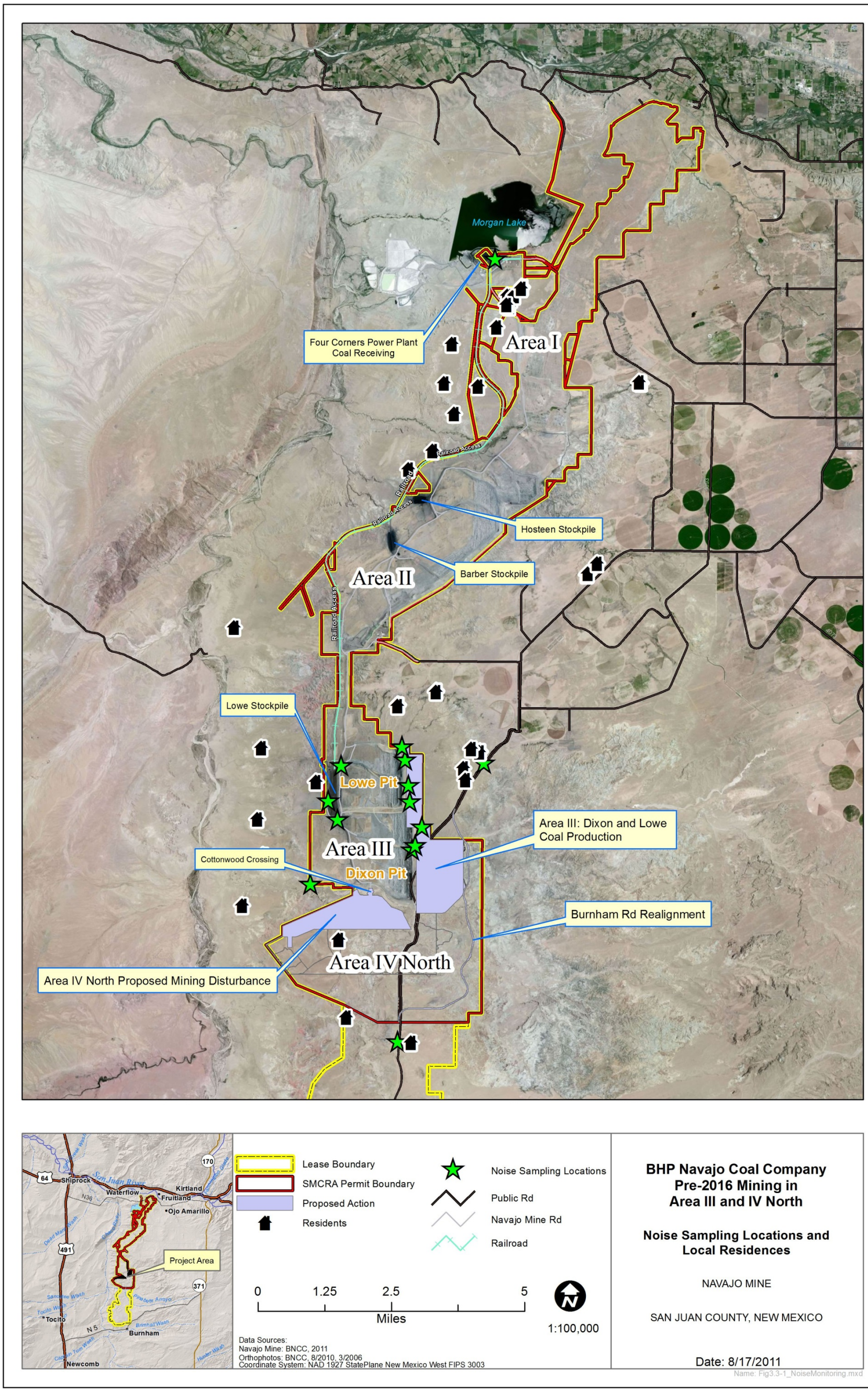
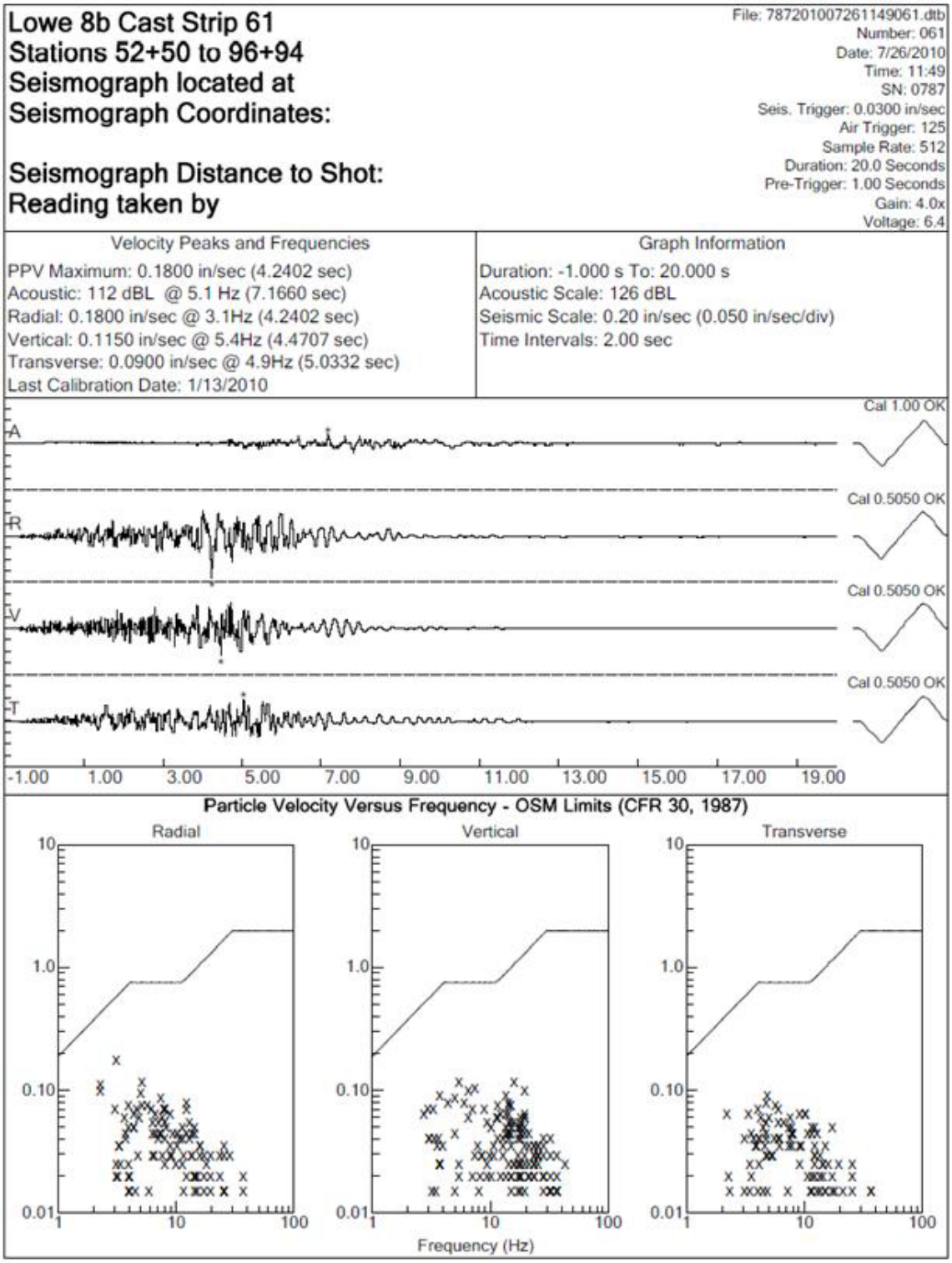


Figure 3.3-2. Typical Vibration Measurement at Residence 5,539 Feet from Blasting Area during Blasting Activities



Source: BNCC 2010a

3.4 Visual Resources

3.4.1 Definition of Resource

The BLM's visual resource methodology was used to characterize the visual environment. This methodology (BLM Manual H-8410-1) is a common methodology for conducting visual resource inventory and determining visual contrast ratings (BLM Manual 8431) for projects with a BLM federal action. The area of analysis for visual resources consists of the project viewshed or areas from which the project activities and equipment may be visible in the long term (greater than five years). The viewshed, which extends outside of the proposed Project Area, was defined using a computerized 30-meter grid size Digital Elevation Model (DEM) program. The program considered the areas that would be located within topographic line of sight of the project's tallest components. Overburden piles as tall as 153 feet are likely the most visible components of the Proposed Action and the draglines, the tallest of which is 190 feet, are the tallest component of the Proposed Action. To ensure a conservative approach to estimating visual resources impacts, 190 feet was used. The information from the modeling is presented in Figures 3.4-1 and 3.4-2.

The DEM viewshed program analyzed whether each cell in the DEM grid would be in the line of sight of the Project. In the program, the tallest proposed project component was given a height offset of 190 feet from the ground elevation of the location on the DEM; this represents the general overall height of the tallest dragline. All other cells were given a 6-foot offset to simulate the view from a standing adult. The viewshed modeling performed for this project also considered the line of sight of the proposed mining actions to all lands located within 20 miles of the Project Area. Twenty miles was used since beyond that distance few, if any, mine features or activities would be discernible. The model took into account the existing topography between the active Project Area and selected viewpoints as well as the curvature of the earth. It did not include vegetative or atmospheric screening. Additional local factors such as vegetation height (which is minimal in the Project Area), micro-topographic features not represented in the DEM, time of day, atmospheric conditions, and distance from the Project Area ultimately determines how visible project activities and equipment would be from locations within the modeled line of sight.

3.4.2 Affected Environment

Existing visual conditions in the Project Area and the potential visual impact area include views of existing BNCC coal-mining operations. Open, undulating, low shrubland-dominated arid landscapes lie east, west, south, and north of the proposed Project Area with distant views of the La Plata, Chuska and Lukachukai, and Carrizo mountain ranges to the northeast, west, and northwest of the site, respectively. Views in the area include panoramic landscapes or views with a limited number of obstructions within a 360-degree field of vision. Foreground and middleground views throughout most of the Project Area include the reddish-brown dragline and black coal stockpiles and light brown to gray overburden piles of existing coal mining operations, and light brown or gray-green shadscale or greasewood-dominated scrublands to the east, west, south, and north of the active mining areas. No large trees are generally visible in this landscape, although some patches of tamarisk and coyote willow are found along the Cottonwood Arroyo that runs along the approximate boundary between Area III and Area IV North. The Hogback geologic feature lies northwest of the Project Area and is both a major geographic landmark as well as a cultural landmark to the Navajo people.

Burnham Road runs through the eastern portion of the existing mine lease area southward to the Burnham Chapter. Other travel routes in the area include a variety of two-track access roads to local residences and corrals, and abandoned stone buildings and hogans, and a west-running public roadway along the Cottonwood Arroyo. Vegetation is minimal in the region and signs of sheep, horse, and cattle grazing are evident.

No residences are located within the Project Area; however, eleven active residences were found within two miles northeast, south, and northwest of the Project Area (see Figure 3.4-2). Viewers in the immediate Project Area are primarily BNCC employees, livestock managers, and local residents. Existing visitation in the area is low and is expected to continue to be low.

Night lights used in existing mining operation areas are currently visible from select locations along Highway 491, from Burnham Road, and from at least two area residences.

Although no formal visual classifications have been identified for the Project Area, the *San Juan River Coal Region Environmental Impact Statement* (BLM 1984) classifies lands west and south of the Project Area between the communities of Gallup and Crownpoint, north to the Bisti area, as BLM Visual Resource Management (VRM) Classes III and IV. Under VRM Class III objectives, visual changes are limited to relatively moderate levels, and activities may attract attention, but should not dominate the view and should partially retain the existing character of the landscape. VRM Class IV objectives provide for management activities that require major modifications to the existing character of the landscape. These BLM classifications are used by the BLM for areas under their surface management and do not necessarily apply to the Project Area other than to provide a regional context of surface management.

To assist in identifying existing visual conditions near the Project Area, important view locations were identified through review of the viewshed analysis mapping generated for the project, consideration of the cultural landscape, and discussions with agency representatives, residents, and archeologists. The rationale used in picking these locations is summarized on Table 3.4-1 and are mapped on Figures 3.4-1 and 3.4-2. These important view locations included several residences located within two miles of the Project Area, and locations near culturally sensitive landscape features, such as the Hogback geologic feature. Key observation points (KOPs) were chosen from among the important view locations identified for the Project Area to conduct impact analyses.

Figure 3.4-1. 20 Mile Vicinity Viewshed and Key Observation Points Map

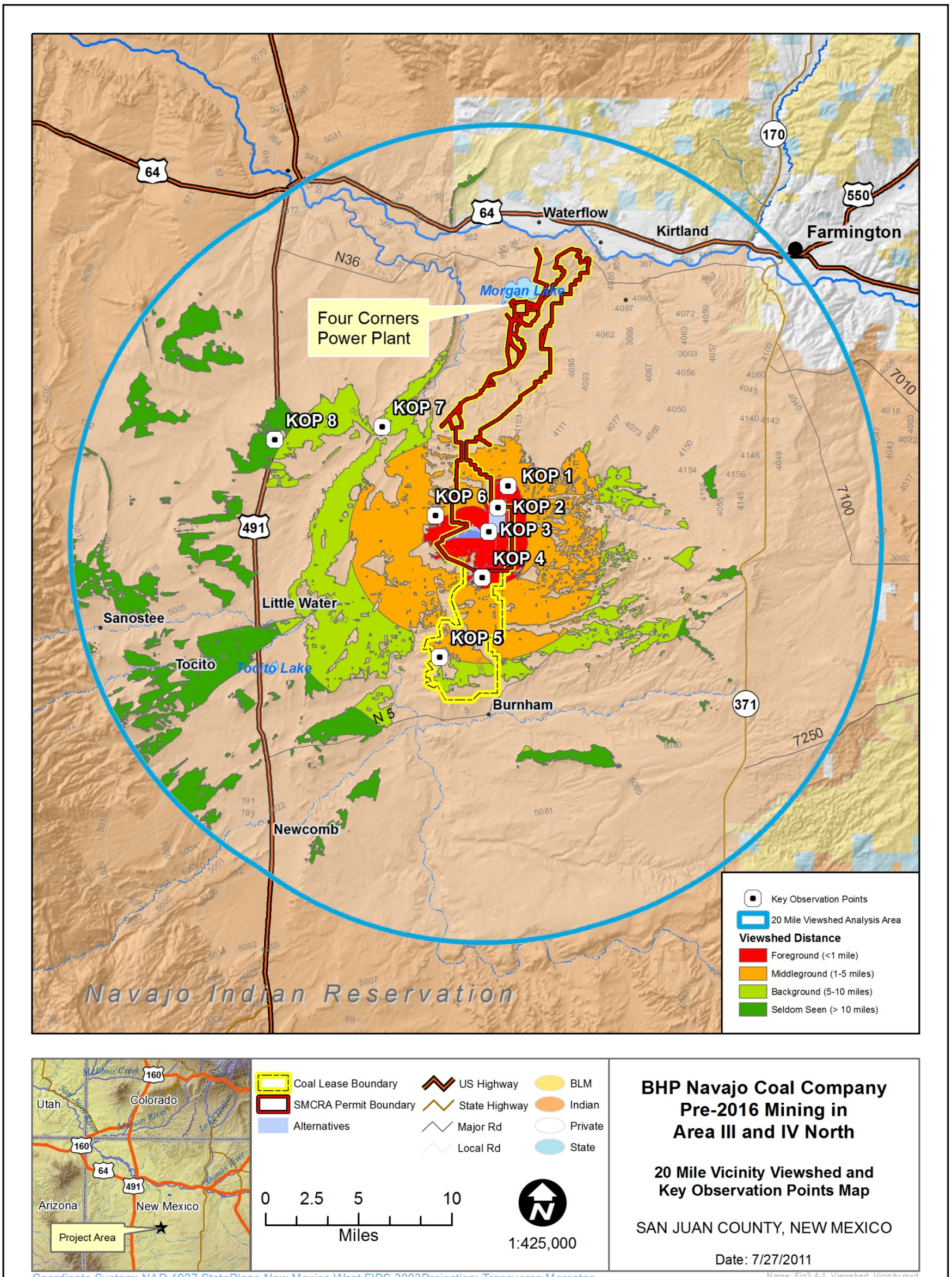
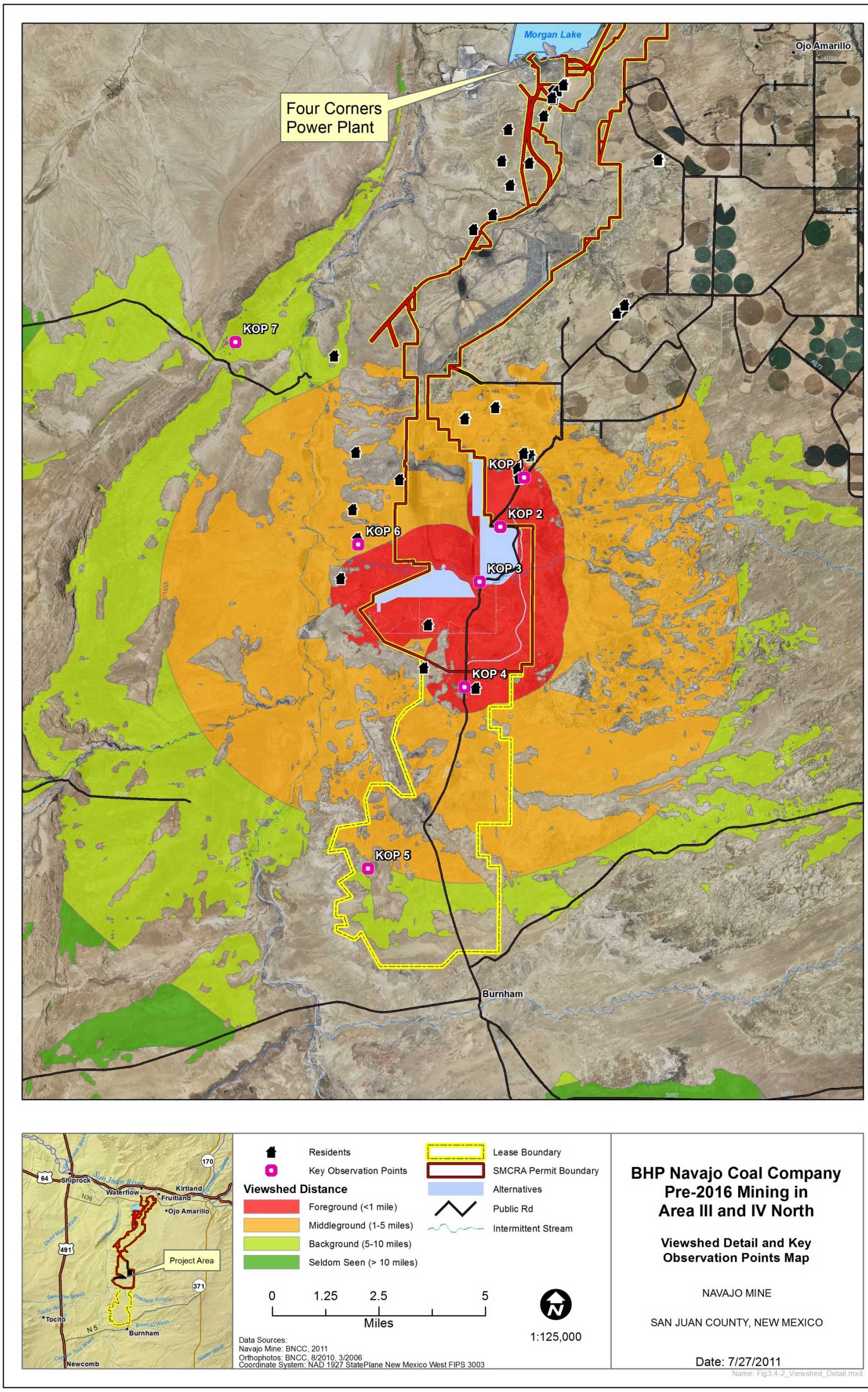


Figure 3.4-2. Viewshed Detail and Key Observation Points Map



The important view locations were visited in February 2011 by an Ecosphere Environmental Services visual resource specialist, who documented existing conditions of form, line, color, and texture at each location. Appendix D contains information on the existing visual setting at each of these locations. In total, eight important view locations were identified and evaluated during the field reconnaissance session for existing visual conditions. Distance zones utilized in this project for the purposes of classifying relative visibility based on distance, were confirmed in the field for each of the sensitive view locations in relation to the Proposed Action. All locations were assigned distance zone designations as described below:

- Foreground – This zone is located within one mile from the Project Area boundaries. Existing coal mine infrastructure is readily visible in this zone.
- Middleground – The area that is located more than one mile but less than five miles away from the Project Area boundary. The outer boundary of this distance zone is defined as the point where the texture and form of individual plants are no longer apparent in the landscape.
- Background – This zone includes the area greater than approximately five miles away, but less than 10 miles that can be seen from travel routes or KOPs. It does not include areas in the background that are so far distant that the only thing discernible is the form or outline. In order to be included within this distance zone, vegetation must be visible at least as patterns of light and dark.
- Seldom Seen – This zone includes areas greater than 10 miles away where views of the Project Area may still be faintly visible under excellent atmospheric conditions.

Overall, existing conditions in the Project Area are predominately natural to the east, west, and south, with minimal visual disturbance beyond improved travel corridors. Existing coal mining operations are currently visible in portions of the Project Area.

Table 3.4-1. Key Observation Locations Used for Identifying Existing Conditions in the Project Region

KOP	Location	Datum/ Zone	Easting	Northing	KOP View Compass Bearing Angles	Approximate Bearing at Center Point Towards Project Area	Observer Position	General Type of Viewer	Amount of Use	Duration of Visibility	Distance Zone in Relation to Project Area Boundaries	Surrounding Land Ownership
KOP 1	Burnham Road; 200 feet east of active residence and meeting shelter	NAD 27 Zone 12	725582	4047706	180-360	240	Vehicle on roadway	Residents, livestock managers	Low	Approximately 1-2 minutes in car; greater than 5 minutes at residence or shelter	Middleground (1-5 miles)	Navajo Nation
KOP 2	Burnham Road temporary reroute #2	NAD 27 Zone 12	724646	4045807	90-240	190	Vehicle on roadway	Residents, livestock managers	Low	Approximately 1-2 minutes	Foreground (less than 1 mile)	Navajo Nation
KOP 3	Intersection of Burnham Road and public roadway along Cottonwood Arroyo	NAD 27 Zone 12	723861	4043717	180-360	240	Vehicle on roadway	Residents, livestock managers	Low	Approximately 1-2 minutes	Foreground (less than 1 mile)	Navajo Nation
KOP 4	Burnham Road; west of active residence and southwest of red ochre mine site	NAD 27 Zone 12	723425	4039716	240-90	360	Vehicle on roadway or resident	Residents, livestock managers	Low	Approximately 1-2 minutes in car; greater than 5 minutes at residence	Foreground (less than 1 mile)	Navajo Nation
KOP 5	Active residence approximately 1 mile west of Burnham Road	NAD 27 Zone 12	720002	4032751	240-90	180	Resident	Residents, livestock managers	Low	Varies - typically greater than 5 minutes	Middleground (1-5 miles) to background	Navajo Nation
KOP	Active	NAD	719237	4044971	360-180	90	Resident	Residents,	Low	Varies -	Middleground	Navajo

KOP	Location	Datum/ Zone	Easting	Northing	KOP View Compass Bearing Angles	Approximate Bearing at Center Point Towards Project Area	Observer Position	General Type of Viewer	Amount of Use	Duration of Visibility	Distance Zone in Relation to Project Area Boundaries	Surrounding Land Ownership
6	residence east of Chaco Wash and west of Project Area	27 Zone 12						livestock managers		typically greater than 5 minutes	(1-5 miles)	Nation
KOP 7	Access road to radio towers on Hogback geologic feature northwest of Project Area	NAD 27 Zone 12	714354	4052457	360-180	90	Vehicle on roadway	Local residents, recreators, livestock managers	Low	Varies - typically greater than 5 minutes	Background (5-10 miles)	Navajo Nation
KOP 8	Highway 491; south of Shiprock geologic feature	NAD 27 Zone 12	705180	4050848	360-180	90	Vehicle on highway	Tourists, residents, general public	High	Approximately 1-2 minutes in vehicle	Seldom seen (>10 miles)	Navajo Nation

3.5 Air Quality

3.5.1 Definition of Resources

"Air quality" is a generic term that refers to the relative levels of air pollution in ambient air (i.e., outside air to which the general population may be exposed). Air quality for a specific air pollutant is quantitatively expressed in terms of the concentration of that pollutant in ambient air (e.g., micrograms per cubic meter of air, or $\mu g/m^3$). In general, local air quality for a given pollutant is heavily influenced by emissions of that pollutant from stationary and mobile sources in the surrounding area. Once emitted into the atmosphere, the pollutant disperses into the ambient air.

The affected environment for air quality is typically the existing ambient concentrations of relevant pollutants in the Air Quality Resource Area (AQRA) prior to the Proposed Action. The sources of emissions that likely cause or contribute to those air quality levels are identified as well.

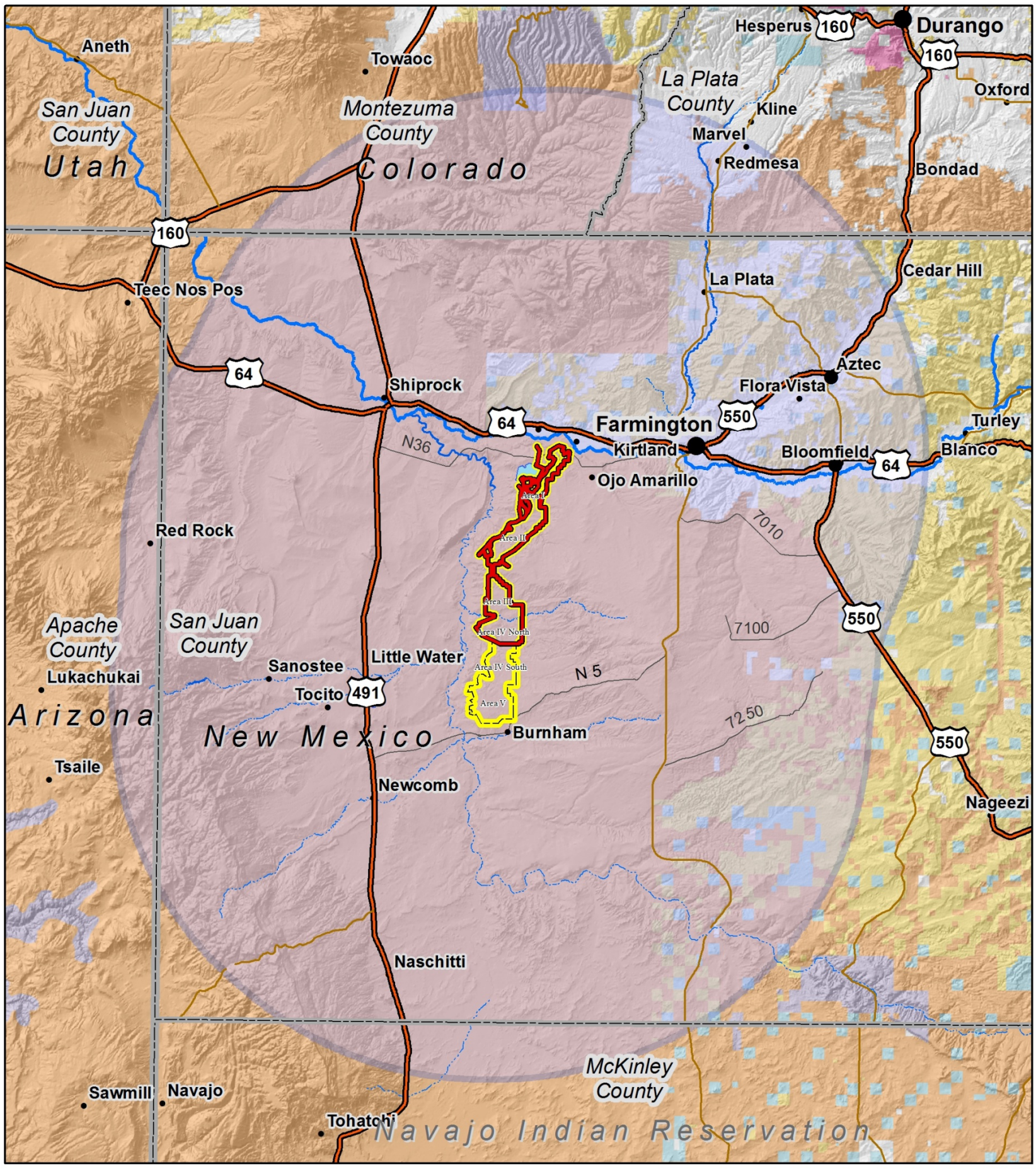
Because the principal pollutant emitted from a surface coal mine is particulate matter, the ambient air concentration of particulate matter (PM) is the air quality element of most interest for this study. Ambient air concentration of PM is regulated for two different forms of particulate matter: PM_{10}—particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers, and $PM_{2.5}$—particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers.

The ambient air generally affected by particulate emissions from a surface coal mine is highly local in nature (i.e., the geographic area in proximity to the mine's boundary). Nevertheless, consistent with the minimum geographic scope commonly used for an air quality analysis to support the preconstruction review of major emission sources, the AQRA for this study is the geographic area extending out to 50 km from the mine's boundary, as shown in Figure 3.5-1. An AQRA with that broader expanse will allow identification of those emission sources in the surrounding area and their air quality impacts, which may overlap with those from Navajo Mine. The identification of aggregate emissions and air quality impacts in the AQRA, with and without contributions from the Proposed Action, will allow assessment of ambient levels of air pollutants that are representative of what the population and environment in that area experience now and may experience in the future as a result of the Proposed Action.

3.5.1.1 Air Quality Regulatory Framework

The CAA, (42 U.S.C. 7401 et seq.) and EPA-established CAA implementing regulations (40 CFR 50-99), establish a comprehensive framework for the evaluation and regulation of both air quality and air quality impacts via national ambient air quality standards (NAAQS). NAAQS set the maximum allowable concentration of pollutants in ambient air. The overall approach of the CAA is based on the linkage between emission sources of air pollutants and the ambient concentrations of those pollutants.

Figure 3.5-1. Air Quality Resource Area



In the CAA Amendments of 1990, Congress authorized EPA to treat a qualifying Indian tribe in the same manner as a state for the regulation of air resources within the exterior boundaries of the reservation or other areas within the tribe's jurisdiction. Subject to EPA approval, an eligible tribe may develop, administer, and enforce its tribal implementation plan (TIP). CAA requires EPA to designate existing air quality in all of the planning areas identified by each state relative to the NAAQS for each pollutant as:

- "attainment," if the area meets a NAAQS for the pollutant
- "nonattainment," if the area does not meet a NAAQS for the pollutant (or if the area contributes to air quality in a nearby area that does not meet a NAAQS for the pollutant)
- "unclassifiable," if the area cannot be classified on the basis of available information

3.5.1.1.1 National Ambient Air Quality Standards

The NAAQS are the principal parameters for evaluating air quality. EPA has promulgated NAAQS for six different criteria pollutants that apply throughout the United States: sulfur oxides, measured as sulfur dioxide (SO_2), carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), lead (Pb) and particulate matter. Table 3.5-1 identifies the value of each NAAQS for each applicable averaging time. In the context of NEPA, a NAAQS defines an appropriate threshold of air quality for those pollutants beyond which adverse change would cause significant degradation of the air quality resource.

Table 3.5-1. Summary of National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary Standards		Secondary Standards	
	Concentration	Averaging Time[1]	Concentration	Averaging Time
Carbon Monoxide	9 parts per million (ppm) (10 mg/m^3)	8-hour	None	
	35 ppm (40 mg/m^3)	1-hour		
Lead	1.5 $\mu g/m^3$ (2)	Quarterly Average	Same as Primary	
Nitrogen Dioxide	0.053 ppm	Annual (Arithmetic Mean)	Same as Primary	
	100 parts per billion (ppb)	1-hour	None	
Particulate Matter (PM_{10})	150 $\mu g/m^3$	24-hour	Same as Primary	
Particulate Matter ($PM_{2.5}$)	15.0 $\mu g/m^3$	Annual (Arithmetic Mean)	Same as Primary	
	35 $\mu g/m^3$	24-hour	Same as Primary	
Ozone	0.075 ppm (2008 std)	8-hour	Same as Primary	
	0.08 ppm (1997 std)	8-hour	Same as Primary	
Sulfur Dioxide	0.03 ppm	Annual (Arithmetic Mean)	0.5 ppm	3-hour (1)
	0.14 ppm	24-hour		
	75 ppb	1-hour	None	

[1] Averaging periods for a numerical standard are qualified in a variety of ways, e.g., 3-year average of 98th percentile, 3-year average of the fourth-highest daily maximum, not to be exceeded more than once per year, etc. Complete details of averaging period for each pollutant are provided at 40 CFR Part 50.

[2] The 2008 standard (0.15 $\mu g/m^3$) does not go into effect until one year after an area is designated attainment or unclassifiable (projected for Oct. 2011). For an area currently designated nonattainment for the existing (1978) standard above, that standard remains in effect until an implementation plan to attain or maintain the 2008 standard is approved.

Note: SO_2 emissions are limited to tailpipe emissions from vehicles and equipment and small quantities associated with blasting. The precise quantities have not been measured from tailpipe emissions but are estimated to be about 2 – 3 orders of magnitude smaller than NO_x factors, due to prevalence of low-sulfur fuels. SO_2 emissions from blasting activities are included in the Appendix F tables.

3.5.1.1.2 Navajo Nation Regulatory Program

Just as individual states may implement air quality statutes, in 2004 the Navajo Nation Council enacted The Navajo Nation Air Pollution Prevention and Control Act (Act). The Act is structured in many respects like the federal Clean Air Act in that it authorizes the NNEPA to create and implement a variety of air quality programs such as Prevention of Significant Deterioration, Visibility Protection, Operating Permits, Hazardous Air Pollutants, New Source Performance Standards, Acid Deposition, etc. To date, the NNEPA has only promulgated its Navajo Nation Operating Permit Regulations (NNOPR) that apply to major sources of criteria pollutants. NNEPA intends to seek EPA approval of the NNOPR as part of a

tribal implementation plan (TIP), after which NNEPA would then implement a tribal "Title V" operating permit program that would conform federal specifications contained in 40 CFR Part 70.

In October 2004, the USEPA delegated full authority to NNEPA to administer the federal Title V operating permit program for major stationary sources located within the exterior boundaries of the Navajo Reservation. The permit program is administered by NNEPA in accordance with a delegation agreement with EPA Region IX. "Major" sources on the Reservation are generally ones that have the potential to emit 100 tons per year (tpy) or more of any criteria pollutant, more than 10 tpy of a single hazardous air pollutant (HAP), or more than 25 tpy of aggregated HAPs. It is noteworthy that federal permitting regulations exclude fugitive emission sources from certain source categories, such as surface coal mining, when determining the potential to emit for major source applicability. Consequently, the Navajo Mine is currently not subject to the federal or NNEPA major source permit program.

3.5.2 Affected Environment

3.5.2.1 Existing Navajo Mine Sources of Emissions

This section identifies and quantifies the mine's baseline particulate and other air pollutant emissions from permitted activities associated with mining currently taking place in Area III of Navajo Mine. Use of the term "Area III" in this section should not be construed as meaning that all baseline operations are only performed in Area III of the mine, as some activities such as coal mixing and transportation do not take place in Area III (refer to Sections 1.1. and 2.1).

Sources of particulate emissions from Area III prior to the Proposed Action have been sub-divided into the categories listed in Table 3.5-2.

Table 3.5-2. Categories of Area III Emission Sources

Categories of Area III Emission Sources
Overburden Drilling and Blasting
Coal Seam Drilling and Blasting
Overburden Dragline Stripping
Mine Extraction Operations and Loading
Coal Haul Truck to Stockpiles
Unloading at Stockpile and Railcar Loading
Plant Vehicle Travel
Wind Erosion – Soil/Overburden Spoil Pile
Wind Erosion – Coal Stockpile
Reclamation – Mine Pit Backfilling, Grading, and Topdressing
Preparation Plant

For each of those categories, the dust-generating nature of each pollutant-emitting activity has been identified and levels of each activity's baseline emissions of PM_{10} and $PM_{2.5}$ have been estimated.

The general equation for emission estimation is: $E = A \times EF \times (1-ER/100)$, where:

E = emissions

A = activity rate

EF = emission factor

ER = overall emission reduction efficiency, percent

This general approach (EPA 1995) has been used to calculate estimated PM_{10} and $PM_{2.5}$ emissions from each of the individual pollutant-emitting activities within each of the categories of Area III Emission Sources identified above. The specific emission factor and estimating equation applied for each of the pollutant-emitting activities in Area III of Navajo Mine is identified in Table 3.5-3.

Annual emissions of PM_{10} or $PM_{2.5}$ from a particular pollutant-emitting activity (and NO_x from blasting) are estimated by multiplying the specific PM_{10} or $PM_{2.5}$ (or NO_x) emission factor or equation shown above for that activity times the "rate" at which that particular activity operates. For example, the "rate" for blasting is the number of blasts per year, the "rate" for haul trucks is the annual vehicles miles traveled; the "rate" for unloading and loading is the tons handled per year, etc. The basis for establishing each pollutant-emitting activity's "rate" is detailed in Appendix F along with the emission factor and emission reduction efficiency applied to estimate that activity's emissions.

Diesel engines power most of the mining equipment as well as the coal haul trucks. Those non-road mobile sources emit oxides of nitrogen (NO_x), CO, and VOCs. Medium-duty and light-duty gasoline-powered vehicles are used for transportation purposes. Emissions from the diesel-powered and gasoline-powered engines at the Mine have been calculated using comprehensive equipment-specific emission factors updated in 2008 for the "1993 CEQA Air Quality Handbook" of the South Coast Air Quality Management District. Emission calculations based on the particular emission factors applied to the different engines are documented in Appendix F.

The overall amount of particulate matter emitted from a surface coal mine is a function of the quantity of coal the mine produces. During the past several years Navajo Mine has produced coal from Area III at a nominal annual rate of 8.5 million tons.

Table 3.5-3. Emission Factors and Estimating Equations for Pollutant-Emitting Activities

Emission Factor/Equation for Each Pollutant-Emitting Activity
Drilling – overburden (AP-42, § 11.9, Table 11.9-4) TSP, lb/hole = 1.3
Drilling – coal (AP-42, § 11.9, Table 11.9-4) TSP, lb/hole = 0.22
Blasting – coal or overburden (AP-42, § 11.9, Table 11.9-1) PM_{10}, lb/blast = $0.52[0.000014(A)^{1.5}]$, where A = horizontal area (ft^2) $PM_{2.5}$, lb/blast = $0.03[0.000014(A)^{1.5}]$
Blasting – coal or overburden (AP-42, § 13.3, Table 13.3-1 for ANFO) NO_x, lb/ton = 17
Dragline – overburden (AP-42, § 11.9, Table 11.9-1) PM_{10}, lb/yd^3 = $0.75[0.0021(d)^{0.7} / M^{0.3}]$, where d = drop height (ft), M = material moisture content (%) $PM_{2.5}$, lb/yd^3 = $0.017[0.0021(d)^{1.1} / M^{0.3}]$
Haul Trucks – unpaved roads (AP-42, § 13.2.2, Eq'n 1(a)) PM_{10}, lb/VMT = $1.5[(s/12)^{0.9} (W/3)^{0.45}]$, where s = surface material silt content, (%), W = mean vehicle weight (tons) $PM_{2.5}$, lb/VMT = $0.15[(s/12)^{0.9} (W/3)^{0.45}]$

Emission Factor/Equation for Each Pollutant-Emitting Activity
Unloading to Stockpile (AP-42, § 13.2.4, Eq'n 1) PM_{10}, lb/ton = $0.35(0.0032)\ [(U/5)^{1.3}/(M/2)^{1.4}]$, where U = mean wind speed (mph), M = material moisture content (%) $PM_{2.5}$, lb/ton = $0.053(0.0032)\ [(U/5)^{1.3}/(M/2)^{1.4}]$
Loading to Railcar (AP-42, § 13.2.4, Eq'n 1) PM_{10}, lb/ton = $0.35(0.0032)\ [(U/5)^{1.3}/(M/2)^{1.4}]$, where U = mean wind speed (mph), M = material moisture content (%) $PM_{2.5}$, lb/ton = $0.053(0.0032)\ [(U/5)^{1.3}/(M/2)^{1.4}]$
Wind Erosion (AP-42, § 13.2.5.2, "Emissions and Correction Parameters")
Railcar Unloading (AP-42, § 13.2.4, Eq'n 1) PM_{10}, lb/ton = $0.35(0.0032)\ [(U/5)^{1.3}/(M/2)^{1.4}]$, where U = mean wind speed (mph), M = material moisture content (%) $PM_{2.5}$, lb/ton = $0.053(0.0032)\ [(U/5)^{1.3}/(M/2)^{1.4}]$
Coal Crushing (AP-42, § 11.19.2) PM_{10}, lb/ton = $PM_{2.5}$, lb/ton = 0.0024
Transfer Points (AP-42, § 13.2.4, Eq'n 1) PM_{10}, lb/ton = $0.35(0.0032)\ [(U/5)^{1.3}/(M/2)^{1.4}]$, where U = mean wind speed (mph), M = material moisture content (%) $PM_{2.5}$, lb/ton = $0.053(0.0032)\ [(U/5)^{1.3}/(M/2)^{1.4}]$

Note: SO_2 emissions are limited to tailpipe emissions from vehicles and equipment and small quantities associated with blasting. The precise quantities have not been measured from tailpipe emissions but are estimated to be about 2 – 3 orders of magnitude smaller than NO_x factors, due to prevalence of low-sulfur fuels. SO_2 emissions from blasting activities are included in the Appendix F tables.

Table 3.5-4 provides estimates of annual baseline emissions of PM_{10} and $PM_{2.5}$ from current and recent mining, reclamation, processing, and erosion.

The emissions summaries in Table 3.5-4 include an estimate of the mine's NO_x emissions from its blasting operations as well as estimates of NO_x, CO, and VOCs from the various diesel- and gasoline-powered engines in use at the mine site.

Table 3.5-4. Estimated Annual Baseline Emissions from Area III

Emission Source Category [1]	Area III Emissions (tons/yr)				
	PM_{10}	$PM_{2.5}$	NO_X	CO	VOC
Overburden Drilling and Blasting	3.33	0.96	5.49	21.64	--
Coal Seam Drilling and Blasting	4.82	1.40	62.64	246.9	--
Overburden Dragline Stripping	62.96	5.56	--	--	--
Mine Extraction Operations and Loading	142.6	17.12	133.07	60.86	14.46
Coal Haul Truck to Stockpiles	265.2	26.52	125.54	68.15	14.17
Plant Vehicle Travel	214.6	21.46	35.72	10.44	3.56
Unloading at Stockpile and Railcar Loading	0.71	0.11	--	--	--

Emission Source Category [1]	Area III Emissions (tons/yr)				
Reclamation	128.5	25.70	--	--	--
Preparation Plant (ex. storage piles)	13.89	4.05	--	--	--
Wind Erosion	69.67	25.39	--	--	--
TOTAL - Area III Baseline Emissions	906.3	128.3	362.5	408.0	32.2

[1] Listing of the individual emission sources and equipment within each category is shown in Appendix F tables. Equipment roster and "rate" of a particular activity reflect BNCC representative baseline year level for equipment working in Area III. Applicable emission factors or emission equations have been addressed in previous sub-section. All estimates incorporate the control measures outlined in the preceding sub-section. Calculations for each pollutant and category are provided in Appendix F.

[2] Although the magnitude of CO emissions is the same as those for PM_{10}, $PM_{2.5}$ and NO_x, the magnitude of the NAAQS for CO is a hundred times or more greater than the NAAQS for other criteria pollutants. Consequently, compliance with the CO NAAQS for the aggregate level of CO emissions from Navajo Mine and other sources in the AQRA is not an issue.

Note: SO_2 emissions are limited to tailpipe emissions from vehicles and equipment and small quantities associated with blasting. The precise quantities have not been measured from tailpipe emissions but are estimated to be about 2 – 3 orders of magnitude smaller than NO_x factors, due to prevalence of low-sulfur fuels. SO_2 emissions from blasting activities are included in the Appendix F tables.

3.5.2.2 Other Existing Stationary Sources within the AQRA

Navajo Mine is located in the north central portion of San Juan County. Although numerous stationary sources of particulate matter emissions exist in San Juan County, FCPP and SJGS are the only major (>100 tpy) point sources of PM emissions. The remaining sources are predominantly oil and gas development and production facilities that are generally concentrated east and north of Farmington and more than 50 km from Navajo Mine. Other than FCPP and SJGS, a number of larger stationary sources of particulate matter emissions in San Juan County are sufficiently close to Navajo Mine to possibly affect ambient PM_{10} and $PM_{2,5}$ concentrations in the AQRA as listed in Table 3.5-5.

Point source emissions of NO_x in San Juan County are dominated by the contributions from FCPP (45,000 tpy) and SJGS (21,000 tpy) (76 Federal Register [FR]. 10,536; 76 FR 500-01). However, area sources of NO_x emissions, especially from oil and gas production, are also significant in San Juan County. In 2006, San Juan County alone, exclusive of tribal lands, contained almost 8,300 conventional gas wells, over 3,100 coal-bed-methane wells, and 451 conventional oil wells. Another 300+ wells, mostly conventional oil and gas, were located on tribal lands within San Juan County (Environ 2009). Emissions from those extensive oil and gas operations are estimated to be 27,500 tpy NO_x and 32,700 tpy VOCs. NO_x emissions from FCPP, SJGS and oil and gas operations in San Juan County dwarf the nominal 360-tpy annual NO_x emissions from Navajo Mine.

Table 3.5-5. Stationary Sources of Particulate Emissions with the Potential to Impact AQRA[1]

Stationary Sources of Particulate Emissions with the Potential to Impact AQRA[1]
Four Corners Power Plant
San Juan Generating Station
Bloomfield Gravel (300 tpy crusher)

Stationary Sources of Particulate Emissions with the Potential to Impact AQRA[1]
Consolidated Construction (asphalt and crusher)
El Paso Field Services (Chaco gas plant)
Four Corners Materials (crusher, asphalt, and batch plant)
Halliburton (cement and sand)
Industrial Repair Service
San Juan Fly Ash
Valley Scrap Metal (aluminum sweat)
Western Tan Manufacturing

[1] EPA 2002, Steag 2004.

3.5.2.3 Baseline AQRA Air Quality

OSM regulations (30 CFR 780.15) require BNCC to perform air quality monitoring to evaluate the effectiveness of the fugitive dust control measures that the mine implements. BNCC currently operates an air quality monitoring network consisting of five PM_{10} monitoring stations located in the vicinity of existing mining activities and field stockpiles. Quarterly data summary reports are submitted to OSM's Indian and Federal Programs Team and to NNEPA.

Quarterly summaries of calendar year 2010 results from the mine's PM_{10} monitoring network are shown in Table 3.5-6. By their nature, monitoring data reflect a contribution of particulate matter from multiple sources within and near the AQRA. By design, the PM_{10} monitoring results at Navajo Mine primarily reflect fugitive dust from mining operations, wind erosion of disturbed areas including stockpiles, and haul road traffic.

Table 3.5-6. Navajo Mine PM_{10} Monitoring Data

Navajo Mine Ambient Air Monitoring Sampler	First Quarter – 2010		Second Quarter – 2010		Third Quarter - 2010		Fourth Quarter - 2010	
	Max 24-hr PM_{10} ($\mu g/m^3$)	Avg 24-hr PM_{10} ($\mu g/m^3$)[1]	Max 24-hr PM_{10} ($\mu g/m^3$)	Avg 24-hr PM_{10} ($\mu g/m^3$)[1]	Max 24-hr PM_{10} ($\mu g/m^3$)	Avg 24-hr PM_{10} ($\mu g/m^3$)[1]	Max 24-hr PM_{10} ($\mu g/m^3$)	Avg 24-hr PM_{10} ($\mu g/m^3$)[1]
NM-01	21	10.9	129	27.3	27	15.0	20	10.0
NM03-1	74	20.4	140	58.7	129	65.5	91	29.8
NM04-B NM04/4C	267 [2]	39.9	118	63.9	388 [3]	94.1	75	26.7
NM06	45	19.7	164 [2]	66.6	93	32.7	149	32.2
NM07	38	11.1	90	30.7	94	36.2	19	9.7

[1] Reported average is the arithmetic mean concentration of the all valid samples.

[2] The listed maximum 24-hour value represents the single sample that exceeded NAAQS during the quarter.

[3] The NAAQS was exceeded for two samples during the quarter; the second highest sample was 187 $\mu g/m^3$.

Source: BHP Navajo Coal Company, 2010 Quarterly Reports.

Measured concentrations of PM_{10} near the mine's boundary are consistently lower than the applicable NAAQS. A small number of elevated concentrations noted in Table 3.5-6 are attributable to coinciding high wind events and/or movement of large equipment in close proximity to monitoring stations.

In accordance with CAA, the state of New Mexico operates a network of air quality monitoring stations designated as State and Local Air Monitoring Stations or "SLAMS," which measure ambient concentrations of pollutants for which a NAAQS has been promulgated. In the geographic area surrounding the AQRA there are relatively few monitoring stations to characterize the local air quality. The New Mexico Environment Department (NMED) operates four SLAMS monitoring sites in San Juan County. Table 3.5-7 indicates the location of each SLAMS site, its approximate distance and direction from Navajo Mine's Area III boundary, and the criteria pollutants monitored at each site (NMED 2008).

Table 3.5-7. NMED Ambient Air Monitoring Stations in San Juan County

Station ID	Location Relative to Area III Boundary	Pollutants Monitored
Farmington	20 km ENE (12.4 mi.)	PM_{10}, $PM_{2.5}$
Shiprock	28 km NNE (17.4 mi.)	SO_2, NO, NO_2, O_3
Bloomfield	41 km ENE (25.4 mi.)	SO_2, NO, NO_2, O_3
Navajo Lake	89 km ENE (55.5 mi.)	$PM_{2.5}$, NO, NO_2, O_3

Table 3.5-7 shows that ambient levels of particulate matter near the AQRA are monitored only at two of the four SLAMS sites. Consequently, the regional air quality with respect to particulate concentrations is sparsely monitored. Based on the most recent ambient PM_{10} and $PM_{2.5}$ monitoring data from the Farmington station that are reported on EPA's AirData website, Table 3.5-8 and Table 3.5-9 compare the second-highest short-term and highest annual observed concentrations to the applicable NAAQS for three recent representative years (EPA 2011b).

Table 3.5-8. Measured PM_{10} (µg/m^3), NMED Farmington SLAMS

Year	24-Hour Values		Annual Values	
	2nd Highest	NAAQS	Mean	NAAQS
2008	37	150	18	50
2007	29	150	15	50
2006	29	150	16	50

Table 3.5-9. Measured $PM_{2.5}$ (µg/m^3), NMED Farmington SLAMS

Year	24-Hour Values		Annual Values	
	2nd Highest	NAAQS	Mean	NAAQS
2008	14.4	35	5.91	15.0
2007	15.5	35	5.96	15.0

Year	24-Hour Values		Annual Values	
2006	12.0	35	6.06	15.0

The state's monitoring data indicate that actual ambient levels of PM_{10} and $PM_{2.5}$ in the Farmington area consistently remain well below the applicable NAAQS on both a short-term and long-term basis. EPA has previously concluded that measurements from the Farmington monitors are "regionally representative" of air quality throughout the general Four Corners area (EPA undated). However, as indicators of regional background concentrations, measurements from the Farmington SLAMS site are not expected to be representative of ambient levels of PM_{10} and $PM_{2.5}$ closer to sources of particulate matter emissions in the AQRA.

The SLAMS monitoring station closest to Navajo Mine is the San Juan Substation site in Shiprock, approximately 17 miles northeast of Navajo Mine. Table 3.5-10 summarizes ambient concentrations of SO_2, NO_2, and O_3 observed at that site during 2008-2010. This station does not include particulate monitoring. In general, measured ambient levels of SO_2 and NO_2 from the station have confirmed consistent satisfaction of the NAAQS for those pollutants.

Table 3.5-10. Monitored Ambient Air Data – NMED San Juan Substation

Pollutant and Basis	NAAQS[1]	2008	2009	2010
SO_2 ppm, Max 24-hr Avg.	0.14	0.0038	0.0050	0.0029
SO_2ppm, Annual Avg.	0.03	0.00047	0.00055	0.00035
NO_2 ppm, Max 1-hr Avg.	0.100	0.043	0.045	0.051
NO_2 ppm, Annual Avg.	0.053	0.019	0.018	0.020
Ozone ppm, Max 8-hr Avg. [2]	0.075	0.071	0.063	0.069

[1] All NAAQS values are listed in units of ppm to facilitate their comparisons to NMED results, as reported.

[2] Compliance with the ozone NAAQS is determined using the three-year average of the fourth-highest daily maximum 8-hour average ozone concentration measured at each monitor within an area over each year.

Source: NMED 2011a.

Over the last several years, measured levels of ambient ozone at all three SLAMS sites in San Juan County have been increasing. Although the state has recommended to EPA that San Juan County be designated as attainment for the revised 2008 ozone NAAQS, trends in measured ozone levels in the county will be closely watched in the future (NMED 2008).

3.5.2.4 Regional Haze

Regional haze has been an air quality issue in Class I areas throughout the southwestern U.S., including those closest to the AQRA. In the 1977 Amendments to the CAA, Congress established a national goal of having no manmade visibility impairment in any mandatory Class I federal area. Sixteen mandatory federal Class I areas are within roughly 300 km of Navajo Mine. The nearest such area, Mesa Verde National Park, is located in southwestern Colorado approximately 62 kilometers from the mine. The next two Class I areas closest to Navajo Mine are the Weminuche Wilderness Area in Colorado (137 km) and

the San Pedro Parks Wilderness Area in New Mexico (160 km) (75 FR 64, 229-30). Regional haze conditions in the closest Class I areas can be affected by emission from the coal-fired power plants nearest to the AQRA, more so than the operation of the ground-level particulate sources operated at the Navajo Mine.

Under the federal regional haze rule (30 CFR 51.308), each state was required to submit its initial regional haze SIP to EPA by December 17, 2007. The compliance-planning period for those first SIPs extends through July 2018. The Navajo Nation has not elected to develop a regional haze TIP. Therefore, EPA has decided to implement the regional haze program on the Navajo Reservation for the first regional haze planning period by proposing source-specific requirements. EPA has proposed to implement the BART requirement for FCPP by obtaining major NO_x emission reductions from all five electric generating units at that source. In addition, NMED adopted a regional haze SIP for the SJGS, including a NO_x BART requirement for each unit (NMED 2011b).

Because the majority of particulate emissions from surface coal mines are larger particles emitted at or near ground level with little or no buoyancy, surface coal mines are not the typical contributors to visibility impairment at distant locations. Surface coal mines were not one of the stationary source categories for which Congress specifically required BART. Nevertheless, during one of the future planning periods for regional haze, EPA may elect to evaluate Navajo Mine's particulate emissions to assess whether they contribute to visibility impairment in any mandatory federal Class I area.

3.5.2.5 Climate and Meteorology

The climatic region for Navajo Mine is arid to semi-arid, sparsely vegetated high desert. The region has warm summers and cold, relatively dry winters. Average monthly temperatures are listed for long-term periods at several monitoring stations in Table 3.5-11. The summer climate in San Juan County displays typical southwestern high desert characteristics. This region is at high elevation, so there is usually a wide diurnal temperature swing between daily low and high levels. The summer heat is tempered somewhat by the extremely low relative humidity. However, humidity can increase markedly for the months of July through October in association with a moist "monsoonal flow" from the south. Winters are generally moderate with monthly average temperatures just below freezing.

Overall annual precipitation is low. As shown in Table 3.5-11 the recorded average annual total precipitation for three stations in the region are between 6 and 7.5 inches per year. Pacific storms may produce winter snow or rainfall in northwestern New Mexico, but snow accumulation is unusual. The highest monthly precipitation totals occur during the warmer months. In this area, moist winds from the south and east support the development of thunderstorms associated with significant flash flooding and/or strong downburst winds. Strong wind episodes in the warmer summer and early fall months are usually connected with thunderstorms and are thus isolated and localized (WRCC 2011b, 2011c).

The Navajo Mine operates three meteorological stations within the mine property. In addition, data is also available for three stations in San Juan County nearest to the mine: Newcomb, Fruitland, and Shiprock, New Mexico (WRCC 2011a). Representative data from each of these stations are listed in Table 3.5-11 for average monthly temperatures and precipitation. The monthly average temperatures at the mine site tend to be slightly higher than for other monitoring stations in the region.

Table 3.5-11. Climatology Summary: Mean Temperature and Precipitation in the Region

Monthly Average Dry Bulb Temperature (degrees Fahrenheit)					Average Monthly Total Precipitation (inches)			
Month	Navajo Mine[1] (2010)	Newcomb[2]	Fruitland[3]	Shiprock[4]	Navajo Mine[1] (2010)	Newcomb[2]	Fruitland[3]	Shiprock[4]
Monthly Mean Values								
Jan	27.9	28.3	29.6	29.4	1.10	0.22	0.58	0.46
Feb	35.4	35.2	35.7	36.0	0.70	0.16	0.52	0.46
Mar	43.5	42.2	43.3	43.7	0.52	0.31	0.58	0.54
Apr	53.2	51.7	51.2	52.4	0.20	0.26	0.54	0.41
May	61.3	61.7	60.0	61.8	0.10	0.34	0.44	0.51
June	75.7	71.2	69.2	70.7	0.02	0.29	0.27	0.29
July	78.0	76.5	75.2	76.6	0.53	0.92	0.80	0.66
Aug	73.9	73.2	73.2	74.6	1.30	1.13	0.93	1.00
Sept	70.6	65.8	64.9	66.5	0.67	0.72	0.82	0.80
Oct	60.9	54.0	53.1	54.2	1.56	0.81	0.84	0.78
Nov	39.1	39.5	40.1	40.7	0.09	0.36	0.57	0.52
Dec	39.0	28.7	30.6	30.5	0.41	0.44	0.60	0.57
Annual Mean					**Annual Total**			
	54.9	52.3	52.2	53.1	7.18	5.96	7.49	7.00

[1] Navajo Mine operates three on-site meteorological stations at different locations within the mine property. The average of the monthly mean values for the three stations is tabulated for 2010.

[2] Newcomb is a small tribal community 16 miles southwest of the BNCC Site. Period of Record of Newcomb Climate Summary 6/6/1948 to 4/30/1971

[3] The Town of Fruitland is a rural agricultural/residential community on U.S. 64 approximately 10 miles northeast of the BNCC Site. Period of Record of Fruitland Climate Summary 1/1/1893 to 8/31/2010

[4] The Town of Shiprock is an agricultural and tribal community, with a large number of traveler services, approximately 8 miles northwest of the BNCC Site. Period of Record of Shiprock Climate Summary 7/1/1926 to 10/31/2007

Source: WRCC 2011a.

Located in the center of Area IV North, the mine's Meteorological Station No. 3 monitors meteorological parameters at an accepted standard height of 10 meters above ground level that are representative of Areas III and IV North.

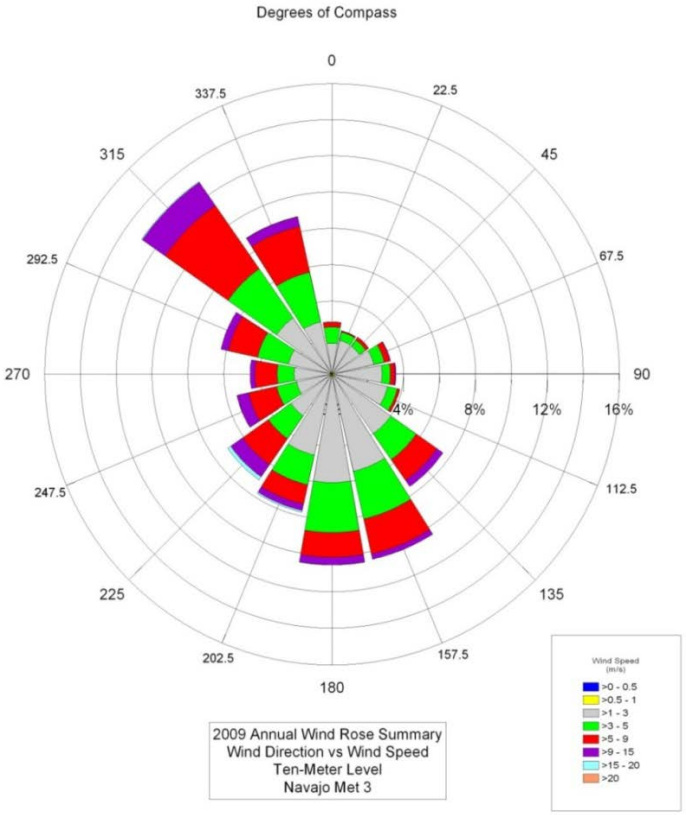
Figure 3.5-2 presents an annual wind rose that summarizes Station No. 3 measurements of wind speed and direction during 2009.

As shown in Figure 3.5-2, with 13 percent of total measurements, the prevailing wind direction during 2009 was from the Northwest. Those NW winds were mostly in the wind speed range of >5 – 9 m/s, with the next most frequent component in the >3 to 5 m/s range. In addition, almost 9 percent of the winds were from the North-Northwest. The second most frequent wind direction during 2009 was from the South, with slightly less than 11 percent of the total winds. Most of those winds were in the wind speed range of >1 to 3 m/s. In addition, winds from the South-Southeast made up a little more than 10 percent of the total winds during 2009. The greatest frequency of higher-speed winds was from the Northwest. Measured wind patterns in Area IV North during 2009 indicate that the mine's particulate emissions likely dispersed in the Southeast and South-Southeast directions for roughly 22 percent of the time and in the North and North-Northwest directions approximately 21 percent of the time.

Atmospheric stability is a meteorological factor that also affects the dispersion of air pollutants. When the atmosphere is stable, emitted pollutants tend not to rise much, instead diffusing horizontally within a few hundred feet of the surface. Conversely, when the atmosphere is unstable, air pollutant emissions mix vertically within the atmosphere and tend to be carried away by prevailing winds.

In northwestern New Mexico, stable and unstable conditions of the atmosphere occur for roughly the same duration during the warmer months. Periods of atmospheric instability are typically manifested in monsoon rain events and wind storms that may occur almost daily from approximately early July through mid-October. Wind speeds tend to be highest during the monsoon months of July through October.

Figure 3.5-2. Measured Wind Speed and Direction Wind Rose for Area IV North



3.5.2.6 Greenhouse Gas Emissions (GHGs) and Climate Change

3.5.2.6.1 GHGs Framework

EPA has designated as an "air pollutant" the aggregate mix of six different greenhouse gases—carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) (74 FR 66,496). These six gases remain in the atmosphere for decades to centuries, which allows time to become well mixed globally in the atmosphere. EPA's "endangerment finding" found that current and projected atmospheric concentrations of GHGs are reasonably anticipated to endanger the public health and welfare of current and future generations. EPA has also found that GHGs from new motor vehicle and new motor vehicle engines contribute to the GHG pollution that threatens public health and welfare.

In recent years, EPA has promulgated—among other GHG-related regulations—the GHG Mandatory Reporting Rule, 40 CFR Part 98, which requires facilities in certain stationary source categories and other facilities with total GHG emissions above 25,000 tpy CO_2e to monitor and report their annual GHG emissions. Once GHGs became subject to regulation under the Act, EPA had to promulgate its GHG Tailoring Rule to incorporate the regulation of GHGs into the PSD and Title V permitting programs for major sources (75 FR 31,514; 40 CFR 51, 52, 70, 71). EPA is now considering development of New Source Performance Standards (NSPS) for GHGs from coal-fired power plants and oil refineries.

New Mexico is a founding member of the Western Climate Initiative (WCI), a coalition of several western states and Canadian provinces that intend to enact a regional cap-and-trade to curb GHG emissions. To that end, New Mexico promulgated its greenhouse gas cap-and-trade program in December 2010 (20.2.350 NMAC). However, at this time the state's executive branch does not support the program, so the implementation schedule for that program is unclear. California is the only other WCI member that has developed regulations for a GHG cap-and-trade program, and that latter program is facing political and legal challenges.

New Mexico's inventory requirement for GHG emissions which began in 2008 (20.2.73.300 NMAC) will be replaced by the state's recently promulgated GHG reporting rule (20.2.300 NMAC), which parallels EPA's Mandatory GHG Reporting Rule. The state has also adopted a third-party verification requirement for reporting GHG emissions from the largest stationary sources (20.2.301 NMAC).

3.5.2.6.2 GHG Emissions

As of 2007, the largest sources of GHG emissions in New Mexico were electricity production (41 percent), the fossil fuel industry (22 percent), and transportation fuel use (20 percent) (NMED 2010). The fossil fuel industry consists of (1) production, processing, transmission, and distribution in the natural gas industry, (2) production and refineries in the oil industry, and (3) coal mining. The oil and natural gas industries emit large amounts of CO_2 and CH_4, while coal mining emits mostly CH_4.

Estimated emissions from the State's fossil fuel industry showed a slight decrease from 2000 to 2007, from 19.1 million metric tons of CO_2 equivalent ($MMTCO_2e$) to 16.9 $MMTCO_2e$. NMED acknowledges, however, that significant uncertainty exists in the GHG emissions estimates for this sector due to inadequate data and changes in the estimating methodology for some source categories.

For the fossil fuel industry, the most significant change in GHG emissions from 2000 to 2007 was a sharp increase in methane emissions from coal mining due to the opening of a new underground mine, which replaced an existing surface mine. Compared to a surface coal mine, an underground coal mine emits substantially greater amounts of CH_4 due to an underground mine's ventilation and degasification systems. With that new underground mine in New Mexico, the coal mining industry's GHG emissions in the state are only about 6.5 percent of total estimated GHG emissions from the fossil fuel industry.

The predominant GHG emitted by surface coal mines is methane (CH_4). During the surface mining process, significant amounts of methane are released when overburden removal exposes coal seams and when those seams are then fractured to extract the coal. Smaller amounts of methane are also emitted during post-mining activities when the raw coal is processed, handled and then stored (EPA 2011a).

Surface coal mines rely on a variety of diesel-fired, non-road heavy equipment for coal extraction and loading as well as large, diesel-fired trucks for coal hauling and related purposes. Surface coal mines also operate a number of medium- and light-duty gasoline-fired trucks for transportation and maintenance. The combustion of diesel fuel and gasoline results in significant amounts of CO_2 emissions as well as smaller amounts of CH_4 and N_2O emissions.

Navajo Mine's baseline annual GHG emissions from Area III are summarized in Table 3.5-12. The various mobile sources at the mine emit an estimated 13,603 metric tons of CO_2 per year (Mtpy CO_2). The mine's estimated emissions of CH_4 and N_2O have a CO_2-equivalence of 57,800 Mtpy CO_2e and 739 Mtpy CO_2e, respectively. Navajo Mine's total baseline GHG emissions are estimated to be 72,142 Mtpy CO_2e. Coal mine methane accounts for 80 percent of the mine's GHG emissions on a CO_2-equivalent basis. Appendix F contains the "rate" of each type of emission source's activity at the mine as well as the relevant emission factor that was applied to estimate that source category's GHG emissions.

Table 3.5-12. Estimated Annual Baseline GHG Emissions, Mtpy CO_{2e}

Emission Source Category	CO_2	CH_4	N_2O
Nonroad Mine Vehicles	7,260	104.6	691.8
Coal Haul Trucks	3,973	4.8	31.6
Plant Vehicles	2,370	2.5	15.7
Surface Coal Mine and Post-mining	--	57,688	--
TOTAL - Baseline GHG Emissions	**13,603**	**57,800**	**739**

Currently, Navajo Mine is not subject to any federal or state GHG emission standards, permit requirements, or other CAA regulatory programs. EPA's Mandatory GHG Reporting Rule applies to certain underground coal mines, but not to surface coal mines. The PSD and Title V programs defined by the Tailoring Rule apply to "major" stationary sources, which include those with the potential to emit 100,000 metric tons per year of CO_2e or more. Emissions from mobile sources are not included in the calculation of potential to emit for a stationary source, such as a surface coal mine. In addition, fugitive emissions such as coal mine methane are not included in the calculation of potential to emit for a surface coal mine. Once its mobile source emissions of CO_2 and its fugitive emissions of CH_4 are discounted, Navajo Mine is far from being a major stationary GHG source for PSD or Title V purposes.

3.5.2.6.3 Climate Change

Energy from the Sun drives the Earth's weather and climate. The Earth absorbs energy from the Sun, and radiates energy back into space. However, much of this energy going back to space is absorbed by "greenhouse" gases in the atmosphere. Because the atmosphere then radiates most of this energy back to the Earth's surface, Earth is warmer than it would be if the atmosphere did not contain these gases. Without this natural "greenhouse effect," surface temperatures would be about 60ºF lower than they are now, and life as we know it today would not be possible (EPA 2009).

During the past century, humans have substantially added to the amount of greenhouse gases in the atmosphere by burning fossil fuels. The added gases—primarily carbon dioxide and methane—are

enhancing the natural greenhouse effect, and likely contributing to an increase in global average temperature and related climate changes. Climate change refers to any significant change in measures of climate (such as temperature, precipitation or wind) lasting for an extended period (decades or longer). The average temperature of the Earth's surface has reportedly increased by about 1.2 to 1.4ºF since 1900. Other aspects of the climate such as precipitation patterns and storminess are also changing.

Warming, (increases in ambient surface temperatures) in the Southwest during the past thirty years is among the most rapid in the United States, significantly more than the global average in some areas. Declines in spring snowpack and Colorado River flow have been linked to this warming trend (GCRP 2009).

3.6 Vegetation

3.6.1 Definition of Resource

Vegetation resources include the plant communities and the species that comprise them. The vegetation resources assessment area includes the areas of existing mining in Area III, proposed mining in Area IV North, and the Burnham Road realignment.

Under SMCRA, BNCC is required to provide an adequate description of the existing pre-mining environmental resources within the proposed disturbance area(s). This information is used by OSM to determine whether the applicant can comply with the performance standards of the regulations for surface coal mining and whether reclamation of these areas is feasible (30 CFR 779.10). BNCC is required to map and delineate existing vegetative types and provide description of the plant communities within the proposed permit area (30 CFR 779.19). Plant species protected by federal or tribal regulations are addressed in the discussion of Threatened and Endangered and Protected Species, Section 3.8 of this document.

3.6.2 Affected Environment

The natural vegetation community within the area is referred to as Great Basin Desertscrub (Dick-Peddie 1993; Brown 1994). This type of vegetation is known as "cold desert," a name assigned due to the climatic combination of cold winters, low precipitation, and wide fluctuations in both daily and seasonal temperature extremes. The Great Basin Desertscrub is characteristically dominated by salt tolerant plants and has few cacti (Brown 1994). As a whole, the plant species diversity of Great Basin Desertscrub is typically less than other types of desert scrublands. However, within the Great Basin Desertscrub there is considerable variation in plant species diversity between different plant communities.

In 1987, BNCC conducted vegetation studies within the Great Basin Desertscrub community and delineated the community into range sites for SMCRA planning. Range sites are defined as vegetation communities found on rangelands that contain unique associations of plant species composition and productivity; and have distinctive soils, hydrology, and topography (BNCC 2009a; NRCS 2011). The original 1987 characterization delineated eight community types in the vegetation resource assessment area as Alkali Wash, Arroyo Shrub, Badlands, Dunes, Thinbreaks, Calcareous Sands, Saline Sands, and Sands. The three sands sites were later combined into a single vegetation community type "Sands" to simplify analysis and reporting. These range sites were delineated by interpretation of aerial photography

followed by ground-truthing along with site-specific data on soils, geology, and topography. Subsequent studies used ground-truthing to confirm range sites as community types based on vegetative attributes (Ecosphere 2004a).

In undisturbed areas throughout the vegetation resource assessment area, forbs are the most dominant vegetative life form, followed by shrubs and then grasses. The most common plant species overall is Russian thistle (*Salsola tragus*), an introduced weed, followed by scorpion weed (*Phacelia crenulata*) and cryptantha (*Cryptantha crassisepala*). The current vegetation type distribution in the vegetation resource assessment area is shown in Figure 3.6-1. The acreages of vegetation types/range sites and corresponding percentage of the total vegetation within the assessment area are shown in Table 3.6-1 along with average cover and shrub densities for each range site. Disturbed vegetation associated with the existing mining area in Area III and previously disturbed areas in Area IV North accounts for 16 percent of total vegetation within the assessment area. Six vegetation range sites are present in the undisturbed areas associated with Area IV North. Area III has been disturbed by ongoing mining activities and is either reclaimed or un-vegetated. Species composition and density have been altered in this area from its natural state.

Table 3.6-1. Characterization of Vegetation in the Project Area

	Project Area		Areas I, II, III[1]		Area IV North[2]	
Vegetation Type	Acres	Percent	Average cover (%)	Average Shrub Density (shrubs/m^2)	Average cover (%)	Average Shrub Density (shrubs/m^2)
Alkali Wash	238	12	0.85	0.10	3.20	0.24
Arroyo Shrub	32	2	2.05	0.33	5.71	0.34
Badlands	689	36	0.35	0.05	1.08	0.10
Dunes	10	1	2.55	0.48	6.23	0.94
Sands	206	11	2.26	0.39	8.35	0.16
Thin Breaks	89	5	1.4	0.33	2.11	0.01
Disturbed	626	33	n/a	n/a	n/a	n/a

[1] OSM 2009
[2] Ecosphere 2004a

Alkali Wash

Alkali Wash is associated with minor waterways. Terrain is nearly level to moderately sloping and ranges from 0 to 3 percent. These community areas are typically broad and level with occasional small, dense patches of galleta grass (*Pleuraphis jamesii*) and alkali sacaton (*Sporobolus airoides*). Alkali Wash is typically located in washes and drainages as well as at the base of Badlands. The soils are shallow, often with heavy clays and high sodic levels. These conditions contribute to the lack of productivity in the community type.

Arroyo Shrub

Arroyo Shrub is found on level or nearly level terrain (0-2 percent slopes) located next to streambeds in major drainages, such as Cottonwood Arroyo and Pinabete Arroyo. The soils are stratified sands and often have a high sodium adsorption ratio value, which generally means soils are compacted, dry with only trace vegetation present. Production is still high because of the deep, well-drained soil and proximity to water. Shrubs and perennials characteristic of this community include greasewood (*Sarcobatus vermiculatus*), burroweed (*Isocoma azteca*), lemon scurf-pea (*Psoralidium lanceolatum*), and saltgrass (*Distichlis spicata*).

Badlands

Badlands have the least vegetation of any community type in the Project Area. Badlands consists of exposed, weathered shale with moderately undulating to steep topography (10-60 percent slopes). The vegetation community common to Badlands generally occurs between plateau edges and major drainages. Plants, where they occur, are often located along the small relief channels of these barren areas. Species typical of Badlands are Gardner's saltbush (*Atriplex gardneri*), Powell's saltbush (*Atriplex powellii*), yellow beeplant (*Cleome lutea*), and poverty weed (*Monolepis nuttalliana*). This community can abruptly shift to another community type or gradually transition to Alkali Wash or Thinbreaks.

Dunes

Dunes form gently rolling terrain (0 to 5 percent slopes) located on the leeward side of ridges, bluffs, and plateaus. Dunes soils are deep and composed of well-drained sands. The soil depth in Dunes offers deep, but more consistent water availability. Since only deep-rooted perennial plants can exploit this water, Dunes often harbor unique plant species such as San Juan milkweed (*Asclepias sanjuanensis*). The Dunes community type is one of the more productive found in the area.

Sands

As with Dunes, the deeper penetration of rainwater into sandy soils allows for greater water availability and increases plant species diversity. The types of sand in this vegetation community can vary from saline to calcareous. Sands often transition to, and can be mixed with the Thinbreaks community. In years with high amounts of spring rainfall, sandy soils display an abundance of annuals, especially scorpion weed, annual Townsend daisy *(Townsendia annua*), and cryptantha.

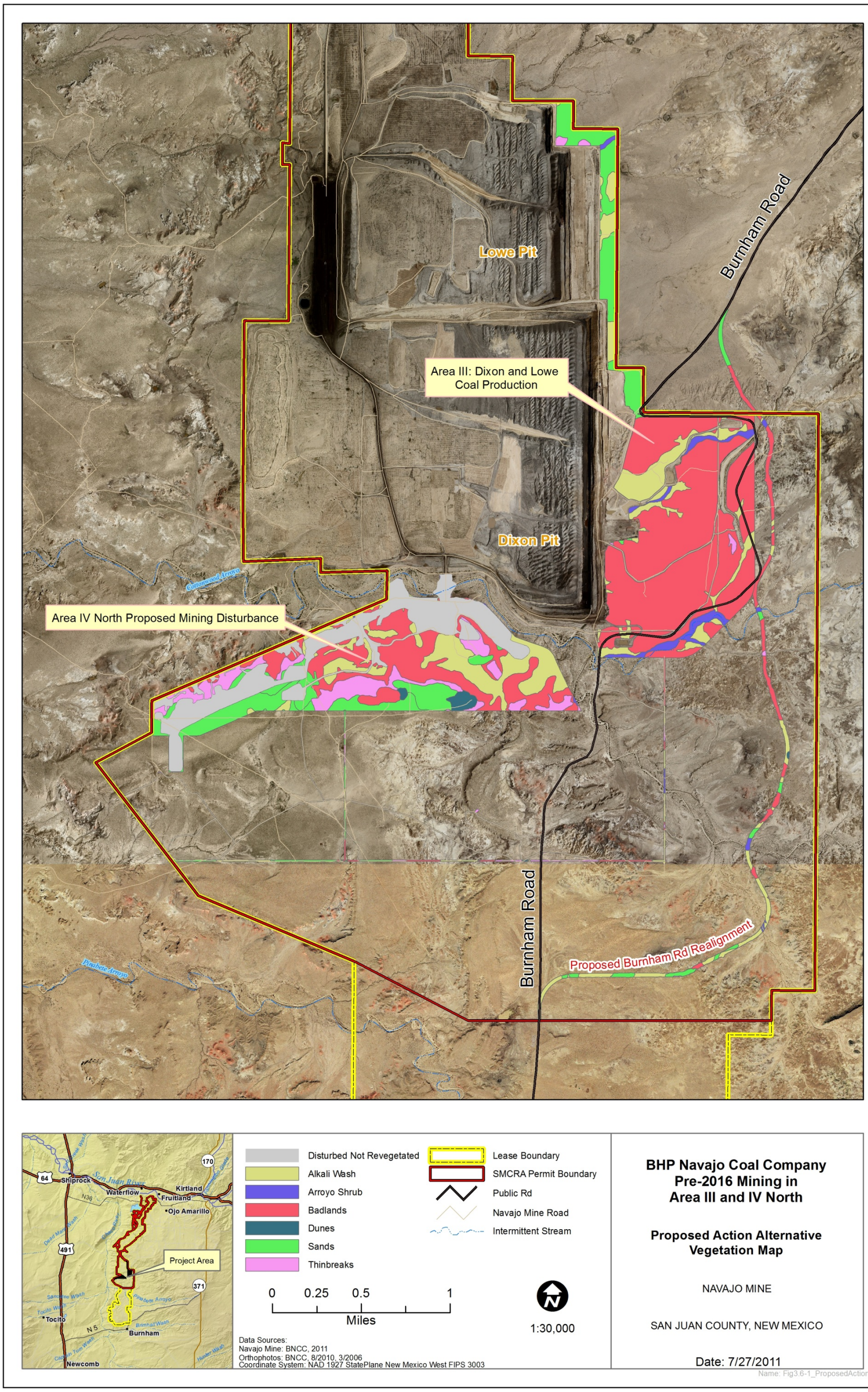
Thinbreaks

Thinbreaks are typically located in upland habitats with surface rock as a unifying feature. These are rocky areas, usually characterized by shale, and may contain loose rock or large pieces of rock firmly embedded in the ground. Slopes vary from 2 to 9 percent. These sites usually occur along ridges and rock outcrops that are in between plateaus and major drainages or plateaus and Badlands, but can also occur on butte and mesa tops. Thinbreaks can abruptly shift to another community type or gradually shift to Badlands or Sands. Typical soils are shallow sandy deposits overlaying sandstone. Thinbreaks plant species that occur in fissures between rocks include Bigelow sagebrush (*Artemisia bigelovii*), Mojave brickellbush (*Brickellia oblongifolia*), Fendler's spurge (*Euphorbia fendleri*), and basin daisy (*Platyschkuhria integrifolia*).

Disturbed

This category refers to areas where native vegetation has been removed or disturbed from ongoing mining activities in Area III and from previous disturbances in Area IV North. Mining strips, stockpiles, roads and other areas subject to frequent use are unvegetated. Those areas that are in the process of reclamation are vegetated with varying densities of shrubs and forbs including saltbush (*Atriplex* sp.), Indian ricegrass (*Achnatherum hymenoides*), galleta grass (*Pleuraphis jamesii*) and alkali sacaton (*Sporobolus airoides*).

Figure 3.6-1. Vegetation Distribution in Project Area



3.7 Wildlife

3.7.1 Definition of Resource

Wildlife is defined as those terrestrial and aquatic animal species previously documented or having potential to occur in the proposed areas of mining and Burnham Road realignment, and within a one-mile area around the existing Navajo Mine Permit Area. This assessment area pertains to the general area that OSM requires BNCC to monitor annually for wildlife utilization. The NNDFW are responsible for the stewardship and conservation of wildlife within the Navajo Nation including the Navajo Mine. The wildlife resources assessment area is part of the larger New Mexico Department of Game and Fish Game Management Unit 1, which covers the entire Navajo Nation exclusive of checkerboard areas and is managed by the NNDFW. Wildlife species protected by federal or tribal regulations are addressed in the discussion of Threatened and Endangered and Protected Species, Section 3.8 of this document.

3.7.2 Affected Environment

The dominant vegetation community within the wildlife resources assessment area is Great Basin Desertscrub (see Section 3.6 – Vegetation) The assessment area supports a wide diversity of wildlife species due to a variety of landscape features and topography such as rock outcrops, washes, and rolling hills that provide habitat for these species. Overall, annual precipitation is likely a limiting factor for wildlife. Consequently, perennial stock ponds within the assessment area serve as important water sources for wildlife and drainages are often used disproportionately by wildlife. These areas provide important cover as protection from predation, as breeding habitat, and refuge from adverse weather and heat of the summer.

The wildlife resources assessment area has been surveyed numerous times over the years to fulfill the requirements of the SMCRA permit including wildlife, raptor, and threatened and endangered species surveys (Ecosphere 2001, 2004b, 2008a, 2008b, 2008c, 2009b; Hawks Aloft 2000-2007). Numerous wildlife, biological resources, and threatened and endangered species surveys have been conducted between 1975 and 2004 (Ecosphere 2001, 2004b). Chapter 10 of the Navajo Mine SMCRA permit (BNCC 2009a) provides several compiled lists of wildlife species that either have been observed in the assessment area or may occur in northwestern New Mexico.

The area provides foraging and watering habitat for several bat species including pipistrel (*Pipistrellus hesperus*), Yuma bat (*Myotis yumanensis),* fringed myotis (*Myotis thysanodes*), Townsend's big-eared bat (*Corynorhinus townsendii*), spotted bat (*Euderma maculatum*), pallid bat (*Antrozous pallidus*), and big free-tailed bat (*Nyctinomops macrotis*) (Adams 2003). Roosting habitat for bat species are cliff faces and rock crevices. No large populations of bats are expected to roost in the assessment area based on marginal roosting and foraging habitat coupled with limited water resources.

Coyote (*Canis latrans*), as well as red fox (*Vulpes vulpes*) and kit fox (*Vulpes macrotis*), have been well documented in the area. Spotlighting surveys in 2005 documented several individuals, including kit foxes and coyotes (Ecosphere 2008b). The occurrence of kit fox, listed as a Group 4 species on the Navajo Endangered Species List, is described in Section 3.8 – Threatened and Endangered Species, Sensitive Species. Bobcat (*Lynx rufus*) may occur in the assessment area in low densities. An individual bobcat was observed north of proposed mining areas in 2008 (Musslewhite 2008 personal communication), and

bobcat tracks were identified in Chaco Wash (Ecosphere 2004a) and around Morgan Lake (Ecosphere 2008b). It is unlikely that mountain lion (*Felis concolor*) occur in the assessment area, other than transitory individuals, due to the lack of mule deer (*Odocoileus hemionus)* or other sufficient prey base.

Mule deer are occasional transients wandering into the area from the San Juan River corridor, but are not common residents of Great Basin desertscrub habitat (Hoffmeister 1986). Pronghorn antelope (*Antilocapra americana*) are not known to occur in the assessment area. Desert cottontail (*Sylvilagus audubonii*) and black-tailed jackrabbit (*Lepus californicus*) are well-documented in the area and are commonly observed (Ecosphere 2008b, 2009a). Both of these species are likely important prey species to carnivores and raptors.

A badger (*Taxidea taxus*) was observed in a prairie dog colony in the wildlife resource assessment area in summer 2004 (Ecosphere 2004b). Badgers (of the Mustelidae family) commonly occur in areas inhabited by prairie dogs (*Cynomys spp.*). Populations of badgers can be correlated to prairie dog populations and the availability of prey, therefore, the assessment area is expected to only support low densities of badger. Other mustelids documented or having potential to occur include skunk (*Mephitis mephitis*) and long-tailed weasel (*Mustela frenata*) (BNCC 2009a). Gunnison's prairie dog (*Cynomys gunnisoni*) has been documented in almost all surveys conducted by BNCC since 1975 (BNCC 2009a; Ecosphere 2001; Ecosphere 2004b). In 2007, five prairie dog towns ranging in size from 75 to 317 acres were mapped in the adjacent Area IV South and Area V (Ecosphere 2008a; Ecosphere 2008b). In February 2011, two prairie dog towns within the proposed mining areas were identified, encompassing 13 and 60 acres, respectively. These towns are in the southern portion of Area IV North, in the vicinity of the existing ancillary roads and outside of proposed ground disturbance areas. Other common squirrel species include white-tailed antelope squirrel (*Ammospermophilus leucurus*), ground squirrel (*Spermophilus sp.*), and rock squirrel (*Spermophilus variegatus*). These species also likely serve as important prey for carnivores and raptors.

Other small mammal species documented include Ord's kangaroo rat (*Dipodomys ordii*) and banner-tailed kangaroo rat (*Dipodomys spectabilis*), both relatively abundant in the assessment area. Other small mammal species documented include silky pocket mouse (*Perognathus flavus*), Apache pocket mouse (*Perognathus apache*), deer mouse (*Peromyscus maniculatus*), western harvest mouse (*Reithrodontomys megalotis*), woodrat (*Neotoma spp.*), northern grasshopper mouse (*Onychomys leucogaster*), and the Botta's pocket gopher (*Thomomys bottae*). These species also comprise an important prey component for carnivores and raptors.

Avian species are also an important wildlife resource and have been well documented in the Project Area. Baseline surveys for breeding birds have been conducted in the Project Area since 1975 as documented in BNCC's current SMCRA permit (BNCC 2009a), and for adjacent Area IV South and Area V south of the Project Area (Ecosphere 2008b). Birds and other highly mobile wildlife species that occur in these adjacent areas may also use the Project Area on a regular or incidental basis. Birds commonly documented in the Project Area include common raven (*Corvus corax*), horned lark (*Eremophila alpestris*), vesper sparrow (*Pooecetes gramineus*), lark sparrow (*Chondestes grammacus*), mourning dove (*Zenaida macroura*), and western meadowlark (*Sturnella neglecta*). Ecosphere Environmental Services also recorded a list of avian species during baseline surveys for Area IV South and Area V (Ecosphere 2008b). Waterfowl and shorebird species including American avocet (*Recurvirostra americana*), black-

crowned night heron (*Nycticorax nycticorax*), killdeer (*Charadrius vo*ciferus), Eurasian wigeon (*Anas penelope*), and cinnamon teal (*Anas cyanoptera*), were observed at the temporary pond located along the southern boundary of the Area IV North mine lease boundary within the Project Area (Ecosphere 2008b). For a discussion of avian species protected by the Migratory Bird Treaty Act, see Section 3.8.

In addition to those surveys listed above, raptor monitoring is completed annually as part of BNCC's compliance with SMCRA regulations (Ecosphere 2008c; Ecosphere 2009a). Both nesting and foraging habitat for red-tailed hawk (*Buteo jamaicensis*), great-horned owl (*Bubo virginianus*), golden eagle (*Aquila chrysaetos*), ferruginous hawk (*Buteo regalis*), northern harrier (*Circus cyaneus*), prairie falcon (*Falco mexicanus*), and American kestrel (*Falco sparverius*) have been documented in the Project Area. In 2004, two juvenile bald eagles (*Haliaeetus leucocephalus*) were observed flying over the Project Area during baseline surveys, but they are more likely to utilize the San Juan River and Morgan Lake. Burrowing owls (*Athene cunicularia*) have also been documented in the Project Area, usually associated with prairie dog burrows (Ecosphere 2004b). For more detailed discussion of bald and golden eagle, protected by the Bald and Golden Eagle Act, and burrowing owl and ferruginous hawk, both Group 4 species on the Navajo Endangered Species List, see Section 3.8.

Reptiles and amphibians have typically been documented only as incidental sightings or during cursory pedestrian surveys within the wildlife resources assessment area (BNCC 2009a). Amphibians generally do not occur in the assessment area (BNCC 2009a; Howell 2004 personal communication). Reptiles commonly documented include western whiptail (*Cnemidophorus tigris*), gopher snake (*Pituophis melanoleucus*), bull snake (*Pituophis melanoleucus sub. sayi*), prairie rattlesnake (*Crotalus viridis*), short-horned lizard (*Phrynosoma douglassii*), side-blotched lizard (*Uta stansburiana*), lesser earless lizard (*Holbrookia maculata*), and collared lizard (*Crotaphytus collaris*). The assessment area does not contain streams or ponds that could sustain any species of fish.

Terrestrial invertebrates, namely moths, butterflies, wasps, ants, bees, beetles, and flies common to northwestern New Mexico, have potential to occur throughout the assessment area (URS 2007b).

3.8 Threatened and Endangered Species, Sensitive Species

3.8.1 Definition of Resource

The Endangered Species Act (ESA) of 1973 (PL 93-205, as amended) requires federal agencies to ensure that no actions that they authorize, fund, or carry out are likely to jeopardize the continued existence of any endangered or threatened species, or result in the destruction or adverse modification of their critical habitat.

Navajo Nation threatened and endangered species are managed under the Navajo Nation Code requirement for species of concern (17 NNC 507) administered by the Natural Heritage Program (NHP) of the NNDFW. On the Navajo Nation, all applications for land use are considered by the Resources Committee of the Navajo Nation Council, or their delegate. The NNDFW reviews applications for impacts on biological resources on behalf of the Division of Natural Resources, for recommendation to the Resources Committee pursuant to 2 NNC 164. Pursuant to 17 NNC 507, the Navajo Endangered Species List identifies those native plants and animals in danger of extinction (Group 2) on the Navajo Nation or threatened with endangerment in the near future (Group 3), and protected against take, as

defined by ESA. Group 4 species are "candidates" for listing and have no legal protection under Section 507 of the Navajo Code.

The Resources Committee of the Navajo Nation Council is responsible for legislative oversight of the Division of Natural Resources, which includes the NNDFW. The Resources Committee has the responsibility and authority to adopt policies, procedures, and regulations that protect the biological resources of the Navajo Nation. The Resources Committee, by Resolution No. RCMA-34-03, dated March 13, 2003, approved the Biological Resource Land Clearance Policies and Procedures. The entire Navajo Nation has been divided into six types of wildlife areas. These areas provide the framework for planning specific development projects.

Under the Migratory Bird Treaty Act of 1918 (16 USC 703-712; Ch. 128, as amended) and Executive Order 13186, “Responsibilities of Federal Agencies to Protect Migratory Birds,” federal agencies are required to consider management impacts to migratory non-game birds.

Information used to prepare this section is derived from existing information and data collected during field-based habitat evaluations within the Project Area conducted in February 2011 and are reported in the project BE included as Appendix E. A review of existing data sources was conducted prior to fieldwork. Extensive wildlife baseline data has been prepared for the BNCC mine permit and lease area. Annual monitoring of raptors and wildlife at Navajo Mine is conducted in accordance with the SMCRA regulations as administered by the OSM (OSM 2009; Hawks Aloft 2000-2007; Ecosphere 2008a; 2008c; 2009a). Additionally, extensive baseline biological surveys of the Project Area were conducted in 2004 (Ecosphere 2004a; 2004b; and 2005). In 2007, baseline surveys were conducted in Area IV South and V located south of the Project Area (Ecosphere 2008a; Ecosphere 2008b). Threatened and endangered species surveys for the Burnham Road Realignment (OSM 2008a) and the Lowe-Dixon surface addition (Ecosphere 2009b) contribute to the data available for determining impacts and effects.

3.8.2 Affected Environment

The affected environment or Action Area considered for federal and Navajo Nation listed species was delineated based on consideration of all direct and indirect effects of the Proposed Action [50 CFR 402.02 and 402.14(h)(2)]. The Action Area analyzed in the project BE (Appendix E) was determined based on maximum distance that a particular impact from mining could reasonably be expected to affect a listed or sensitive species. For example, in the BE the Action Area was largely determined by consideration of spatial factors or impact pathways such as the distance mining noise could be heard over ambient noise; the distance that fugitive dust could reasonably travel and be demonstrated to cause a measurable adverse effect on a listed species; and/or the pathway of water quality or quantity potentially reaching a receiving water.

Based on the results of the noise, water, and air impact pathway analyses completed in this EA, a one-mile radius around the Navajo Mine lease area is a conservatively large Action Area to assess potential impacts to listed species from the Proposed Action.

3.8.2.1 Federally Listed Threatened and Endangered Species

USFWS listed species were obtained from the USFWS Southwest Region Endangered Species List (USFWS 2011) and via direct communication with the USFWS (Appendix E). According to the USFWS,

there are 11 federally listed threatened, endangered, proposed threatened, or candidate plant and animal species with potential to occur in San Juan County, New Mexico. Federally listed species for San Juan County, New Mexico, their habitat associations, and a description of the potential for each to occur in the assessment area is provided in Table 3.8-1.

Table 3.8-1. Species Listed by the U.S. Fish and Wildlife Service as Threatened, Endangered, Proposed Threatened, or Candidate for San Juan County, New Mexico and the Potential to Occur in the Action Area.

Species	Status	Habitat Associations	Potential to Occur
MAMMALS			
Black-footed ferret (*Mustela nigripes*)	Endangered	Open grasslands with year-round prairie dog colonies greater than 198 acres in size with greater than 20 burrows per 2.5 acres.	There are no prairie dog colonies of sufficient size to support black-footed ferret in the Action Area.
Canada lynx (*Lynx Canadensis*)	Candidate	Generally occurs in boreal and montane forests dominated by coniferous or mixed forest with thick undergrowth.	No boreal or montane forests occur within the Action Area.
BIRDS			
Mexican spotted owl (*Strix occidentalis lucida*)	Threatened with Critical Habitat	Nests in caves, cliffs, or trees in steep-walled canyons of mixed conifer forests.	No suitable habitat in the Action Area due to lack of mixed conifer forests or forested canyons.
Southwestern willow flycatcher (*Empidonax traillii extimus*)	Endangered with Critical habitat	Breeds in dense, shrubby riparian habitats, usually in close proximity to surface water or saturated soil.	No suitable nesting habitat within the Navajo Mine permit area. Potential habitat exists along the San Juan River in the Action Area. Potential migratory stopover habitat occurs in an approximate 100 foot stretch of Cottonwood Arroyo, along the lower Chinde Wash, and wherever tamarisk trees occur.
Yellow-billed cuckoo (*Coccyzus americanus*)	Candidate	Breeds in riparian woodlands with dense, understory vegetation.	No suitable nesting habitat within the Navajo Mine permit area. Potential habitat exists along the San Juan River in the Action Area.
FISH			
Colorado pikeminnow (*Ptychocheilus lucius*)	Endangered with Critical Habitat	Large rivers with strong currents, deep pools, and quiet backwaters.	No suitable habitat within the Navajo Mine permit area. Potential habitat exists along the San Juan River in the Action Area. Critical habitat is also located approximately 16 miles north on the San Juan River.

Species	Status	Habitat Associations	Potential to Occur
Razorback sucker (*Xyrauchen texanus*)	Endangered with Critical Habitat	Medium to large rivers with silty to rocky substrates. Prefers strong currents and deep pools.	No suitable habitat within the Navajo Mine permit area. Potential habitat exists along the San Juan River in the Action Area. Critical habitat is also located approximately 16 miles north on the San Juan River.
Roundtail chub (*Gila robusta*)	Candidate	Large rivers. Present in low numbers in the San Juan, Mancos, La Plata, and Animas rivers in Colorado and New Mexico.	No suitable habitat within the Navajo Mine permit area. Potential habitat exists along the San Juan River in the Action Area.
PLANTS			
Knowlton's cactus (*Pediocactus knowltonii*)	Endangered	Alluvial deposits that form rolling, gravelly hills in piñon-juniper and sagebrush communities (6,200-6,400 feet.).	No rolling, gravelly alluvial deposits vegetated with piñon-juniper woodland in the Action Area.
Mancos milkvetch (*Astragalus humillimus*)	Endangered	Cracks of Point Lookout Sandstone of the Mesa Verde series (5,000-6,000 feet.).	Point Lookout Sandstone does not occur in the Action Area.
Mesa Verde cactus (*Sclerocactus mesae-verdae*)	Threatened	Highly alkaline soils in sparse shale or adobe clay badlands of the Mancos and Fruitland formations (4,000-5,550 feet.)	The majority of soil substrates in the Action Area are sands. Badlands in the area are capped with sandstone or red cinders and do not provide suitable habitat.

Source: USFWS 2011

Based upon evaluation of existing data, habitat associations (Table 3.8-1), discussions with the NNDFW and the USFWS, and field surveys; the following species are eliminated from detailed evaluation in the BE due to an absence of habitat in the Action Area: Mexican spotted owl, black footed ferret, Canada lynx, Knowlton's cactus, Mancos milkvetch, and Mesa Verde cactus.

There is no suitable habitat for any federally listed species to reside or breed within the Navajo Mine lease or SMCRA permit areas, including within the areas proposed for mining in Area IV North and Area III and the Burnham Road realignment. It is possible that the southwestern willow flycatcher could land on a native or exotic tree within any of the ephemeral washes that traverse the mine site; however, the potential is low due to the infrequent occurrence of trees on the mine and along ephemeral and intermittent washes.

The Action Area however extends to include the San Juan River north of the mine lease. Known and suitable potential unoccupied habitat for several federally listed species occurs associated with this river system. In addition to breeding and migratory stopover habitat for the southwestern willow flycatcher, there is habitat and known occurrences of yellow-billed cuckoo and roundtail chub, and known

occurrence and critical habitat for the Colorado pikeminnow and razorback sucker. As such, the BE prepared for the project evaluates the potential impacts to these species.

3.8.2.2 Navajo Nation Listed Species of Concern

The Project Area is located within a Moderately Sensitive Wildlife Resources area (Area 2), as identified by the NNDFW and described in the Biological Resources Land Clearance Policies and Procedures, approved September 10, 2008. A list of Navajo Nation species of concern was obtained through coordination with the NNNHP. Species of concern include protected, candidate, and other rare or otherwise sensitive species. The species listed by the Navajo Nation are map quadrangle-specific—rather than project-site specific. The NNNHP currently lists 11 species of concern (four of which are also federally listed) with potential to occur on the United States Geological Survey (USGS) 7.5-minute topographic maps that encompass the Project Area. Table 3.8-2 lists these species, their conservation status, habitat associations, and potential to occur in the Project Area. The BE prepared for the Proposed Action included in Appendix E addresses the potential for Navajo Nation listed species to occur in the Action Area and details potential effects to those species.

Table 3.8-2. Navajo Nation Listed Species of Concern and the Potential to Occur in the Action Area.

Species Name	Navajo Nation Status	Habitat Associations	Potential to Occur
MAMMALS			
Black-footed ferret (*Mustela nigripes*)	Group 2 ESA	Open grasslands with year-round prairie dog colonies greater than 198 acres in size with greater than 20 burrows per 2.5 acres.	There are no prairie dog colonies of sufficient size to support black-footed ferret in the Action Area.
Kit fox (*Vulpes macrotis*)	Group 4	Desert scrub or desert grassland with soft, alluvial or silty-clay soils, with sparse vegetation cover.	Recorded as occurring in the Action Area.
BIRDS			
Southwestern willow flycatcher (*Empidonax traillii extimus*)	Group 2	Breeds in dense, shrubby riparian habitats, usually in close proximity to surface water or saturated soil.	Has potential to occur in the Action Area.
Ferruginous hawk *Buteo regalis*)	Group 3	Nests in badlands, flat or rolling grasslands and desert scrub.	Known to nest in the Action Area.
Golden Eagle (*Aquila chrysaetos)*	Group 3	Open habitats in mountainous, canyon terrain. Nests primarily on steep cliffs and occasionally large trees.	Known to occur in the Action Area although only 4 nest sites detected within 2 miles of the lease area since raptor monitoring was initiated in 1993.
American peregrine falcon	Group 4	Cliffs that generally exceed 200 feet in height near permanent surface	Known to occur in the region, although the Action Area lacks high cliffs suitable for

Species Name	Navajo Nation Status	Habitat Associations	Potential to Occur
(*Falco peregrinus anatum)*		water.	nesting/perching for this species.
Mountain plover (*Charadrius montanus)*	Group 4	Breeds in short sparse vegetation in disturbed-prairies or semi-deserts with less than a two-degree slope.	Suitable habitat has been documented and several individual plovers detected in Areas IV South and V of the Navajo lease area within the Action Area.
Western burrowing owl (*Athene cunicularia hypugea)*	Group 4	Nests in ground burrows (often deserted prairie dog burrows) in dry open grasslands or desert scrub.	This species has been recorded as breeding within the Action Area.
PLANTS			
Mancos milkvetch (*Astragalus humillimus*)	Group 2	Cracks of Point Lookout Sandstone of the Mesa Verde series (5,000-6,000 ft.).	Has no potential to occur.
Mesa Verde cactus (*Sclerocactus mesae-verdae*)	Group 4	Highly alkaline soils in sparse shale or adobe clay badlands of the Mancos and Fruitland formations (4,000-5,550 ft.)	Has no potential to occur. Refer to Table 2.
San Juan milkweed (*Asclepias sanjuanensis*)	Group 4	Sandy loam soils in juniper savanna and Great Basin desert scrub at 5,000-5,500 ft.	Potential habitat for this species occurs within the Action Area.

Navajo Nation Endangered Species List (NESL): Group 2 = species whose prospects of survival or recruitment are in jeopardy; Group 3 = species whose prospects of survival or recruitment are likely to be in jeopardy in the foreseeable future; Group 4 = species for which the NNDFW does not currently have sufficient information to support their being listed in Group 2 or Group 3. The NNDFW will actively seek information on these species to determine if they warrant inclusion in a different group or removal from the list. Group 4 species are "candidates" for listing and have no legal protection under section 507. Sensitive = species for which there may be some concern range-wide; however there is not enough information to support inclusion on the NESL.

Based upon evaluation of habitat associations (Table 3.8-2) and field surveys, five of the 11 (NNNHP) species of concern can be eliminated from detailed consideration in the EA and BE. These species include the black-footed ferret, peregrine falcon, mountain plover, Mancos milkvetch, and Mesa Verde cactus—three of which are federal species described in Section 3.8.2.1.

Six of the NNNHP species of concern have potential to occur within the Action Area. These species include the kit fox, southwestern willow flycatcher, golden eagle, ferruginous hawk, western burrowing owl, and San Juan milkweed. The western burrowing owl, ferruginous hawk, and golden eagle are known to occur within one mile of the Project Area. Southwestern willow flycatcher is addressed in Section 3.8.2.1.

3.8.2.3 Migratory Birds

While law protects all migratory songbirds, certain species have been determined to be at greater risk. Data collected through breeding bird surveys coordinated by the USFWS as well as other private sector efforts have provided the basis for the New Mexico Partners in Flight (NMPIF) organization to develop bird "Watch Lists" and the USFWS's "Birds of Conservation Concern List." The NMPIF organization has identified priority species of birds for the State of New Mexico by habitat type.

Most of the priority bird species identified by the NMPIF also occur on the USFWS Division of Migratory Bird Management "Birds of Conservation Concern 2008" within Bird Conservation Region 16 – Southern Rockies/Colorado Plateau. Birds included on this list are those "species, subspecies, and populations of all migratory non-game birds that, without additional conservation actions, are likely to become candidates for listing under the ESA of 1973" (USFWS 2008). The Action Area contains one of the habitat types addressed in these documents—Plains-Mesa Grassland, a subset of the Basin desertscrub. The ferruginous hawk, mountain plover, and long-billed curlew (*Numenius americanus*) are listed as "highest priority" species under the Plains and Mesa Grassland habitat type.

3.9 Socioeconomics

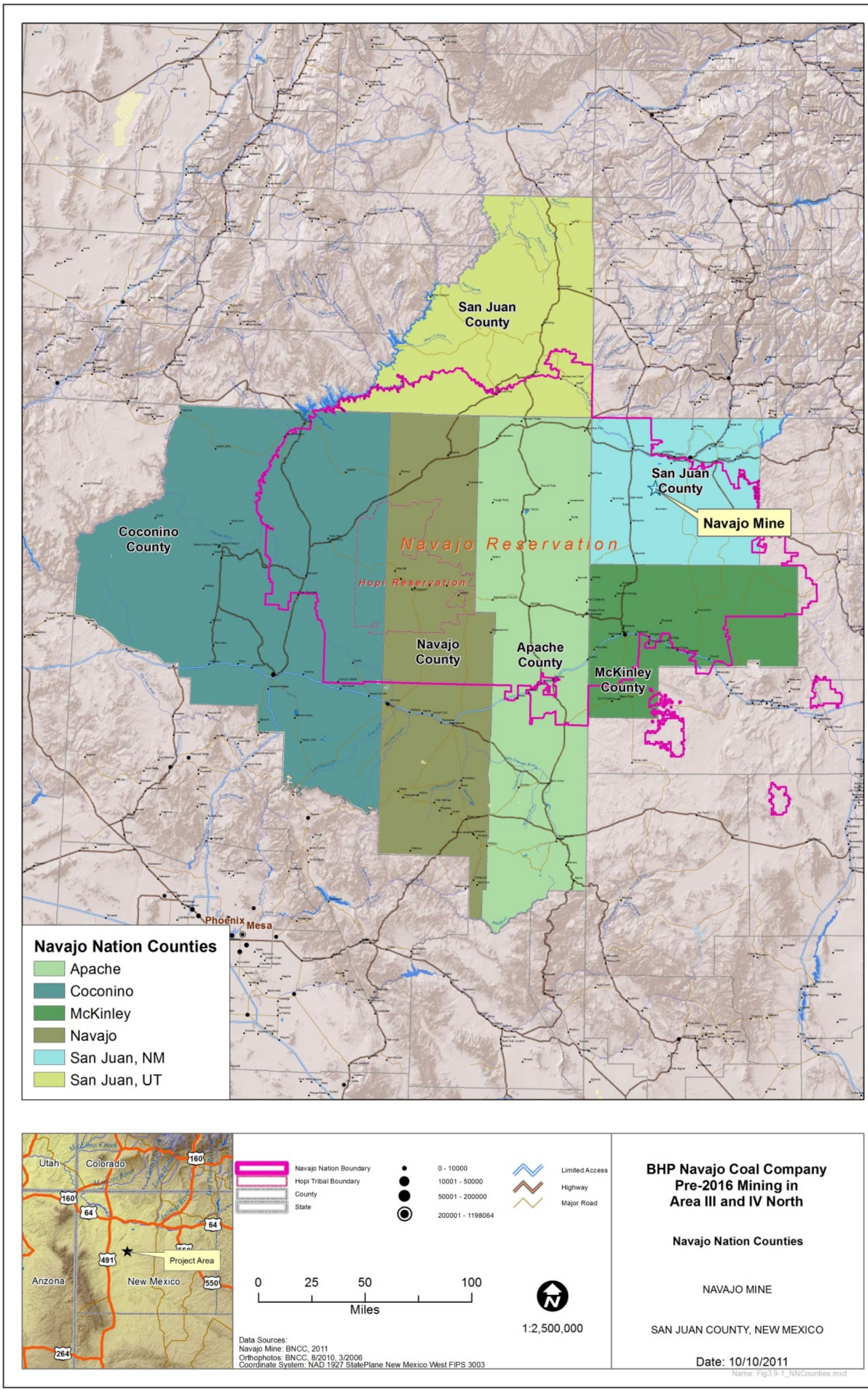
3.9.1 Definition of Resource

For this socioeconomic impact analysis, economic impacts are generally expressed as changes to population, employment, income, government revenue, and related benefits. Social impacts are expressed as changes to community infrastructure—such as access to social and health care services.

3.9.2 Affected Environment

The Project Area for socioeconomics is comprised of the eight counties surrounding Navajo Mine—San Juan County, New Mexico (NM); McKinley County, NM; Navajo County, Arizona (AZ); Apache County, AZ; Coconino County, AZ; San Juan County, Utah; Montezuma County, Colorado (CO); and La Plata County, CO. Figure 3.9-1 displays a map of the affected area. This affected area is identified because it includes New Mexico portions of the Navajo Nation, which receives royalty revenues from coal production. In addition, it is where the majority of the BNCC employees reside and it includes the communities where the tax revenues generated by Navajo Mine coal production are spent. Given the rural nature of this area, the data on employment and income as well as economic models are not available at a scale smaller than by county. In addition, the Navajo Reservation as a whole is also considered because tribal tax and royalty revenues from BNCC's mine operations flow to the Navajo Nation government. Similarly, local governments including San Juan County, NM and the Navajo Chapters located near the Navajo Mine are analyzed to capture the impacts of local government expenditures. BNCC and its sister company, San Juan Coal Company (SJCC) in Waterflow, NM jointly manage those companies' social and community investment funding projects in New Mexico. These community investments are only reported for the combined mine investments. Numerous comments at the public workshops and informal conference indicated that the revenue, income, and jobs provided by the mine are important to the Navajo Nation, tribal and community members, and their families. Opportunities for steady employment and income, skills training, and education for children were particularly noted by commenters.

Figure 3.9-1. Navajo Nation Counties



3.9.2.1 Population

Population estimates from 1990 through 2030 are included in Table 3.9-1. Table 3.9-2 shows population for Navajo Chapters for 2000 through 2020. In 2010, the estimated total population of all eight counties was over 650,000 and the Navajo Nation had a population of about 212,220. With a total land area exceeding 30,300 square miles, the estimated average population density for the affected area is approximately 21 persons per square mile. Despite the small total numbers, population in the affected area has been growing rapidly. San Juan County, NM experienced population growth averaging 25 percent between 1990 and 2000 because of rapid oil and gas investment in the San Juan Basin. Since then, population growth has averaged about 7 percent (SJC 2010). The Navajo Nation has been averaging 1.8 percent annual growth since 2000 (Navajo Nation 2010).

Table 3.9-1. Population Estimates for Affected Area

County/Year	1990	2000	2010	2020	2030
Apache, AZ	61,591	69,423	78,230	86,530	93,450
Coconino, AZ	96,591	116,320	141,460	159,345	173,830
Navajo, AZ	77,674	97,470	123,170	147,045	166,650
La Plata, CO	32,284	44,580	52,530	66,720	80,770
Montezuma, CO	18,672	23,845	25,970	31,260	37,500
San Juan, NM	91,605	113,801	133,170	146,815	155,590
McKinley, NM	60,686	74,798	80,750	88,155	92,300
San Juan, UT	12,621	14,360	15,053	15,320	16,650
Navajo Nation	146,000	180,462	212,220	258,820	n/a
TOTAL Affected Area			650,330		

Sources: AZDES 2006; UNM 2008; Utah 2008; CDLG 2010

Table 3.9-2. Population Data for Navajo Chapters Surrounding Project Area

Chapter	Population 2000	Estimated Population 2010	Estimated Population 2020
Nenahnezad	1,695	1,990	2,430
Tiis Tsoh Sikaad (Burnham)	240	280	340
Fruitland	2,892	3,400	4,150
Tse Daa K’aan (Hogback)	1,386	1,630	1,990
Tsé ałnáozt'ı'í (Sanostee)	1,908	2,240	2,740
Shiprock Gadii’ahi/To’koi (Cudeii)	9,279	10,910	13,310
Sheep Springs	821	970	1,180
Naschitti	1,695	1,990	2,430

Chapter	Population 2000	Estimated Population 2010	Estimated Population 2020
White Rock	60	70	90
Crystal	778	910	1,115
Newcomb Toadlena/Two Grey Hills	1,838	2,160	2,640
Teec Nos Pos	1,323	1,560	1,900
Huerfano	2,366	2,780	3,390
Beclabeto	819	960	1,175
Red Valley	1,742	2,050	2,500
Tsaile/Wheatfields	2,044	2,400	2,930
TOTAL Affected Area	30,886	36,300	44,310
TOTAL Navajo Nation	180,462	212,220	258,820

Source: Navajo Nation 2010

Overall, the population in the affected area has a higher percentage of Native Americans and younger median age than the respective state. For example, in 2008 in San Juan County, NM the median age was 32.6 years as compared to 36 years for the state of New Mexico. In addition, more than one-third of the population of San Juan County, NM was identified as Native American, primarily Navajo, compared to about 10 percent for the state of New Mexico.

3.9.2.2 Royalty, Tax Revenues, and Local Contributions

Coal production from the Navajo Mine has averaged about 8.5 million tons annually between 2008 and 2010. During that same period, BNCC paid an average annual royalty of roughly $8.5 per ton of coal mined in federal, state, and Navajo Nation taxes and Navajo Nation royalties as shown in Table 3.9-3, Annual Taxes and Royalties Paid by BNCC for Navajo Mine.

Table 3.9-3. Annual Taxes and Royalties Paid by BNCC for Navajo Mine

Category	2010	2009	2008
Coal Mined (tons)	7,809,929	9,178,169	8,897,563
Federal Taxes			
Black Lung Excise Tax (BLET)	$4,327,713	$4,855,014	$4,519,639
Reclamation Act Levy	$2,478,162	$2,780,599	$2,558,620
New Mexico State Tax			
Property Tax	$2,328,629	$2,241,690	$2,103,764
Severance Tax	$5,332,543	$10,171,600	$7,860,170
Conservation Tax	$333,974	$406,537	$406,196

Category	2010	2009	2008
Resource Excise Tax	$1,321,265	$1,602,753	$1,601,621
Gross Receipts Tax	$8,539,857	$9,732,285	$10,036,430
Navajo Nation Taxes and Royalties			
Tribal Royalties	$26,802,424	$32,202,529	$32,219,881
Navajo Business Activity Tax	$3,940,000	$5,108,425	$4,775,853
Navajo Possessory Interest	$3,799,253	$3,672,030	$4,799,922
Navajo Fuel Excise Tax	-	$964,137	$977,387
Total Payroll Taxes			
Total Payroll Taxes	$3,503,444	$3,431,365	$3,124,692
TOTAL Taxes & Royalties	**$62,687,264**	**$77,168,965**	**$75,014,175**
Total Tax & Roy. per Ton Coal Sold	**$7.94**	**$8.74**	**$9.08**
Navajo Mine Employees	**509**	**498**	**515**
Total Payroll	**$46,817,856**	**$44,651,000**	**$41,373,742**

Source BNCC 2008b, 2009b, 2010b.

Revenue to Navajo Nation Government

Coal mining has been one of the most important revenue sources for the Navajo Nation. However, recent coal mine closures at Peabody Western Coal Company's Black Mesa Mine (Kayenta, AZ) and Pittsburgh and Midway Coal and Mining Company's McKinley Mine (Gallup, NM) have substantially reduced these revenues (Navajo Nation 2010). In fiscal year 2005 (year end in September), total Navajo Nation revenues from coal mining were approximately $74.6 million—accounting for almost one-third of gross general fund revenue for the Navajo Nation. In fiscal year 2010, projected revenues from coal mining were $50 million—comprising about one-quarter of gross general fund revenue. Of that $50 million in tax and royalty revenue, approximately $35 million (comprised of royalty and tax payments to the Navajo Nation) was from BNCC's Navajo Mine operations.

State of New Mexico and Local Government Payments

The state of New Mexico charges taxes on coal produced in the state that can amount to an effective tax rate of over five percent of the cost depending on the coal source and eligible deductions. The production taxes paid to New Mexico by BNCC from its Navajo Mine operations are severance tax, resource excise tax, and conservation tax. The effective tax rate for these combined production related taxes was $1.20 per ton in 2010 as shown in Table 3.9-3. The severance tax funds New Mexico's Severance Tax Permanent Fund (STPF), which has been used to retire debt from bond issues that have funded various capital projects in the state. The STPF had assets of more than $3.5 billion at the end of 2009. The Resource Excise Tax and Conservation Tax revenues are used in the State General Fund. In 2009, mineral production taxes, including those from oil and gas, comprised less than 10 percent of New Mexico's General Fund revenue (New Mexico 2009).

BNCC also pays sales tax or gross receipts tax to the state and local governments for purchases of equipment, supplies, and services. These tax revenues can be substantial as BNCC and SJCC spent over

$164 million in local purchases in 2008 and the tax rate is approximately 7 percent (BNCC 2009b). In 2010, BNCC paid more than $8.5 million in gross receipts tax as shown in Table 3.9-3.

Federal Government Taxes

Like all coal mines in the United States, BNCC paid the federal Black Lung Excise Tax (BLET) and into the Abandoned Mine Land (AML) fund. In 2010, BNCC paid more than $4 million to the BLET and almost $2.5 million to AML as shown in Table 3.9-3.

Other Contributions to Local Communities

BNCC, SJCC, and their employees have made charitable contributions to local communities in several ways. First, in 2010, BNCC and SJCC jointly invested approximately $1.6 million in the community according to their joint Community Relations Plan (BNCC 2011c). As part of this plan, they established the Community Investment Program, which is focused on "creating sustainable value and contributing to long term benefits based on community needs, balanced with company imperatives and impacts to stakeholders" (BNCC 2010b). Second, BNCC and SJCC employees jointly contributed more than $0.5 million to San Juan County's United Way campaign in 2010 (BNCC 2011a). All employee-raised funds were matched dollar for dollar by the companies' matched-giving policy. In total, over $1 million was provided by BNCC and SJCC to San Juan United Way for the 2010 campaign (BNCC 2011a). Separate data for BNCC contributions were not available.

3.9.2.3 Mine and Non-Mine Employment

In 2010, BNCC employed 509 people (85 percent Native American) and mined almost eight million tons of coal (BNCC 2010b). The labor force and unemployment rate for the counties in the affected area for 2009 are included in Table 3.9-4. Unemployment rates in the affected area have increased substantially since 2007 because of the economic downturn, as well as reduced oil and gas production in the San Juan Basin. For example, the unemployment rate in San Juan County, NM increased from less than five percent in 2007 to nine percent in October 2009 (SJC 2010a).

Table 3.9-4. Labor Force, Unemployment Rate, Average Household Income

County	Labor Force 2009	Annual Average Unemployment Rate 2009	Median Annual Household Income 2009
Apache, AZ	23,000	14.5%	$29,000
Coconino, AZ	75,500	10%	$50,000
Navajo, AZ	41,500	16%	$35,000
La Plata, CO	30,500	8%	$56,600
Montezuma, CO	13,800	10%	$40,900
San Juan, NM	56,000	9%	$46,000
McKinley, NM	27,000	9%	$30,800
San Juan, UT	5,300	15.5%	$36,000

Source: Bureau of Labor Statistics 2010; USCB 2010.

Focusing on employment on the Navajo Indian Reservation, data from the Navajo Nation found that in 2007 the calculated overall unemployment rate was over 50 percent and much higher for some areas of the Navajo Nation (Navajo Nation 2010). The most recent data available for the Navajo Nation is 2007. The estimated labor force and calculated unemployment for Navajos based on their county of residence is shown in Table 3.9-5. Note that the unemployment rate is estimated by the number of Navajo tribal members aged 16 or older that are not employed, divided by the total Navajo population aged 16 or older. Unlike the federal unemployment rate, this estimated rate does not account for discouraged workers or workers outside the labor force.

Table 3.9-5. Navajo Labor Force and Unemployment Rate in 2007

County	Navajo Population	Navajo Labor Force	Number of Navajos Employed	Estimated Navajo Unemployment Rate
Apache, AZ	68,388	20,858	10,754	42%
Coconino, AZ	26,826	26,826	3,419	49%
Navajo, AZ	28,367	8,652	3,047	60%
San Juan, NM	30,903	9,425	4,533	42%
McKinley, NM	33,240	10,138	2,758	68%
San Juan, UT	6,833	2,084	730	55%
Navajo Nation	204,698	62,433	26,306	51%

Source: Navajo Nation 2010

The sectors of the economy employing the most Navajo tribal members (in order) were Services, Government, Retail Trade, Transportation/Communication, and Mining. BNCC was the 11th largest employer of Navajos in 2007.

3.9.2.4 Mine and Non-Mine Income

Direct Employment and Income

Total payroll for BNCC was almost $47 million in 2010 (BNCC 2010c). Wages in the mining sector are substantially higher than wages in other sectors of the local economy. For example, in San Juan County, the average annual wage was approximately $43,000 per year in 2009 and the average annual wage in the coal mining sector was $70,600 (IMPLAN 2009). Median household income in San Juan County, NM in 2009 was $46,000, which is higher than the median household income for the state of New Mexico of $42,800 (USCB 2011). Median household income levels for the affected area are shown in Table 3.9-4.

Indirect Employment and Income

In addition to the direct employment and income generated by continued mining operations, indirect employment and income is created by the spending of employees and BNCC. The multipliers that will be applied to estimate indirect employment and income are from a 2009 IMPLAN model of San Juan County, NM. IMPLAN is a set of data and a computer model for assessing economic conditions and changes on a county level basis. The most recent version of the IMPLAN model (version 3) and datasets (2009) were used in this economic analysis. The multipliers are generated by an input-output model of the

economy in San Juan County, NM using 2009 data and are used to estimate indirect impacts of changes in output and employment in a particular industry. For example, in San Juan County, NM:

- Each dollar paid for produced coal supports 0.15 dollars of production elsewhere in the local economy, as represented by an output multiplier of 1.15.
- One dollar of income earned by mine workers supports 0.16 dollars of income elsewhere in the local economy, as represented by an income multiplier of 1.16.
- One coal mining job supports about one additional job elsewhere in the economy as represented by an employment multiplier of 1.8.

These multipliers are used to estimate economic impacts of the alternatives for the entire affected area because San Juan County, NM is representative of the region and includes Navajo Mine jobs in the model.

3.9.2.5 Social Baseline Conditions

Baseline conditions for determining potential social impacts consider quality of life and community indicators such as health and community assets. Recently, San Juan County, New Mexico updated its Community Health Profile that includes a comprehensive overview of social baseline conditions for the communities surrounding the Navajo Mine (SJC 2010). Key findings of this study relevant to Navajo Mine Plan alternatives are summarized below.

- San Juan County's rapid population growth has leveled off in recent years. Between 1990 and 2000, population grew by 25 percent, but between 2001 and 2008, population grew only by seven percent. This means that one of the main stressors of social cohesiveness—rate of population growth—has eased in the past decade.
- Consistent with New Mexico overall, the Native American and Hispanic populations had higher proportions of individuals under 35, whereas the white population had higher proportions of those 55 and older. This means that youth issues and programs that target 15 to 24 year olds must take into account that Native Americans are 36 percent of the county's population, but are 46 percent of the 15 to 24 year olds in the county.
- Poverty affects all areas of life, including health, educational attainment, stress, and general well-being. San Juan County encompasses areas of extreme household and child poverty, coupled with unemployment and transportation challenges. This is especially true for rural areas, poorer neighborhoods in Farmington, and parts of the Navajo Nation where poverty is 30 percent or higher.
- The County's Community Health Profile found that San Juan County is not lacking in health or social services. However, awareness and access to these services needs to be improved. Better public transportation and public awareness of services and programs is identified as a critical action area. Public health concerns are discussed in Section 3.13.
- Navajo Nation Chapter Houses represent central community gathering places. There are 20 chapters in San Juan County. The Restoring and Celebrating Family Wellness program that meets

at the Shiprock Chapter House, offers monthly workshops. Historically, Chapter Houses played a more central role, and many contemporary Navajo residents currently strive to inspire increased interest in community gathering at the chapter level on the Nation.

The social impact analysis considers the scale and pace of change to these baseline social conditions.

3.10 Land Use

3.10.1 Definition of Resource

This section addresses the existing conditions in the affected environment with respect to land use. The land use resource assessment area includes the pre-2016 mining areas in Area III and Area IV North, support features, and Burnham Road realignment, and a one-mile area surrounding these actions. Land use-related comments raised during the public workshops and the informal conference include concerns about contemporaneous reclamation, timing of release of reclaimed lands, and the effect that the Proposed Action may have upon tribal member rights and customary use areas, including relocation of livestock grazing. These comments have been used to develop the discussion of current land use contained herein.

Through the course of operations at the existing Navajo Mine and as proposed, all BNCC mining activities within the land use resource assessment area would be conducted under the guidance of OSM as required by SMCRA. BNCC would develop a SMCRA mine permit amendment to the current approved Navajo Mine permit that must show how the company proposes to develop coal resources while protecting and minimizing adverse effects to other resource considerations. Under SMCRA (30 CFR 761.11(a)), BNCC has, and would continue to conduct any proposed mining in consideration of existing (pre-development) land uses, and where coal mining is prohibited, limited, or unsuitable. During active mining operations, BNCC is required by SMCRA to develop contemporaneous reclamation for all surface disturbances—and upon cessation of active operations—to develop final reclamation for bond release and the approved post-mining land use. BNCC is required by OSM directive to conduct its operations within the requirements and timeframes established under SMCRA.

3.10.2 Affected Environment

The land use resource assessment area is wholly within lands of the Navajo Nation Indian Reservation. The Tiis Tsoh Sikaad (Burnham) Chapter House, located approximately 5.5 miles south of the Project Area, is the nearest tribal community building.

Active surface coal mining by BNCC has been ongoing since 1957 at the Navajo Mine, when BNCC's predecessor was granted Navajo Tribal Coal Lease 14-20-603-2505 (see Section 1.1). Since 1957, BNCC has developed the Navajo Mine coal lease, associated right-of-ways, and mine permit area within an approximately 33,600-acres area near Fruitland, New Mexico (Figure 1.1-1). The approximately 25 mile long coal lease area includes an 18,520 acre mine permit area encompassing an extensive mining infrastructure that include areas of active mining, operational support, and reclamation. Currently, 12,990 acres of the mine permit area are utilized for surface coal mining operations and support, while 7,925 acres of completed mining have been reclaimed.

The surface and mineral rights within BNCC's current coal lease area are held in trust by the United States for the benefit of the Navajo Nation. The Navajo Mine coal lease is subdivided into six

administrative areas known as Areas I, Area II, Area III, Area IV North, Area IV South, and Area V (see Figure 1.1-1). Mining activities are complete in Area I and is largely reclaimed except for support areas required for mine operation. OSM has terminated its jurisdiction over Area I and BNCC is coordinating with the Navajo Nation and BIA regarding status and release of associated lands back to the Navajo Nation. It is anticipated that the release will occur once appropriate coordination is complete. Active mining operations in Area II and III are ongoing and anticipated to be complete in 2011 and 2016 respectively. In Area IV North, mining preparation activities have been conducted to develop the required infrastructure for surface coal mining, though no mining has been conducted within this area. Area IV South and Area V are undeveloped.

Historically, coal was also mined approximately 7.5 miles south of the land use resource assessment area within the CONSOL coal lease area for the Burnham Mine from 1980 to 1984. One historic coal mine (Figure 3.10-1) and several other smaller mines near the Project Area have been operated over the past 60 years, although none remain active. Cultural resource studies indicate the presence of historic coal mining activities by the general public in the area for more than 200 years.

In addition to surface coal mining activities, the major land use within the land use resource assessment area includes lands used for low-intensity domestic grazing and for wildlife habitat. Limited rainfall within the area produces primarily rangeland plants useful to the tribal livestock grazing. Other potential lands uses within the area are limited by the lack of irrigation and the poor soil conditions that restrict the suitability of lands for agricultural and forestry uses, the lack of forage species and perennial water resources that limit value of fish and wildlife habitat, and the lack of sufficient utility and access infrastructure that constrains residential and industrial land uses. Further information on land productivity is provided in Section 3.1.2.2 – Soils and Section 3.6 – Vegetation. Regional infrastructure information is provided in Section 3.9 – Socioeconomics and Section 3.13 – Traffic and Transportation.

Existing land within the land use resource assessment area is managed and maintained by the BIA and Navajo Nation Land Department and is comprised of eight customary use areas (CUAs), which are broken into 11 different grazing permits (Table 3.10-1). Each CUA is based on traditional (customary) use rights, and grazing permits are primarily used for grazing of sheep, goats, cattle, and horses. Grazing permits have been historically granted to allow for year-long grazing. Grazing permits are typically unfenced, with management relying on topographic features and roads. Sources of water to support livestock include two stock ponds in Area III and in Area IV North. Water resources available to livestock grazing are described in detail in Section 3.2 – Water Resources. As per terms of the Navajo Mine coal lease, the post-mining land use is designated as rangeland for livestock grazing and wildlife habitat (same as current environment). Access to the grazing permit areas and CUAs is supported by the existing Burnham Road (BIA Road N-5082) and an array of unimproved two-track roads (Figure 3.10-1). Roads and access within the land use resource assessment area are further described in Section 3.13 – Traffic and Transportation.

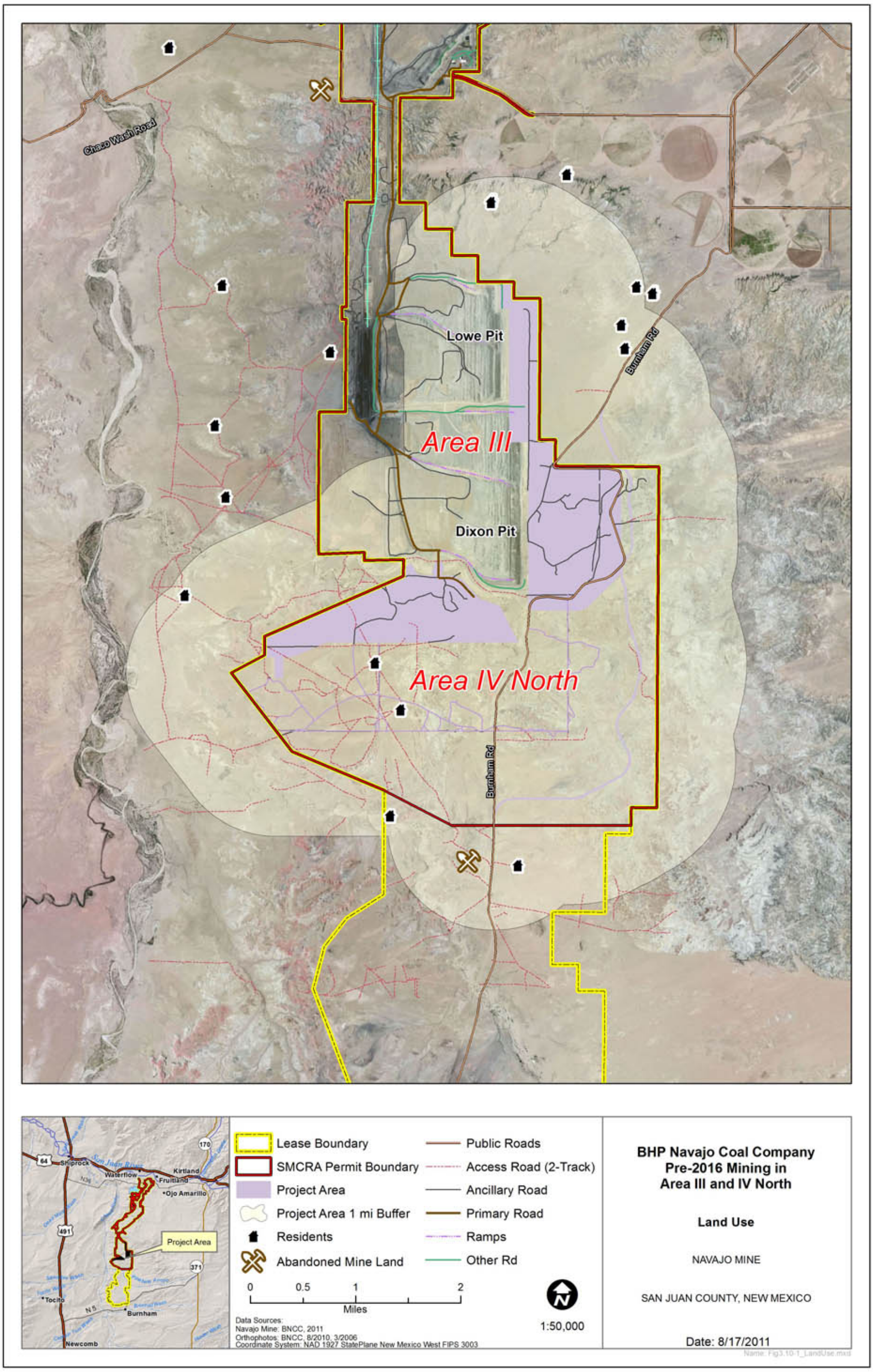
There are no existing right-of-ways for pipelines, railroads, telephone, and water/sewage conveyances within the land use resource assessment area. BNCC constructed two power lines within Area IV North. One active powerline enters Area IV North from the adjacent Navajo Mine Permit area and follows the western permit boundary, crosses east-west midway through Area IV North, and then traverses due north back into the adjacent Navajo Mine area. The second powerline, which is inactive and disconnected from

the mine power grid, starts halfway in Area IV North and continues south into Area IV South. An active Navajo Tribal Utilities Authority (NTUA) powerline enters the southeastern corner of the land use resource assessment area, supplying electricity to Permit Number 13-96/CUA No.0394.

Table 3.10-1. CUAs within the Land Use Resource Project Area

Permit Number	CUA No.
13-431	.0396
13-296	.0396
13-471	
13-562	.0049
13-629	
13-336	.0362
13-559	
13-500	.0050, .0351, .0366
13-661	.0047
13-565	
13-96	.0394

Figure 3.10-1. Land Use Map



3.10.2.1 SMCRA Land Use Requirements

As defined by SMCRA for consideration of land use resources, criteria are defined for where coal mining is prohibited, limited, or unsuitable. The following discussion describes these criteria considered in relation to the current land uses within the land use resource assessment area.

Prohibited Lands: This includes lands within the boundaries of national parks, national wildlife refuges, national trails, national wilderness areas, rivers designated or being considered as wild and scenic, or national recreation areas. These land use designations do not occur within the land use resource assessment area. Other prohibited uses include location of mining activities adjacent to public buildings, schools, parks, or cemeteries. No public buildings, schools, parks, or cemeteries are located within the land use resource assessment area. The Burnham Chapter House is located over approximately 5.5 miles to the south.

Limited Lands: These lands include those within the National Forest System, public parks, historic places, public roads, and occupied dwellings. National Forest System land use designations and public parks do not occur within the land use resource assessment area. Although there are no National Register of Historic Places (NRHP) listed historic properties within the land use resource assessment area, four sites, identified during cultural resource and historical resource surveys conducted within the cultural resources assessment area were determined as eligible for inclusion on the NRHP. Under SMCRA, BNCC has developed a plan for protecting any cultural resources, as well as the mitigation and treatment measures to be taken to protect historic places (developed in consultation with OSM, the Navajo Nation, and other parties participating in the 2007 Section 106 consultation). Cultural resources surveys and sites that may be eligible for inclusion on the NRHP are discussed in Section 3.12 - Cultural Resources.

The Burnham Road runs north to south through the land use resource assessment area (Figure3.10.1). The Burnham Road, a BIA-managed road with no recorded right-of-way, is considered a public road under 30 CFR 761.5. Under SMCRA regulations, BNCC would be required to protect the affected public road use system, and would develop measures to be taken to protect related resources (developed in consultation with OSM, BIA, and the Navajo Nation), in accordance with 30 CFR 761.11(d) and 761.14. There are numerous two-track unimproved roads that also traverse the land use resource assessment area (Figure 3.10-1). These unimproved roads do not meet road construction standards for other public roads in the area and are not public roads as defined in 30 CFR 761.5, are not maintained with the use of public funds similar to other public roads in the area, and have not been designated as public roads by the Navajo Nation or any applicable jurisdictional authority. Public use of these roads is infrequent and is primarily utilized by tribal members with customary use rights in the land use resource area. Further discussion on the realignment of the Burnham Road and the traffic associated with the transportation infrastructure within the land use resource assessment area is presented in Section 3.13 – Traffic and Transportation.

SMCRA regulations (30 CFR 761.11) prohibit mining within 300 feet of occupied dwellings unless certain regulatory conditions are met. An occupied dwelling is defined (30 CFR 761.5) as any building that is currently being used on a regular or temporary basis for human habitation. The CUAs are used primarily for grazing purposes, with associated permittees having occupied dwellings within their respective CUAs or within approved home site leases granted by the Navajo Nation Land Department. No dwellings are located within the areas proposed for mining or within the road realignment and none are proposed for relocation. Eight dwellings (five permanent dwellings and three temporary/ancestral

dwellings) are found within the one mile buffer of the permitted Area III and proposed Area IV North mining activities or the relocated Burnham Road (Table 3.10-2).

Table 3.10-2. Dwellings within the Land Use Resource Assessment Area

Dwelling Location	Status	Approximate Distance to Proposed Activities (Miles)
North of Area III	Permanent	0.75
West of Area III	Permanent	0.90
West of Area III	Permanent	0.75
West of Area III	Permanent	0.75
South of Burnham Road Realignment	Permanent	0.33
South of Area IV North	Temporary/ Ancestral	0.50
South of Area IV North	Temporary/ Ancestral	0.25
Northwest of Area IV North	Temporary/ Ancestral	0.50

Unsuitable Lands: As defined by SMCRA, no lands considered as unsuitable are located within the land use resource area.

3.11 Environmental Justice

3.11.1 Definition of Resource

President Clinton's Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," issued on February 11, 1994 declares that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States," including Indian tribes. The Executive Order and CEQ guidance on incorporating environmental justice into NEPA analysis applies where a Proposed Action is likely to have disproportionately high and adverse human health or environmental effects on low-income populations, minority populations, or Indian tribes (CEQ, Environmental Justice Guidance Under the National Environmental Policy Act (Dec. 10, 1997). Public outreach efforts conducted as part of the NEPA process for this project are described in Section 1.5 of this document. The analysis considers environmental, human health, economic, and social impacts, taking into account mitigation and participation by the affected community (CEQ Environmental Justice Guidance, § III.B).

3.11.2 Affected Environment

In determining the affected environment for analysis of environmental justice, the CEQ advises agencies to use the U.S. Bureau of Census data to identify potentially affected populations, and to examine geographic distribution by race, ethnicity, and income (CEQ Environmental Justice Guidance, § III.B). Therefore, this analysis provides U.S. Census Bureau information for San Juan County, within which the Project area is located and, to provide context, examines surrounding counties as well. These counties and their minority populations and poverty rates are summarized in Table 3.11-1.

Table 3.11-1. Potential Affected Populations for Environmental Justice Impacts

County	Population (2010)	% Minority Population (2009)	Individual Poverty Rate (2008)
Apache, AZ	78230	61.7%	31.2%
Coconino, AZ	141460	28.2%	16%
Navajo, AZ	123170	39.9%	23.1%
La Plata, CO	52530	7.0%	10.9%
Montezuma, CO	25970	14.2%	16.3%
McKinley, NM	80750	61.3%	30.8%
San Juan, NM	133170	32.6%	14.4%
San Juan, UT	15053	47.2%	28.1%

Source: USCB 2010

Based on the census tract data shown in Figure 3.11-1 and Figure 3.11-2, the percentage of Native American population and individual poverty rate are both marginally higher in those tracts closest to the Project Area. However, this pattern is consistent throughout the region; the census tracts located inside Navajo Nation or other Indian Reservation lands have higher minority populations and poverty rates than those outside the reservation. Given these census tract patterns and CEQ guidance, the impact analysis considers whether there are any disproportionate adverse impacts and any "special" exposures to these vulnerable populations due to cultural or traditional use of resources, such as ceremonial food or medicine gathering. These potential impacts are analyzed in Section 4.11, public health and safety is discussed in Sections 3.14 and 4.14, and 5.2.13; cultural resources are discussed in sections 3.12, 4.12 and 5.2.11; and socioeconomics is discussed in Sections 3.9, 4.9, and 5.2.9. Public outreach is discussed in Section 1.5.

Figure 3.11-1. Map of census tracts shaded to indicate the percent of Native American population

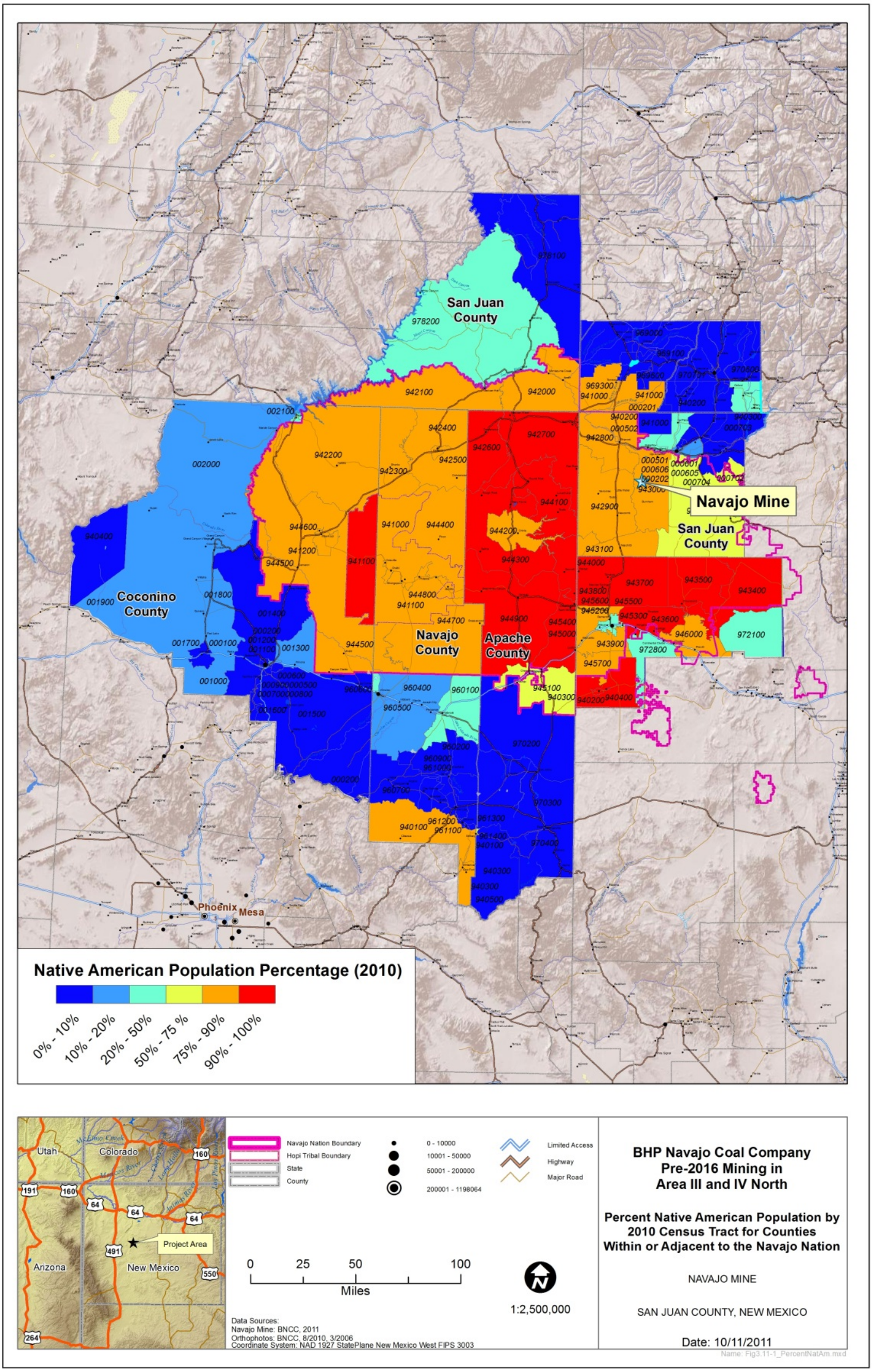
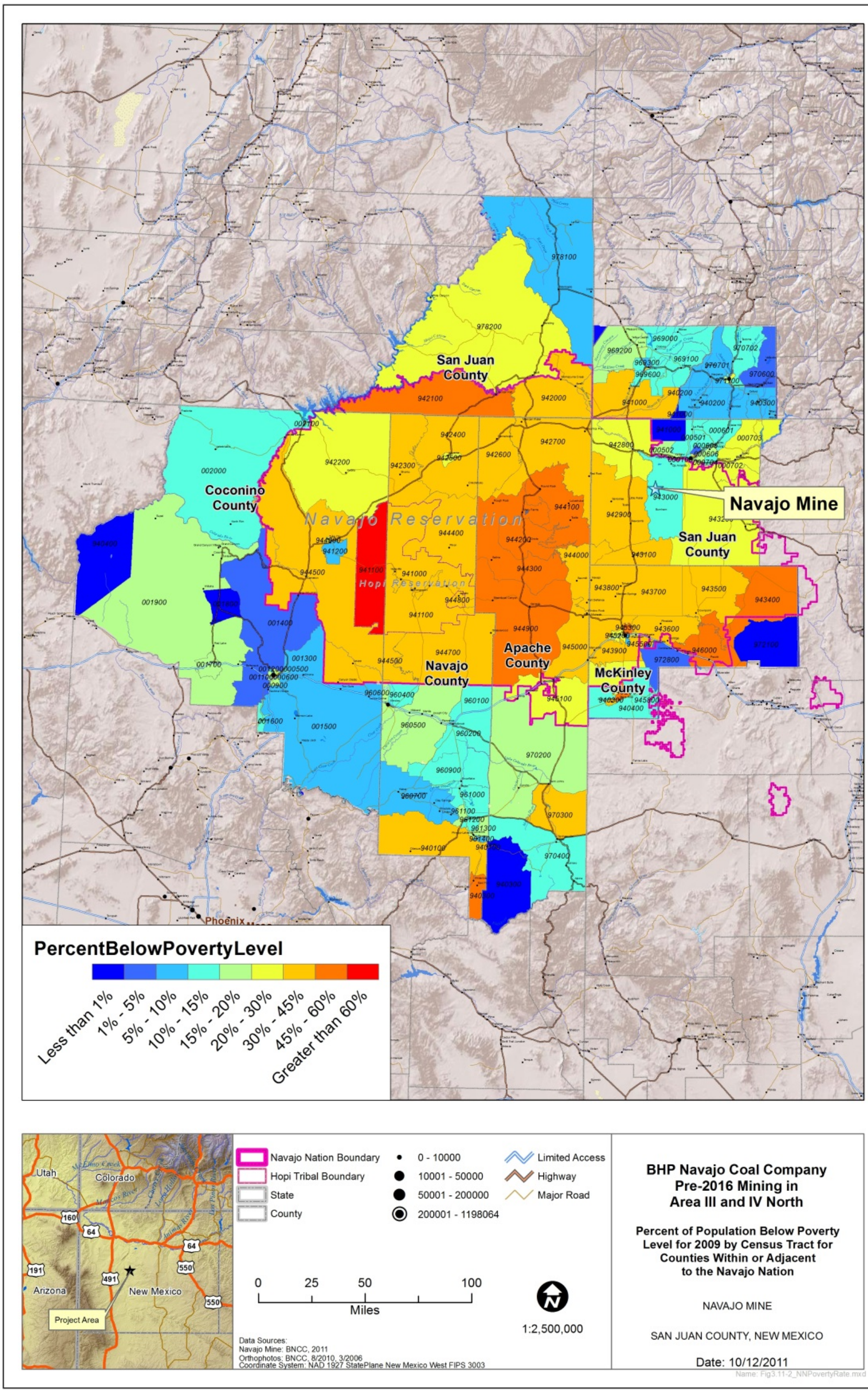


Figure 3.11-2. Map of census tracts shaded to indicate percent of population below poverty level



3.12 Cultural Resources

3.12.1 Definition of Resource

Archaeological sites and historical properties are physical remnants of societies that have occupied the region. Cultural resources include those aspects of the physical environment that relate to human culture and society, along with the social institutions that form and maintain communities and link them to their surroundings.

For purposes of this EA, the inventory and consideration of cultural resources focuses on historic preservation, data recovery or other mitigation and consultation relating principally to (1) archaeological sites and historic period properties that may or may not be eligible for listing on the NRHP, and including sites that may be considered traditional cultural properties within the Project Area and adjacent lands, and (2) burial sites. While certain compliance work is ongoing, most cultural resources within the Project Area have been inventoried, tested, and subjected to mitigation efforts under the supervision and guidance of OSM and the NNHPD. Data regarding traditional cultural properties have been documented through ethnographic efforts. Any further mitigation and compliance work will be performed and incorporated into compliance documentation in accordance with applicable cultural resource management laws and regulations.

The Antiquities Act of 1906 (AA), the National Historic Preservation Act of 1966 (NHPA), as subsequently amended, and the Archaeological Resources Protection Act of 1979 (ARPA) are other federal laws that protect certain cultural resources. In addition, the American Indian Religious Freedom Act of 1978 (AIRFA) requires that all federal agencies take into account the effects of their actions on traditional Native American religious and cultural values and practices. Finally, the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) expressly provides for the protection of Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony, and gives affiliated Native American groups or individuals priority in the treatment of such human remains and artifacts.

Regulations for Protection of Historic Properties (36 CFR Part 800), which primarily implement Section 106 of the NHPA, define key regulatory requirements beyond those of NEPA. These regulations define a process for federal agency consultation with state or Tribal Historic Preservation Officers, the Federal Advisory Council on Historic Preservation, and other interested parties to ensure that certain historic properties are duly considered as federal projects are planned and implemented.

Archaeological work done at Navajo Mine is conducted in accordance with the authorities of the NHPA, NEPA, Executive Order 11593, “Protection and Enhancement of the Cultural Environment,” the AHPA, the Navajo Nation Cultural Resources Protection Act (Tribal Council Resolution CMY-19-88), ARPA and NAGPRA, and related statutes and regulations.

Additional relevant Navajo Nation laws and policies include the Policy for the Disposition of Cultural Resources Collection and Navajo Nation Cultural Resource Protection Act (NNCRPA), Guidelines for the Treatment of Historic, Modern Contemporary Abandoned Sites, Policy to Protect Traditional Cultural Properties, and Policies and Procedures Concerning the Protection of Jishchaa’: Cemeteries, Gravesites & Human Remains, and Guidelines for Discovery Situations.

Cultural resources include prehistoric, historic, and traditional cultural properties (TCPs), buildings, structures, districts, objects, as well as associated artifacts, records, and remains related to such properties. Often the importance of cultural resources is determined in consideration of the criteria for listing on the NRHP (36 CFR 60.4 and Bulletin 38). National Register Bulletin 38 provides guidance for evaluating and documenting TCPs. To be eligible for listing on the National Register, a property must be important in American history, architecture, archaeology, engineering, community, or culture and must possess integrity of location, design, setting, materials, workmanship, feeling, and association. In addition, properties must meet at least one of the following four criteria:

- Criterion A: are associated with events that have made a significant contribution to the broad patterns of our history
- Criterion B: are associated with the lives of persons significant in our past
- Criterion C: embody the distinctive characteristics of a type, period, or method of construction, that represent the work of a master, that possess high artistic values, or that represent a significant distinguishable entity whose components may lack individual distinction
- Criterion D: have yielded, or may be likely to yield, information important in prehistory or history

The importance of other cultural resources may be determined through consideration of other criteria under applicable statutes, including those listed above. Importantly, NAGPRA, ARPA, and their respective implementing regulations provide criteria and definitions for evaluation, consultation and other regulatory compliance efforts relating to resources subject to the protection of, or consideration under, those statutes including ARPA, Navajo Nation requirements, and SMCRA.

The following discussion of cultural resources is general in nature. Data concerning the location, nature, and descriptions are limited to honor the confidentiality restrictions required by the NHPA and its implementing regulations and related statutes and regulations.

3.12.2 Affected Environment

Archaeological investigations on the Navajo Mine leasehold have taken place in phases corresponding to the sequence of mining activities. Prior to any land disturbance in the start of the FCPP and Navajo Mine, BNCC (and its predecessors, BHP Minerals, Utah International Inc., and Utah Construction & Mining Co.) and APS obtained the services of the Laboratory of Anthropology at the University of New Mexico to conduct an archaeological survey of the Area I and Area II. Area I was cleared in June 1961 and the report from this initial survey and excavation was completed in 1962 (Sciscenti and Greminger 1962). Area II was surveyed in 1969. No significant archaeological sites were identified during this survey and an archaeological clearance was granted by the National Park Service in August 1969.

From September 1973 to December 1974, an archaeological survey was conducted for Area III, Area IV North, Area IV South, and Area V (Reher 1977). In this survey, 718 archaeological sites were identified and 153 were determined eligible for inclusion in the NRHP. Prior to mining, seven archaeological actions were completed to mitigate the impacts of mining on eligible sites identified by Reher (1977).

Extensive archaeological and ethnographic studies, evaluation, consultation, and adverse effects resolution efforts undertaken by BNCC and its predecessors from 1961 through 1992, with oversight from appropriate federal agencies and the Navajo Nation, have resulted in the clearance of BNCC lease lands at Navajo Mine, from Area I to the northern third of Area IV North, including most of the Project Area (Hogan and Winter 1983). Artifacts and records from these mitigation and research activities that have not been returned to the Navajo Nation are maintained at one of the approved curatorial facilities located at the Museum of New Mexico, the University of New Mexico, or the San Juan County Museum.

The following more recent consultation, inventory, study, evaluation, and mitigation work was pursued under the direction and guidance of OSM and the NNHPD. In 2004, BNCC contracted with the San Juan County Museum Association's Division of Conservation Archaeology (DCA) to perform an updated inventory/evaluation of archaeological and historical properties within the Area IV North portion of the Navajo Mine lease area—including all of the Project Area. In performing this work, DCA reviewed the literature and conducted field inventories to re-locate and characterize 57 sites that had been identified within this area during previous archaeological survey work (Hogan and Winter 1983; Reher 1977). In addition, DCA identified 16 new sites of varying potential significance. Seventy-three historic properties were re-located and/or newly identified during the evaluation of the project. A report of their survey and findings are presented in "The Eligibility Evaluation of Cultural Resources Located Within Lease Area IV North of BHP Billiton (sic) Navajo Coal Company's Navajo Mine" (Meininger and Wharton 2004).

Based on the review of the DCA report, and in coordination with OSM, the NNHPD issued a Cultural Resources Compliance Form that outlined the "Effects of the Project and Conditions of Compliance." Of the total 73 cultural resource sites located in Area IV North, NNHPD determined that 21 were not NRHP eligible and 52 were NRHP eligible. In addition to the cultural resource sites, one TCP, four burial locations, and two in-use sites were identified; these were all determined not NRHP eligible. In order to mitigate the adverse effects of the proposed mining impact in Area IV North, OSM and NNHPD determined that a thorough ethnographic study, a data recovery plan, treatment plan, and additional testing were required.

In 2005, pursuant to OSM and NNHPD direction, BNCC contracted with Ecosystem Management, Inc. (EMI) to draft a data recovery and treatment plan, conduct a thorough ethnographic study, conduct additional eligibility testing necessary for the development of Area IV North, and survey the proposed approximately five mile Burnham Road relocation. The data recovery plan provided a framework for the mitigation and testing of 47 sites located within Area IV North (Burelson et al. 2006). This plan, which was approved by OSM and NNHPD, provided methodology for formal data recovery at 12 sites and testing at 35 sites to determine whether additional data recovery was warranted.

EMI subcontracted the ethnographic study to Dinétahdóó CRM (DCRM), a Navajo-owned firm with local ethnographic experience. Based on the review of the local literature, field visits to Navajo archaeological sites in Area IV North, and preliminary contacts with members of the two families that were using the Project Area, a plan was made for gathering ethnographic information. This plan was submitted to and approved by NNHPD in 2006. After DCRM obtained a permit, officials of the chapters that encompass the Project Area were consulted—Nenahnezad, Tiis Tsoh Sikaad (Burnham), San Juan, Upper Fruitland, Sanostee, and Newcomb chapters. The chapter officials were informed of the then proposed Area IV mine plan and a formal presentation of the ethnographic study was presented to each

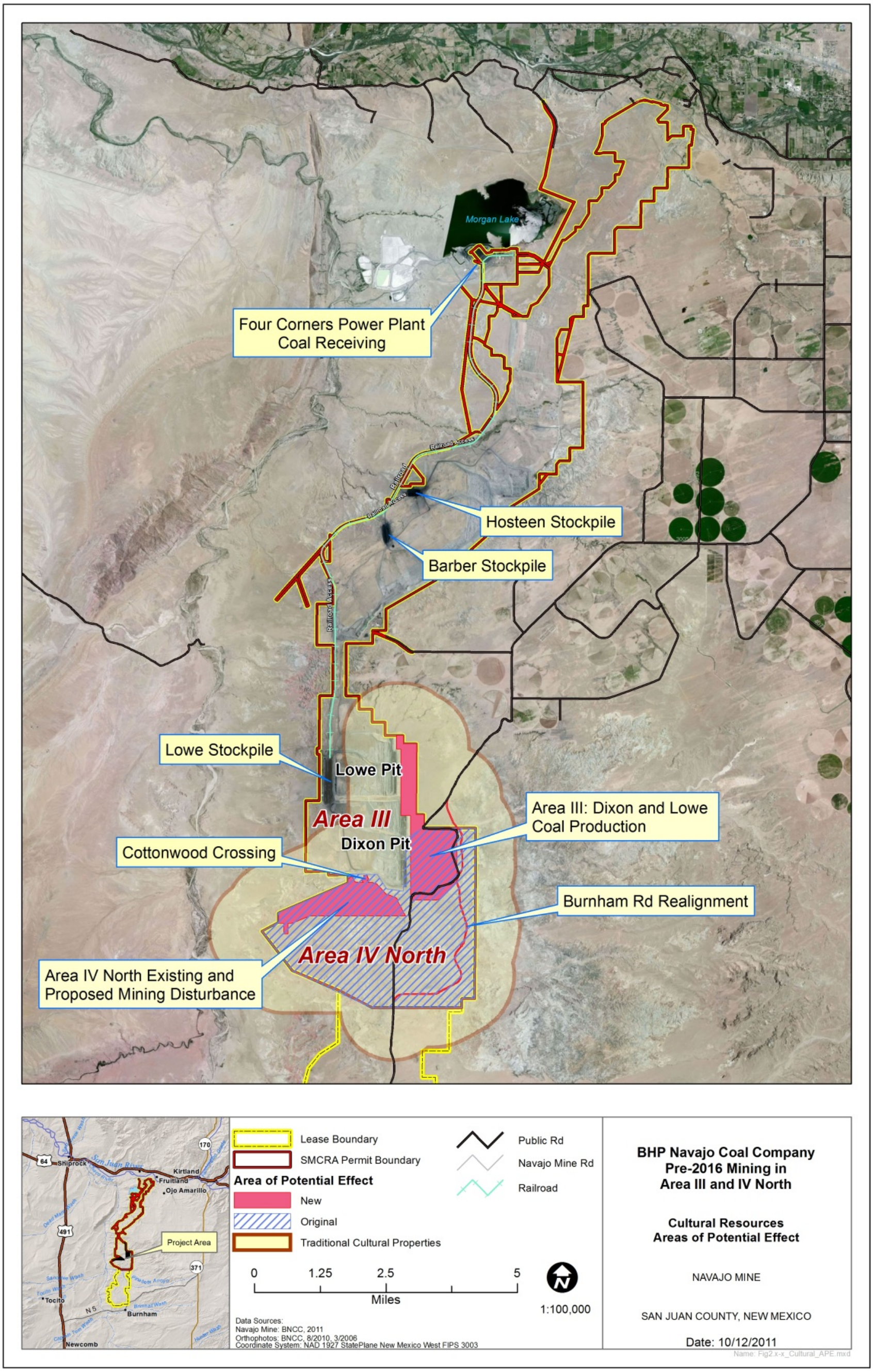
chapter at either a general membership or a local planning meeting. Using data from the chapter contacts, historical users of the area, individuals identified in previous ethnographic interviews by Hogan and Winter (1983) and Martin and Wierto (1985), individuals were identified for contact and ethnographic interviews. Altogether, 36 people within six chapters were contacted and interviewed. Nineteen individuals were taken on field visits to old family sites and or camps. The results to the ethnographic study were presented in their publication "Each Place Brings Stories" (Kelly et al. 2007) that was submitted to NNHPD and OSM in 2007.

Because of the current mining in Area III and proposed Area IV North mine plan revision, it is necessary to relocate a portion of Burnham Road. Since the road relocation is partially outside the mine lease area, EMI conducted a survey of the entire length of the proposed road relocation. In the survey area, four cultural resource sites were located (Burelson 2006). Based on review of EMIs report, NNHPD issued a Cultural Resources Compliance Form that outlined the effects of the project and the Conditions of Compliance. All four sites were determined to be eligible; three of the sites could be avoided by rerouting and one required mitigation. Mitigation work for the one site was completed in 2007 (Honeycutt 2008).

During the spring of 2007, following the earlier work described above, EMI conducted evaluative investigations at 33 sites in Area IV North. Subsurface testing was conducted at 19 sites and detailed mapping and artifact analysis was conducted at the remaining 14 sites. The results of the testing indicated that seven sites should be considered individually as eligible to the NRHP and should be further mitigated according to the data recovery plan. In addition, it was recommended that the sites dating to the Navajo period should be considered as part of an eligible historic landscape and should be mitigated by the development of a cultural landscape study (Johnson et al. 2007). This recommendation was approved by OSM and NNHPD and the cultural landscape study was completed by Woods Canyon in 2011 (Tsosie et al. 2011).

Concurrent with EMI's work, was the development and signing of a Cultural Resources Programmatic Agreement (PA) in 2007 concerning cultural resources compliance work in Area IV North. The PA details the steps and methods for compliance with Section 106 of the NHPA and its implementing regulations. The PA is the agreement between the proponent (BNCC), the federal agency (OSM), and the NNHPD. OSM, in conjunction with NNHPD, is in the process of amending the 2007 PA to include the BIA, BLM, and the USACE. Additional invited signatories to the PA are consulting tribal representatives from the Hopi Tribe, Pueblo of Acoma, Pueblo of Laguna, Pueblo of Zuni, and the Ute Mountain Ute Tribe. The PA amendments will redefine the Area of Potential Effect (APE) by including Area III (see Figure 3-12.1), a reduced Area IV North, and cover the Burnham Road. The PA will continue to include procedures for mitigation and reporting, treatment of unanticipated discoveries of archaeological resources, dealing with TCP, and the treatment of human remains.

Figure 3.12-1. Areas of Potential Effect



In 2007, in accordance with the terms and conditions of the 2007 PA BNCC contracted with Ecosphere Environmental Services to mitigate six sites of the twelve sites initially identified for data recovery. Under subcontract, Woods Canyon Archaeological Consultants, Inc. (Woods Canyon) completed the mitigation work at these sites. As the fieldwork on this project was nearing completion, the results of EMI's testing were finalized. Based on the results of the testing, the contract for mitigation was expanded by thirteen more sites to include the seven additional sites and the remaining six sites. Mitigation work was completed in May of 2008 and the technical report was submitted to OSM and NNHPD (Fetterman 2011). In 2009, OSM and NNHPD determined that BNCC completed all necessary identification and mitigation/data recovery activities for Area IV North (Steele 2009).

In addition to the mitigation work, Woods Canyon was tasked to investigate the location of historic human burials in Area IV North. As a result of the "Each Place Brings Stories" ethnographic study, the locations of 10 human burials were identified in Area IV North. One of these was located in Area III and the remaining nine were located outside the current Project Area. Investigations included surface inspection of locations, metal detector investigations, hand test units in the potential areas of the burial, and in the case of two locations mechanical testing. The investigations located probable evidence of two burials at one location in Area IV North. In accordance with the Navajo Nation Jishchaa' Policy and NAGPRA, the closest lineal descendants were interviewed and it was their desire to leave the graves where they are located. A fence has been built around the location of the burials and proposed mining activities will avoid the location. A written confidential report on the investigations was filed with NNHPD.

3.12.2.1 Archaeological and Historical Resources

Within the Project Area, thirteen archaeological or historical resources are located. Two of these resources have unknown age occupations and eleven of these resources have historic Navajo occupations. The type and age of the occupations (Table 3.12-1) suggest limited activity use and habitation during the historic Navajo period.

Table 3.12-1. Archeological and Historic Occupations within the Project Area

Unknown	Historic Navajo	
Limited Activity	**Limited Activity**	**Habitation**
2	10	1

All thirteen of the cultural resource sites have been extensively studied. One of the thirteen sites has been determined eligible to the NRHP and has been mitigated through excavation; three of the sites were determined eligible and were mitigated through ethnographic studies; two of the sites have been tested and determined not eligible; and the remaining seven sites were determined to be not eligible.

3.12.2.2 Traditional Cultural Concerns

The most recent ethnographic investigations on the BNCC lease were initiated as part of the Area IV North cultural resource compliance effort (Kelly et al. 2007). This work builds on the original ethnographic work conducted by York (1983) and Winter (1983), adding a great deal of new information

in the process. Extensive interviews were conducted with local informants on all of the Navajo sites previously identified within Area IV North. Information was also collected on sites that may be considered TCPs, gravesites and, as these were provided by consultants, on water sources and miscellaneous resources such as agricultural fields, local coal mines, rock art, and cairns.

In addition, the Navajo Nation Archaeological Department (NNAD) completed an ethnographic assessment for URS Corporation in association with the proposed Desert Rock Energy Project (DREP). This was an ethnographic assessment of Navajo TCPs and burials within the BNCC coal lease Areas IV North, IV South, and V, as well as a one-mile-wide buffer zone surrounding these tracts in 2006 (Chavez 2006).

Based on this work, no known TCPs are located in the area of direct impact of the Project Area. In addition, based on work conducted in 1979, no known sites of religious or native significance were present in Area III (Hogan and Winter 1983). Commenters at the public workshops noted that the tribal elders collect clay from nearby washes. Comments also indicated that the Hogback feature and the San Juan River are culturally important to the Navajo people, however these sites will not be impacted by the proposed project.

Eight TCPs are located within a mile of the Project Area. Seven of these sites are considered not eligible to the National Register and one requires additional information before an assessment can be made. In addition to identifying TCPs near the Project Area, a cultural landscape study was undertaken for Area IV North. The study presents an overview of Area IV North from a traditional Navajo perspective (Tsosie et al. 2011). The study examined the origin of the Navajo and the clans of the Navajo that occupied the lease area. It also examined the local landforms as they relate to stories associated with ceremonies.

3.12.2.3 Burial Sites and Related Objects

Ethnographic work identified one historic Navajo burial in Area III and none in the rest of the Project Area. Detailed examination of the location of the burial in Area III failed to produce physical evidence of this burial. Mining in this area should be closely monitored and if human remains are encountered, mining should be suspended in the area, and Navajo Nation Jishchaa' and NAGPRA procedures implemented.

3.13 Traffic and Transportation

3.13.1 Definition of Resource

This section addresses the existing conditions in the affected environment with respect to traffic and transportation. The traffic and transportation resource assessment area is defined as the Proposed Action area, including Area III and Area IV North mining areas and support features, the Burnham Road realignment, and a one-mile area surrounding the Proposed Action. One traffic and transportation related comment was raised during the public workshops and no related comments were received during the informal conference. The public comment addressed improvement of an existing access road located west of Navajo Mine, commonly referred to as the Chaco Wash Road, and concern regarding unfinished improvements. This issue is not associated with the Proposed Action and is outside of the traffic and transportation resource area. Indirectly, land use resource comments in association with effect that the

Proposed Action may have upon tribal member rights and customary use areas (as they relate to management and access) have been used to develop this resource discussion.

3.13.2 Affected Environment

Currently, materials and employees access the Navajo Mine from US Highway 64, NM, Highway 371, or US Highway 491, via an infrastructure of San Juan County and/or BIA roads (Figure 3.13-1). US Highway 64 is the primary transportation route running east to west between Farmington and Shiprock. The New Mexico Department of Transportation (NMDOT) classifies NM Highway 371 as a rural minor arterial route for travel between Farmington and Interstate 40 at Thoreau. US Highway 491 links Interstate 40 at Gallup with US Highway 191 at Monticello, Utah. From these main artery roads, employees and visitors use the following paved BIA road and San Juan County road routes daily to reach the existing Navajo Mine facilities in Area III (primary point of access for the Proposed Action):

- From South or East (Farmington or Bluffview Navajo Housing Authority Housing) on NM Highway 371, via west on BIA Road 3003 to BIA Road 3005 to BIA Road 4104 to Navajo Mine Area III Facilities
- From West (Shiprock) or East (Farmington) on US Hwy 64, via south on San Juan County Road (CR) 6675 to BIA Highway N-36 to BIA Road 3005 to BIA Road 4104 to Navajo Mine Area III Facilities
- From North or South US Hwy 491, via east on BIA Highway N-36 to BIA Road 3005 to BIA Road 4104 to Navajo Mine Area III Facilities

Traffic counts for the major routes used to access Navajo Mine facilities were taken in 2006 and 2009 (NMDOT 2009). Currently, the traffic levels for all segments of these access routes are well within the design volume for annual average and flow.

Heavy mining equipment over 25 tons is delivered directly to the Navajo Mine North Facilities via US Highway 491 to BIA Highway N-36 to CR 6675. Equipment weighing less than 25 tons can be delivered directly to Navajo Mine Area III facilities via the described mining area access routes.

Within the traffic and transportation resource area, the Burnham Road (N-5082)—a BIA-managed and maintained gravel road—is one of the main access roads to the Tiis Tsoh Sikaad (Burnham) Chapter. BNCC re-routed the road in 2009 through and immediately adjacent to Area III and Area IV North. BNCC traffic counts conducted April 1, 2011 through June 14, 2011 found that traffic volume averages approximately 50 vehicles per day, with peak daily traffic occurring on Saturday when traffic counts increase to 70 or 80 vehicles per day. Travel on this road can be hazardous due to inclement weather and a 20-mile per hour hairpin curve resulting from the 2009 rerouting of the road to avoid active mining in Area III. Blasting and mining activities in Area III have gradually progressed to within 100 feet of the road. As per SMCRA permit requirements (30 CFR 816.66), BNCC has developed blasting plans and standard safety actions to minimize hazards to road users. Currently, traffic can be restricted multiple times per month during active coal mining operations to keep the public at a safe distance from blasting operations. Access restriction on the Burnham Road can result in delays of up to 30 minutes.

Also within the traffic and transportation resource area is a variety of unimproved two-track roads utilized infrequently by tribal members with customary use rights in the area (Figure 3.13-2). These unimproved roads do not meet road construction standards for other public roads in the area and are not public roads as defined in 30 CFR 761.5. These routes are not maintained with the use of public funds similar to other public roads in the area, and have not been designated as public roads by the Navajo Nation or any applicable jurisdictional authority. Considered herein as informal access, approximately 50 miles of these routes primarily serve CUA access and livestock grazing in the resource assessment area.

Access to active mining in Area III and activities developed previously within Area IV North between 2009 and 2010 have resulted in either the improvement, closure or restricted access to several of these access routes. BNCC has calculated that approximately five miles of access routes have been either modified (improved, realigned, and/or restricted) or eliminated due to the previous developments within Area IV North. Discussion of CUAs and associated land uses served by existing access routes is included in Section 3.10 – Land Use.

Under SMCRA regulations, BNCC would be required to protect the affected public road use system, and would develop measures to be taken to protect related resources (developed in consultation with OSM, BIA, and the Navajo Nation), in accordance with 30 CFR 761.11(d) and 30 CFR 761.14.

Figure 3.13-1. Regional Transportation Routes

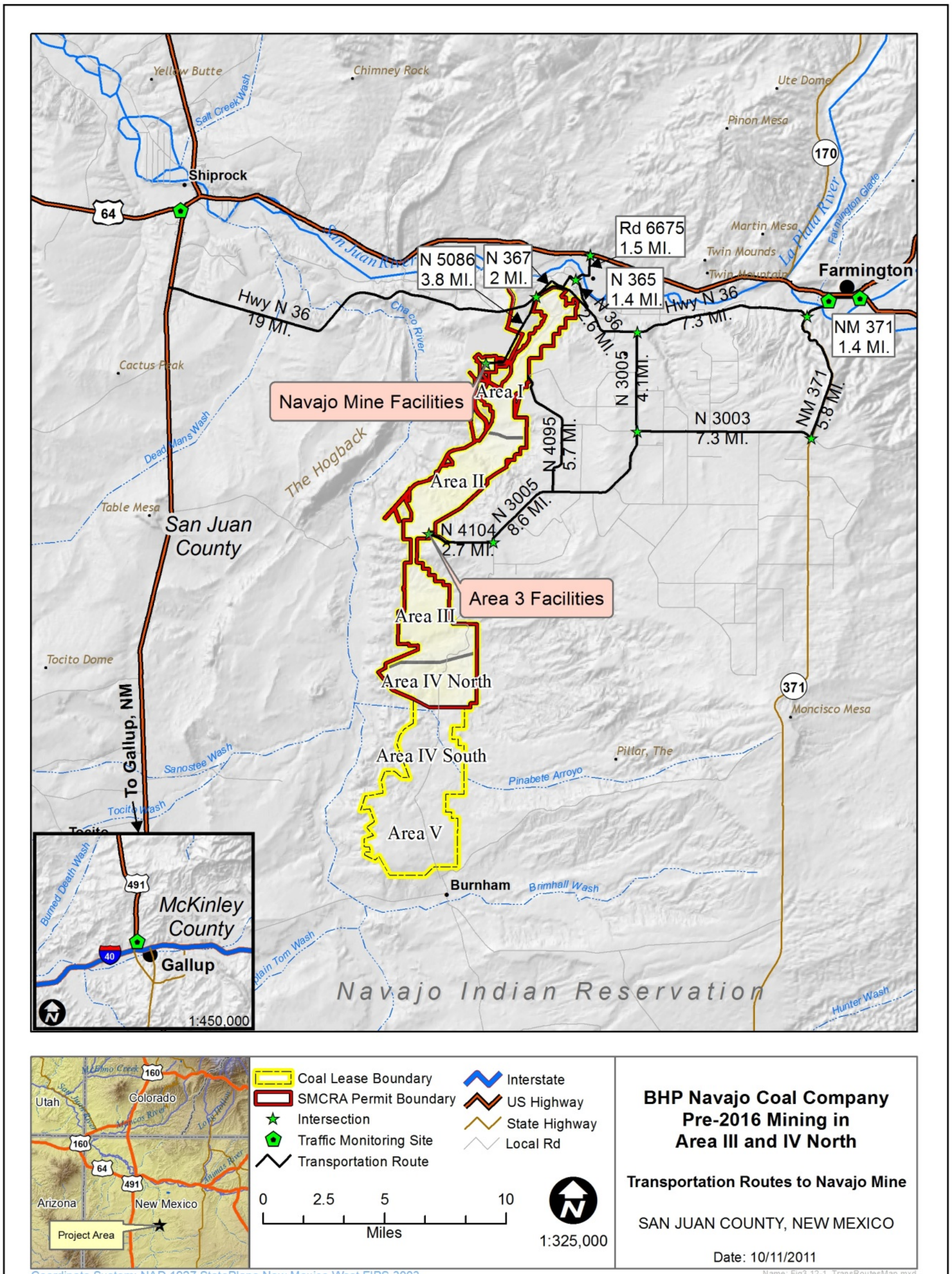
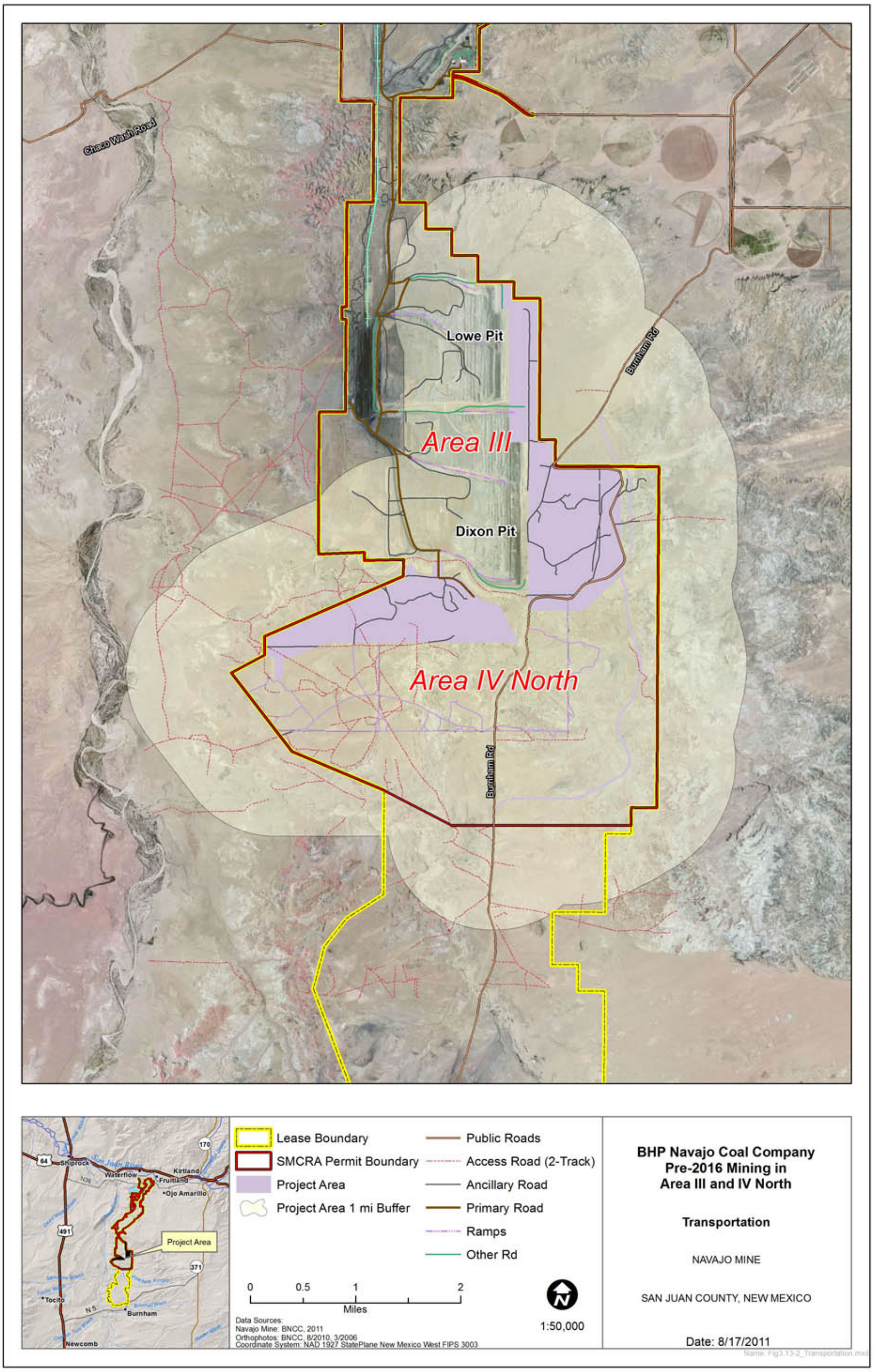


Figure 3.13-2. Transportation System within the Project Area



3.14 Health and Safety

3.14.1 Definition of Resource

The resource under consideration in this section is the health and safety of the Navajo Mine workers and the public. Generally, health and safety risks would be linked to causes or exposures from activities or emissions at Navajo Mine associated with the mining activities for each of the alternatives including realignment of Burnham Road. This assessment of impacts to health and safety focuses on risks from exposure to air emissions produced by activities at Navajo Mine. Public comment on the proposed project identified dust and air quality as a concern (see Section 1.5). Other health and safety risks are expected to be small in comparison because worker risks are mitigated by safety regulations and operating procedures that are designed to minimize worker exposure to hazards and hazardous conditions. Public health and safety risk is limited to exposure to air and water emissions outside the mine. Those exposures are controlled by Clean Air and CWA regulations. Background groundwater quality is generally unsuitable for either domestic or livestock use due to poor water quality (sodium sulfate, TDS) and low well yields. Surface water has been designated by the Navajo Nation EPA as secondary human contact (direct contact to skin associated with recreation or cultural uses), fish consumption, aquatic and wildlife habitat and livestock watering. Water emissions would have minimal risk to public health because local water resources are used for agricultural purposes (see Section 3.2). Public safety is identified in the need for the realignment of Burnham Road. These impacts are assessed in Section 4.13 Traffic and Transportation.

The potential public health impacts associated with air emissions from activities at Navajo Mine are primarily related to fugitive dust or particulate emissions. Particulate matter (PM) emissions are regulated under the Federal Clean Air Act. Specifically, the National Ambient Air Quality Standards (NAAQS) include standards for PM_{10} and $PM_{2.5}$. In general, particles larger than 10 microns are trapped in a person's mouth, nose, and throat, and do not reach a person's lungs. $PM_{2.5}$ tends to reach the deepest areas of a person's lungs, where illnesses can originate. Generally, the PM emissions from mining and material handling operations are coarse and larger than 10 microns. Emissions from fuel-burning equipment such as combustion engines are generally smaller—less than 2.5 microns.

3.14.1.1 Worker Health and Safety

Typical risks encountered at an industrial facility such as Navajo Mine include exposure to dust, noise, heat stress, and chemicals, as well as the increased chance for accidents due to working directly with or in proximity to large equipment. At Navajo Mine, implementation and enforcement of safety policies and procedures reduce risks to mine workers.

Numerous laws and regulations govern the policies and procedures implemented to ensure the health and safety of the mine workers, protect persons living in the surrounding vicinity, and regulate the use and disposal of hazardous materials and wastes. These laws include, but are not limited to, the following:

- The Federal Mine Safety and Health Act of 1977, 30 USC. 801 et seq. as amended by Public Law 91-164, as amended by Public Law 95-164. Enforced by the Mine Health and Safety Administration (MSHA), and administered by the U.S. Department of Labor.
- The Surface Mining Control and Reclamation Act of 1977 (30 USC. 1201 et seq.).

- The Clean Water Act, (Federal Water Pollution Control Act [33 USC. 1251 to 1387]).
- The Clean Air Act of 1970, 42 USC. 7401 et seq., as amended 1990.
- The Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 USC. 9601 et seq. also known as "Superfund".
- The Superfund Amendments and Reauthorization Act of 1986, Title III, embodying the Emergency Planning and Community Right-to-Know Act, Public Law 99-499.
- Resource Conservation and Recovery Act, as amended (42 USC. 6901 et seq.).

Navajo Mine operations are under the jurisdiction of OSM. OSM conducts regular health and safety inspections. In 2008, for example, there were 41 OSM inspections at Navajo Mine (BNCC 2009b). Additional inspections are conducted by MSHA and the Navajo Nation. BHP Billiton has established Health, Safety, Environmental and Community (HSEC) Management Standards for the company. These standards are used to measure the performance of workers at Navajo Mine in minimizing health and safety risks.

3.14.1.2 Public Health and Safety

Some sources of PM emissions associated with activities at Navajo Mine include:

- Mine development and coal extraction activities, primarily from airborne soil and rock fines and equipment exhaust
- Reclamation activities
- Roadway dust from travel on paved and unpaved roads
- Wind erosion from open land
- Off-road vehicles, primarily trucks, and automobiles

See Section 3.5 – Air Quality for more detailed information about PM emissions sources. The major public health risk associated with exposure to PM emissions from coal mines is related to increased asthma symptoms in those afflicted with asthma. Asthma is a disease that affects the breathing passages (bronchi) of the lungs. Asthma is caused by chronic inflammation of these passages. The role of outdoor air pollution, in particular ozone and PM, has not been associated with an increase in asthma incidence. A recent study found that the risk of developing asthma (incidence) was not greater, overall, in children living with high levels of ozone or particulate air pollution (AAP 2004). While the specific causes of asthma are not known, asthmatics share sensitivity to triggers. Common triggers among sensitive persons include exposure to tobacco and wood smoke, inhaling airway irritants such as perfumes and cleaning products, exposure to allergens such as molds and animal dander, exposure to cold, dry weather, an upper respiratory infection such as a cold, emotional stress, stomach acid reflux disease, and sulfites (OSM 2008b). A number of studies have been published that demonstrate a positive relationship between PM and increased symptoms of asthma for those people who already have the condition.

The CAA passed by the United States Congress in 1970, and amended in 1990, authorized the EPA to establish National Ambient Air Quality Standards (NAAQS) for pollutants that threaten human health and the environment (40 CFR, Part 50). The CAA established two types of NAAQS:

- Primary standards to protect public health, including the health of "sensitive populations" such as individuals with respiratory conditions, children, and elderly, and
- Secondary standards which set limits to protect the environment, including protection against "decreased visibility, damage to animals, crops, vegetation, and buildings"

Details regarding the NAAQS are included in Section 3.5 – Air Quality. The current NAAQS require that ambient air levels of PM not exceed 150 $\mu g/m^3$ of PM10 and 35 $\mu g/m^3$ for PM2.5 average over a 24-hour period. If these levels are exceeded regularly, the area is determined to be "out-of-attainment" and measures must be implemented to reduce PM emissions to protect human health.

3.14.2 Affected Environment

3.14.2.1 Worker Health and Safety

In 2009, there were 326 MSHA inspection days at Navajo and San Juan Mines. A measure of the health and safety performance at Navajo Mine is the average number of citations received per inspection day. In 2009, the average citation per inspection days was 1.11 compared to 1.22 in 2008. In 2009, Navajo Mine also met or exceeded all of BHP Billiton's HSEC targets including improving health and hygiene by identifying and controlling dust and noise exposures as well as reducing total injuries and potential for serious injury or fatality (BNCC 2010c). Commenters at the informal conference noted BNCC's emphasis on safety.

Navajo Mine operates an extensive monitoring program for ambient meteorological data and PM_{10} concentrations with five monitoring stations located near the perimeter of the current mining facility. Refer to Section 3.5 – Air Quality for details on this monitoring system. In 2010, none of the average readings exceeded the annual average NAAQS for PM_{10}. During most monitoring quarters, 24-hour PM_{10} concentration detected at a few monitors exceeded the hourly NAAQS. These are isolated events typically occurring one or two days per quarter because of elevated winds and dust entrainment, or the transient operation of mobile mining equipment near the monitors.

3.14.2.2 Public Health and Safety

San Juan County, NM is designated as attainment or unclassified for all criteria pollutants including PM and precursors to ozone. This means that air quality in the region is considered not to be harmful to human health. However, San Juan County recently updated its Community Health Profile that includes a comprehensive overview of health indicators including respiratory health (SJC 2010). This study found that San Juan County has a higher incidence of chronic lower respiratory disease (CLRD) comprised of chronic bronchitis, asthma, and emphysema than New Mexico or the rest of the United States. Elevated levels of ozone in San Juan County have been linked to incidence of asthma-related medical visits. San Juan County residents are 34 percent more likely to have asthma-related medical visits after 20 parts per billion increase in local ozone levels (NMDH 2007).

In considering special exposures for vulnerable populations for Environmental Justice impacts (Section 4.11), a recent study examined the relationship between coal combustion in homes in the Shiprock area and impacts on respiratory health (Bunnell et al. 2010). Shiprock, NM is located on the Navajo Reservation and this census tract (see Figures 3.10-1 and 3.10-2) has a higher percentage of minority population and poverty rate than other surrounding census tracts. This vulnerable population is likely to have the special exposure to the impacts of coal combustion in the home because Shiprock residents have easy access to the low or no-cost coal made available to Navajo tribal members at Navajo Mine. The report found that coal combustion in the home is likely causing poor indoor air quality and increasing risk of CLRD in some Shiprock area residents. The study concludes that, "The presence of two large coal-fired power plants near Shiprock may contribute to that risk, but results from this study suggest that the risk could be reduced by making relatively simple and inexpensive changes to methods of home heating" (Bunnell et al. 2010). Commenters at the public workshops indicated concerns about public health effects of airborne coal dust.