4. ENVIRONMENTAL CONSEQUENCES

Environmental resources can be affected in many ways during implementation of the Proposed Action. The affect, or impact, is defined as any change or alteration in the pre-existing condition of the environment produced by the Proposed Action. This chapter analyzes the environmental consequences of the Proposed Action and the No Action Alternative. Only those elements of the environment potentially impacted by the proposed action will be discussed.

Impacts can be direct, indirect, or cumulative. For this EA, direct and indirect effects are discussed in Chapter 4 and cumulative effects are covered in Chapter 5. Direct effects are caused by the action and occur at the same time and place. Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.

In the following sections, potential direct and indirect impacts to resources are characterized based on their duration, severity, and geographic extent. In general, short-term impacts refer to those that would affect the environment during the proposed mining and reclamation activities. Long-term impacts are those that would last beyond the life of the Proposed Action. Duration of impacts, as well as severity and geographic extent is described in detail for each resource.

4.1 Geological Resources

4.1.1 Impact Assessment Methodology

As defined in Section 3.1, the assessment area for geology within the geological resource assessment 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. The 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. The assessment of geology impacts includes the removal of coal and surrounding geologic layers and the potential for effect to water resources. The assessment of potential impacts to soils includes removal, erosion, changes in productivity and contamination. Severe impacts would include the loss of substantial amounts of soil to erosion by wind and water, long-term loss of soil productivity or contamination from accidental spills that results in risks to human health. The assessment of paleontological impacts includes the removal of resource bearing geologic layers. Specific water resources effects discussion is included as Section 4.2 – Water Resources.

Though no specific geological resources-related comments were received from the public, concerns on impacts resulting from coal dust and fugitive dust on other area resources were considered in development of this section. The assessment of potential effects on geological resources in this EA, including how surface coal mining potentially affects regional geology, water resources, soils and related geological features such as paleontology, is conducted in consideration of SMCRA criteria for protection of such elements. The Proposed Action wholly incorporates these SMCRA-based requirements. Specific discussions on related air quality effects are included in Section 4.5 – Air Quality.

There are no Navajo Nation designated protected soils, geology, or features within or adjacent to the geological resources assessment area. Erosion and contamination of soils would be routinely monitored

and reduced through current BNCC geological resource protection measures, and in accordance with existing plans as described below.

4.1.2 Impacts

4.1.2.1 Proposed Action

Geology and Paleontology

Impacts to geology and paleontological resources resulting from the proposed mining activities include the removal of coal, overburden and interburden materials, including any paleontological resources these layers may contain. The return of overburden and interburden material to the mine pit as backfill material would have a permanent impact on paleontological resources that may occur in overburden and interburden layers, removing them from their geological context. The impacts would be moderate in severity due to the permanent nature of the impact in the mining areas, and the expected presence of similar paleontological resources outside the mine. No unique or sensitive geologic formation areas would be impacted. Geologic formations located stratigraphically below the target coal formation would not be mined or impacted by the Proposed Action. The proposed mining activities are not anticipated to impact geologic formations outside of the geology assessment area. No impacts to geologic or paleontological resources are expected to result from the proposed realignment of Burnham Road.

During active mining, the surface topography would be modified due to removal of overburden and interburden material and coal. Reclamation would backfill and restore or recreate original surface topography to the extent possible while providing stable slopes. Spoil material within mined areas are required to be graded to the approved FSC as described in the Mine Plan Revision (BNCC 2011a). The Proposed Action would result in low to moderate and long-term alterations to the topography of the mine area. Based on the amount of disturbance and the low relief terrain, impacts to topography at the Burnham Road realignment would be low.

Soils

The proposed mining activities would result in the removal and redistribution of soils within approximately 1,400 acres of Area III and Area IV North. Approximately half of these acres occur within Area III, which is already permitted by OSM to be mined. Soils suitable for use as topdressing would be either immediately transported to reclamation areas or salvaged and stockpiled for later use. Some mixing of soils occurs during stockpiling and redistribution of soils during reclamation. Mining activities use non-salvaged surface soils, overburden and interburden for use as mine pit backfill material during reclamation.

All soil material handling activities currently occurring in Area III, and those activities proposed for Area IV North, are and would be conducted in compliance with SMCRA regulations and the approved and proposed mine plans, which prescribe measures to ensure a suitable rooting medium for vegetation establishment (BNCC 1994, 2009a). These measures include salvage of suitable topdressing, and if needed regolith, materials ahead of mining activities to prevent contamination; stockpiling topdressing and regolith not used immediately for later use; the use of berms surrounding topdressing and regolith stockpiles to reduce erosion; and mulching stockpiles left unused for more than 6 months.

Post-mining reclamation of disturbed areas includes backfill and grading to establish approximate final surface configuration or approximate original contour. Placement of suitable topdressing and/or regolith material as part of final grading provides a root zone for establishment of vegetation. A minimum four-foot thickness of suitable root-zone material is placed on the top of all reclaimed areas. Replaced overburden or regolith material is chemically and physically tested prior to top soil placement to ensure root zone suitability criteria are met for reclaimed areas. Annual reports documenting the results of root-zone sampling are prepared and submitted to OSM. Soil removed from proposed mining areas would be redistributed during reclamation, on average, approximately five years after mining has been completed.

To minimize erosion and sediment transport on post reclamation surfaces, BNCC would implement BMPs as described in the Navajo Mine's Reclamation Surface Stabilization Handbook and SWPPP.

Contamination of soils could result from accidental spills of fuel, oil, or other substances from mine equipment. These would be handled according to the Navajo Mine SPCC Plan. If necessary, petroleum contaminated soils would be managed using the existing land farming facilities at Navajo Mine, as described in the current SMCRA Permit (BNCC 2009a). Should soil contamination occur, it would be a short-term impact.

Reclamation activities are expected to have long-term positive impacts on soils. The establishment of vegetation consistent with the post-mining land use of grazing would result in a higher percent of vegetative cover, improving soil stability, reducing soil loss and increasing productivity over pre-mining conditions (BNCC 2011a).

Approximately 75 acres of soils would be disturbed during construction of the Burnham Road. Following construction, areas disturbed outside the driving surface and drainage ditches would be reclaimed. Soils within the roadway would be displaced, mixed, and compacted. This long-term disturbance would impact approximately 23 acres. Soil erosion from wind and/or water during construction activities would be moderate to severe based on the erodibility of soils, but would be minimized to low to moderate levels by implementation of BMPs described in the SWPPP. Accidental leaks or spills of fuel, oil, or other substances from construction equipment could contaminate and compromise the productivity of affected soils. Impacts to project area soils would be low and short term, limited to the duration of construction activities.

4.1.2.2 Proposed Action with Conditions

Under this Alternative, impacts would be the same as those described for the Proposed Action.

4.1.2.3 No Action Alternative

Under the no action alternative, the current mining activities in Area III would continue, but neither Area IV North nor the proposed Burnham Road would be developed. As such, there would be approximately 700 acres of disturbance to soils, topography, geologic, and paleontological resources. The type, severity, and duration of impacts to soils, geology, and paleontological resources from mining and reclamation activities in Area III would be the same as those described for mining under the Proposed Action. The approximately 268 acres of existing surface disturbance (mining disturbance, ancillary roads, and power lines) in Area IV North that occurred following the previous authorization to mine in Area IV North (Permit NM-0003-F-R-01), would be reclaimed as directed by OSM. Reclamation of these acres would

result in similar adverse and beneficial impacts to geologic surface resources as described for the Proposed Action, but would be limited to approximately 268 acres.

4.2 Water Resources

4.2.1 Impact Assessment Methodology

Impact assessment considers the severity of potential direct and indirect impacts as well as the geographic extent, duration, and overall context of potential impacts. Duration of impacts is described as short term, intermediate term, and long term. Short-term impacts include temporary impacts during project implementation (e.g., 5 to 10 years). Intermediate-term impacts are temporary impacts that extend for a period of up to 20 years beyond the particular action associated with the active mining and reclamation operations. Long-term impacts are impacts that extend more than 20 years beyond the Proposed Action and include permanent impacts. Some of the long-term impacts may be a consequence of mining and reclamation actions and might not occur for a significant period. These delayed, long-term impacts are classified as indirect impacts. The severity of impact is described in terms of the magnitude of resource loss, degradation, or depletion. The magnitude of impacts for the purposes of this section are defined as major, moderate, minor, and negligible as outlined in Table 4.2-1.

Table 4.2-1. Magnitude of Impacts

Magnitude	Groundwater Quantity	Surface Water Runoff	Water Quality
Major	Irretrievable loss of the groundwater resource to support existing uses that cannot be provided by alternate water supplies	Impacts that preclude existing uses outside of the permit area that cannot be provided by alternate water supplies	Long-term changes in water quality outside the permit area that preclude the current or potential future use of the resource
Moderate	Irretrievable loss of the groundwater resource to support existing uses that are mitigated by alternate water supplies	Impacted areas or runoff volumes are greater than 30 percent	Long-term changes in water quality that consistently exceed the water quality observed in the baseline fluctuations, but do not preclude the current or potential future use potential of the resource
Minor	Short-term loss of the groundwater resource to support existing uses that can be mitigated by provision of alternate water supplies	Impacted areas or runoff volumes are between 10 and 30 percent	Short term or long-term changes in water quality that occasionally exceed the water quality observed in the baseline fluctuations, but do not preclude the current or potential future use potential of the resource
Negligible	Impacts to groundwater that is not capable of providing a sustainable water supply for use or that	Impacted areas or runoff volumes are less than 10 percent (10 percent is considered within the	Impacts to water quality that are within the water quality observed in the baseline fluctuations

Magnitude	Groundwater Quantity	Surface Water Runoff	Water Quality
	are similar to fluctuations caused by natural processes	range of background levels)	

Several models were used to assess impacts. Assessment of pre-mine and post-mine flows and sediment loss were performed using SEDCAD™ 4 (SEDCAD), an integrated hydrologic model that evaluates flows, water, and sediment yield and effects of sediment control measures, including sediment ponds on downstream resources. SEDCAD uses the Modified Universal Soil Loss Equation (MUSLE) to generate storm-based erosion predictions. Groundwater flow and chemical transport modeling was also performed using the FEFLOW (Finite Element subsurface FLOW system) software. The FEFLOW model was used to predict changes in the groundwater flow system expected to occur as a result of the proposed mining and reclamation within Area IV North. The model was also used to assess the rate of recovery of water in the mine spoil backfill and in the adjacent Fruitland coals and PCS and the long-term fate and transport of spoil water. Further discussion of FEFLOW and SEDCAD including detailed modeling results are included in Chapter 11 of the mine permit revision for Area IV North (BNCC 2011a).

Impact assessment also relied upon relevant published and unpublished reports and papers, experience from past mining and reclamation operations at Navajo Mine and other mines located along the western rim of the San Juan Basin, and observations made by BNCC staff during the day-to-day operations of the mine as well as surface water and groundwater monitoring performed in conjunction with historic and ongoing mining and reclamation activities at Navajo Mine.

4.2.2 Impacts

4.2.2.1 Proposed Action

4.2.2.1.1 Groundwater Impacts

Groundwater Flow and Drawdown

Mining will occur in the Fruitland Formation and PCS units; however, mining will not occur within the alluvium along the main stem of Cottonwood Arroyo. Mining will result in limited drawdown of groundwater levels in the adjacent coal units and underlying PCS but is not expected to result in a drawdown of groundwater levels in the alluvium within the main stem of Cottonwood Arroyo (BNCC 2011a § 11.6).

The direct effect of overburden and coal removal is that each successive open cut acts as a drain causing drawdown of water levels in the adjacent coals and a reduction of potentiometric heads in the underlying PCS. The drawdown in the Fruitland Formation and PCS is expected to be localized and minor based on the results of groundwater monitoring at Navajo Mine Areas II and III as described in the PHC, Chapter 11.6 of BNCCs Mine Permit Revision (BNCC 2011a). Based on past mining experience in Areas II and III, groundwater inflows to the future mine pits in Area III would be negligible and not likely to be observable as seeps along the highwall or as seepage in the pit floor. The pit floors are expected to remain dry except on rare occasions when storm runoff is captured. Model simulations of proposed open pit mining in Area IV North show very limited extent of drawdown in the coal units and the PCS beyond the

limits of Area IV North mining. These results also indicate that proposed mining in Area IV North is not expected to result in a drawdown in water levels or depletion of groundwater in the Cottonwood alluvium downgradient of mining (BNCC 2011a § 11.6).

Post reclamation, groundwater flow rates from Area III may increase in the long-term due to a likely increase in recharge rates following reclamation due to removal of badland topography and inter-bedded coal units, and placement of topdressing materials within reclaimed areas. The more homogenous topdressing materials permit higher rates of infiltration and groundwater recharge relative to pre-mining conditions. Despite an increase in recharge rates, the rate of recharge will still be quite low and the time period required for water levels to recover to near steady-state level in the mine backfill is estimated to be on the order of 100-years or longer, unless other sources (such as NAPI) enhance irrigation seepage and return flows.

In the groundwater model predictions performed for the PHC, recharge rates were estimated to increase from a baseline of 0.02 – 0.03 inches per year to a post-mine estimate of 0.04 inches per year (BNCC 2011a). Even with the estimate of higher recharge rates for post-reclamation conditions, the transient groundwater model simulations show that it may take approximately 400 years for recovery of water levels to approach steady-state conditions in the PCS and in the mine backfill (BNCC 2011a). The groundwater modeling also indicated that upward gradients from the PCS to the mine backfill occur until about 85 years after the start of mining. After that time, the recovery in the backfill is sufficient that gradients are reversed and are downward from the backfill to the PCS.

The modeling results also show that a long-term change resulting from the removal of the inter-bedded coal, shales, mudstones, and sandstone strata and replacement with a more homogeneous mine backfill in Area IV North there would be an increase in the rate of vertical flow into the PCS from the mine backfill compared with the vertical flow into the PCS from the Fruitland Formation prior to mining (BNCC 2011a). Removal of the coals by mining will result in greater depth to the water table within the mine backfill compared to pre-mine conditions. Any perched groundwater in the shallow coal seams (#7 and #8 coals) adjacent to the mine will flow toward the mine backfill. The impact of these changes is considered negligible because the coal units within Area IV are not capable of providing a sustainable water supply for use and do not supply water for springs or seeps.

These groundwater-modeling predictions were also used to help assess the approximate magnitude of changes in groundwater flow and TDS concentrations in the Cottonwood alluvium that might occur as a result of mining in Area IV North. The groundwater model predicted a steady-state post-reclamation alluvial groundwater flow at the mouth of Cottonwood Arroyo of about 4.6 gallons per minute (gpm) compared to the pre-mine alluvial groundwater flow estimate of 4.3 gpm (BNCC 2011). However actual groundwater flows in the Cottonwood alluvium are never at steady state and vary considerably seasonally and from year to year and will continue to vary throughout mining and after reclamation. The model predicted 0.3 gpm increase in groundwater flow in the Cottonwood alluvium is quite low relative to the baseline variability in the alluvial groundwater. Thus, mining and reclamation within Area IV North is not expected to result in a long-term measurable change to the alluvial groundwater flow or potential well yield from the alluvium. Groundwater flows in the Cottonwood alluvium have historically been insufficient to sustain a reliable water supply at two of the three wells that were monitored for baseline conditions. This is not expected to change even with the modeled flow increase of 0.3 gpm (BNCC 2011a

§ 11.6). Impacts to the Cottonwood alluvial quantity are considered to be negligible because they are similar to fluctuations caused by natural processes.

The estimated changes in groundwater flow are not expected to result in any change in surface water availability or surface water quality as groundwater does not discharge to surface water in the area. Groundwater in the Fruitland coals and the PCS near the Project Area are not used by area residents due to low yields and poor water quality (BNCC 2011a § 11.6). Impacts to the Fruitland and PCS groundwater quantity are considered to be negligible as these systems are not capable of providing a sustainable water supply for use.

Water Quality

Spoil leaching tests were performed in support of the PHC assessment for the Navajo Mine SMCRA permit revision (BNCC 2011a § 11.6). The spoil leaching test results show a considerable range in the concentrations of TDS and sulfate. These results show TDS and sulfate to be the primary constituents of concern with respect to spoil leachate. The leaching test results are fairly consistent with the results for the Bitsui #5 spoil well completed in the mine spoils in the Bitsui Pit, located at the north end of the BNCC Navajo Mine (BNCC 2011a § 11.6, Table 11-14i). The Bitsui Pit was backfilled in the 1980s and is the only pit at Navajo Mine where saturation of mine spoils has been observed. Arsenic and selenium were below detection in most of the leaching test results and in the Bitsui 5 spoil well. Fluoride is also lower in the spoil water leachate than in the coal water and is attenuated in flow through mine spoil. Boron and manganese concentrations are elevated in mine spoil water but concentrations are below the criteria for livestock use (BNCC 2011a § 11.6).

A post-reclamation increase in TDS and sulfate concentrations in mine spoil backfill may in the long-term result in increased TDS and sulfate concentrations in the coal and PCS adjacent to Area III mining and in the groundwater in the Cottonwood alluvium downstream of the mine area. Spoil leaching test results found an increase in TDS concentrations in spoil water leachate ranging from 400 to 2,700 mg/l and an increase in sulfate concentrations in spoil water leachate ranging from 630 to 2,580 mg/l (BNCC 2011a, Appendix 11-VV).

Direct intermediate-term impacts to the groundwater quality changes beyond the active mine area at Area IV North are not expected to occur during mining and reclamation operations. During active mining, hydraulic gradients and groundwater flow directions in the Fruitland Formation and in the underlying PCS would be toward the mine pits and backfill areas. Thus, it is expected that there would be little change in the quality of groundwater beyond the limits of the mine pit and mine backfill during mining and reclamation operations.

The TDS concentrations are lower in the Fruitland coals in the vicinity of Area IV North in comparison with the baseline TDS concentrations in the Fruitland coals further north in the vicinity of Areas I and II (BNCC 2011a § 11.6). These results show that in addition to increases in concentrations of TDS and sulfate, concentrations of boron and manganese may also increase relative to the baseline coal water but are unlikely to exceed livestock use criteria.

Long-term TDS transport modeling simulations were performed using a lower bound source concentration of 3,550 mg/l and an upper bound TDS concentration of 11,850 mg/l (BNCC 2011a). Based on these results, the long-term post-reclamation TDS concentrations in the groundwater in the

Cottonwood alluvium may be expected to increase downgradient of the Area IV North mine area. Groundwater modeling results indicate a delayed long-term increase in the TDS concentrations in the Cottonwood alluvium that may be within a magnitude of 0 to 22 percent increase near the mouth of Cottonwood after more than 500 years. A 22 percent increase would result in a predicted TDS concentration of 3687 mg/L. TDS concentrations between 3000 and 5000 mg/L may not cause adverse effects to adult livestock, however, growing/young livestock could be affected by looseness or poor feed conversion (Lardy and Stoltenow 2008). There is no NNEPA 2007 TDS standard for livestock watering.

The natural variability in the baseline TDS concentrations in the Cottonwood alluvium is comparable to or greater than the magnitude of the model predicted changes in TDS concentrations. For example, the median plus one median absolute deviation of the TDS concentrations measured in baseline samples at Cottonwood alluvial wells QACW-2 and QACW-2B are 22 percent and 10 percent higher than the median, indicating wide natural variation in TDS concentrations in the alluvium. Cottonwood alluvial monitoring QACW-1 had insufficient water for sampling so it is not possible to assess the variability in TDS concentrations at this location. The median plus one median absolute deviation of the TDS concentrations measured in baseline samples at alluvial well GM-17 on the North Fork of Cottonwood was 3 percent higher than the median. However, the median TDS concentration in baseline samples from this well was 15,210 mg/l making the alluvial groundwater at this location on the North Fork of Cottonwood unsuitable for use. In summary, the baseline median plus one median absolute deviation range from 3 to 22 percent higher relative to the medians.

While the predicted TDS change of 0 to 22 percent could result in TDS concentrations above criteria recommended by Lardy and Stoltenow for growing/young livestock, the predicted change is within the variability of 3 to 22 percent observed in baseline fluctuations. Thus, the impact of the model predicted changes in TDS concentrations in the Cottonwood alluvium are considered to be negligible as the predicted long-term changes in water quality are within the variability observed in the baseline fluctuations. Additionally, changes unrelated to mining could result in a greater magnitude of change in TDS concentrations in the Cottonwood alluvium, within the 500 year modeled timeframe. Any changes in alluvial groundwater quality are not expected to affect surface water quality or potential ecological receptors, as groundwater does not discharge to the surface in the area.

One commenter indicated concerns regarding water quality impacts of CCB disposal. No CCB disposal is proposed as part of the Proposed Action. The proposed realignment of Burnham Road would have no impacts to groundwater quality or quantity.

4.2.2.1.2 Surface Water

Previously permitted mining in Area III would consist of mining 701 acres. That mining would directly impact about 1.3 acres of WUS within the Lowe and Dixon Pits. Impacts to WUS within Area IV North would include an additional 0.5 acre associated with the proposed mining activities and 0.1 acre associated with the proposed Burnham Road realignment (refer to the 404(b)(1) analysis in Appendix A). Mining activities would effectively remove these ephemeral channels, resulting in containment or diversion of surface flows and divert them around the mine until reclamation occurs and hydraulic functions return to mined areas.

BNCC mining construction and operations must comply with CWA regulations, which require that surface-water runoff from constructed surfaces be controlled such as to "prevent, to the extent possible using the best technology currently available, additional contributions of suspended solids to streamflow, or runoff outside the permit area." The CWA also requires that discharges to streams meet all applicable water quality standards. OSM approval procedures for controlling sediment transport include berms, terraces, sediment ponds, and other energy dissipative channel structures that allow water to pond and sediment to accumulate.

Surface Flows and Sediment Transport

The mining of several ephemeral drainages in Area III may result in minor and infrequent decreases in storm-related flows in tributaries to the Chaco River. These streams rarely carry storm runoff that reaches the Chaco River, and the watersheds are small in comparison to the Chaco River watershed. The Navajo Mine is located in a desert-type environment which receives an average of five inches of precipitation per year. When precipitation occurs, infiltration is high and rising temperatures after a storm result in evaporation. BNCC utilizes highwall impoundments to intercept upgradient flow above the active Lowe and Dixon Pits to ensure the miners' safety and to minimize the potential for water in the pits and to decrease the potential for discharges from the downgradient sediment ponds. Upgradient highwall impoundments and downgradient sediment ponds for Area III result in retention of approximately 83.5 percent of the 12.3 square mile Lowe watershed during active mining operations. SEDCAD modeling of the Lowe Arroyo predicts a 12 percent decrease in sediment yield and 44 percent decrease in peak flow storm pre to post mining. There are no existing uses of the Lowe Arroyo, therefore no use of the Lowe Arroyo outside of the permit boundary are precluded. As impacts to drainage area and surface water runoff are predicted to be greater than 30 percent, impacts are considered to be moderate. The closest surface water used to the Lowe Arroyo are along the Chaco River. The Lowe watershed is approximately 0.27 percent of the Chaco River watershed, and the area retained is 0.2 percent of the Chaco River watershed. Consequently, the impact on the flows in the Chaco River is determined to be negligible.

The North Fork (Cottonwood) Diversion intercepts flow within the North Fork upgradient of current and proposed mining in Area III and diverts these flows into the Middle Fork of the Cottonwood Arroyo. Highwall impoundments and downgradient sediment ponds retain approximately 5.2 percent of the Cottonwood watershed and approximately 0.1 percent of the Chaco River watershed. The impact to drainage area for both Cottonwood and Chaco is therefore considered to be negligible, as less than 10 percent of both the Cottonwood and Chaco watersheds will be impacted.

The sediment ponds have the capability to discharge during and/or following large storm events but contain surface runoff from events smaller than the 10-year, 24-hour precipitation in accordance with the NPDES permit. There have been five discharge events from sediment ponds between 1977 and 2005 at Navajo Mine. The North Fork diversion and the highwall impoundments above the active Lowe and Dixon Pits in Area III minimize the flow contained by sediment ponds and the magnitude of any discharges from these ponds.

BNCC has established a stream buffer zone along the main stem of Cottonwood Arroyo, in accordance with SMCRA regulations (BNCC 2011a). Land disturbance associated with surface mining activities is not permitted within this stream buffer zone, unless approved by OSM. The stream buffer protects approximately 3.1 acres of the main stem of Cottonwood Arroyo from mining activities in Area III.

Cottonwood Arroyo would not be impacted by mining activities within Area IV North except for the existing mining haulroad crossing north of the Area IV North mine disturbance and the proposed 0.1 acres of WUS crossing impacts from realignment of Burnham Road (refer to Appendix A).

Ground disturbance associated with construction and mining has the potential to increase sediments carried by storm flows. However, all discharges from mining and mine-related disturbed areas are subject to National Pollutant Discharge Elimination System (NPDES) permitting requirements. The largest source of potential runoff from the proposed mining operation is storm water. All BNCC operations are conducted in accordance with an individual NPDES permit to cover possible discharges from the mine permit area. In addition, BNCC acquires general NPDES stormwater permits as applicable, such as the Multi-Sector General Permit (MSGP) under Sector H for coal mining (i.e., haul roads and access roads). Runoff from disturbed mining and reclamation areas is managed in evaporation ponds designed and certified by Professional Engineers to contain runoff from 10-year, 24-hour storm event. Should discharges occur from these ponds, they would be subject to the applicable NPDES discharge effluent limitations.

BNCC has already constructed one retention pond upstream of mining activities in Area IV North to intercept and detain flow on the western side of Area IV North and would construct another one on the eastern side (refer to Appendix A). These retention ponds are constructed to prevent run-on from entering the active mining areas of Area IV North for the protection of employees and to prevent surface water from commingling with potential contaminants. Direct short-term impacts of Area IV mining would include decreases in storm-related flows to the Cottonwood Arroyo due to the construction of highwall impoundments and sediment ponds. Since these impoundments and ponds have already been constructed in Area IV North, only the duration of the impact is extended under the Proposed Action. As described below, the impacts to area watersheds from the reduced surface flow is considered negligible.

SEDCAD modeling of worst case impacts associated with full mine development of Area IV North indicate a 2 percent change in sediment yields and a 1 percent change in storm runoff downgradient of mining after reclamation in comparison with pre-mine conditions (BNCC 2011a § 11.6). Therefore, impact to Cottonwood Arroyo surface water runoff are considered to be negligible, as they are less than 10 percent and considered to be within background levels.

BNCC would not discharge any water not covered under the final rule 40 CFR Part 434 or the NPDES MSGP. Stormwater runoff that is not permitted under the MSGP within the mine site would be retained on site in sediment ponds until it evaporates or infiltrates. Retention of a majority of the stormwater would reduce impacts to downstream channels due to discharge from the mine site. Through the MSGP, the mine would be required to maintain a Storm Water Pollution Prevention Plan to mitigate potential impacts from discharges allowed under the permit. The mine site would be returned to approximate original contour during the reclamation process, as required by 30 CFR 816.102. This means discharge from the reclaimed mine site would be similar to pre-mine conditions.

Surface water controls required by SMCRA regulations would result in containment of surface runoff from mining areas on the BNCC lease area. Sediment ponds are designed to detain water long enough to allow settling of suspended sediment, and surface-water impoundments retain water permanently. Use of sediment ponds would allow some amount of surface water to be lost, either through infiltration into the ground or evaporation from the surface. This lost surface flow may represent a depletion of surface water

quantity at the permit boundary, relative to the reaches of the local drainage system that are not under a sediment management system. These direct impacts would be intermediate in duration, yet negligible in severity, since the mine site is in a desert environment, and due to the small contribution of the watersheds within the regional Chaco watershed. The sum total of retained watersheds in Areas III and IV North are 0.6 percent of the Chaco watershed.

Reclamation would incrementally re-establish topography with positive drainage towards the Chaco River. Sediment yields in runoff from the reclaimed areas would soon decline below the pre-mine conditions due to improved post-mine vegetation cover resulting from revegetation activities, including mulching, seeding, and irrigating. The runoff from reclaimed areas could have lower sediment yields than the spoils due to the use of topdressing materials, which improve infiltration, as reclamation soils (BNCC 2011a § 11.6).

A direct long-term impact would be the re-establishment of drainages in the post-mine topography. Approximately 10,660 feet of the North Fork of Cottonwood Arroyo would be permanently re-aligned following reclamation. There would be a 93-acre reduction in the post-mining watershed, due to the change in the alignment of the North Fork of Cottonwood following reclamation. This reflects a 0.19 percent change in 80-square mile Cottonwood watershed, and no change in the Chaco watershed, as any long-duration flows would still make it to the Chaco River. Therefore the impact to Cottonwood Arroyo and Chaco River is considered to be negligible as the predicted change is within 10 percent and considered to be within background levels.

Water Quality

Anticipated direct, short-term impacts may include increases of TDS and sulfate concentrations in runoff from disturbed areas, regraded mine spoils, and newly reclaimed areas. During mining, surface runoff from disturbed areas would be retained by BMPs, such as retention ponds, and are unlikely to reach the Chaco River as these structures are designed to contain a 100-year, 6-hour event. Nevertheless, TDS and sulfate concentrations may result from dissolution of weathered geologic materials on the surface (spoils). The water quality of runoff from newly exposed strata and mine spoils in Area III show TDS and sulfate concentrations of 1,200 mg/l and 670 mg/l, respectively (BNCC 2011a § 11.6, Table 11-14i). Ten samples were acquired from sediment ponds in 1976 (SM-series). TDS values ranged from 303 mg/L 21 to 1363 mg/L with a median value of 1300 mg/L. The sulfate and TDS concentrations are above the medianaverage concentrations of 692 and 285 respectively observed in surface water baseline samples from Cottonwood Arroyo. The median values plus one median absolute deviation for TDS and sulfate are 1116 mg/L and 525 mg/L respectively. The median sediment pond TDS of 1300 mg/L is 16 percent higher than baseline median plus one median absolute deviation, and SPLPS runoff from newly exposed strata and mine spoils in Area III sulfate concentrations are 21 percent higher than baseline median plus one median absolute deviation. Therefore it is possible that water quality could occasionally exceed water quality observed in baseline fluctuations during active mining. There are no NNEPA 2007 water quality standards for TDS or sulfate, however, the highest sediment pond sample TDS concentrations of 1363 mg/L and the SPLP sulfate value of 670 mg/L are both well below livestock criteria recommended by Lardy and Stoltenow. Consequently, current and potential future use for livestock watering is not expected to be precluded. Given the potential for short term occasional exceedances of water quality observed in baseline fluctuations during active mining, and that uses will not be precluded, impacts are considered to be minor.

Trace constituents in spoil leachate are below detection limits—except for fluoride and boron. These parameters are well below their corresponding Navajo Nation livestock and wildlife use criteria. Manganese was also detected, but has no livestock and wildlife use criterion (NNEPA 2007). Post mining, once reclamation criteria are met and ponds are removed, TDS and sulfate concentrations in flows downstream of the mine, are likely to be comparable to baseline conditions. Thus, there would be a negligible impact on downstream surface water quality.

Post reclamation, direct intermediate-term impacts may include a beneficial improvement in the water quality of surface runoff from reclaimed areas in Area IV North, as most of the area proposed for mining is comprised of sodic badland soils and areas disturbed by accelerated weathering from uncontrolled natural combustion of shallow coals. However, the water quality improvement in runoff from reclaimed areas is unlikely to result in measurable changes in surface water quality in Cottonwood Arroyo. This will be a negligible impact, due to the small acreage of mine reclamation relative to the total drainage area of Cottonwood Arroyo, and due to the high variability in the baseline surface water quality. The variation in the source of flow, whether it be NAPI return flow, snow melt, or storm events, contributes more to the actual water quality than any anticipated change from runoff over better reclaimed soils.

Comments have also been raised about the potential impacts of mining and from coals dust from mining operations on water quality of stock ponds. Two samples were obtained in year 2008 from Stevenson's Pond located immediately adjacent to Area IV North. The results of these samples are presented in Table 4.2-2. Results from both samples meet applicable surface water criteria for livestock use. The samples meet all the relevant aquatic use criteria except for cadmium, which exceeds the chronic aquatic criteria for the estimated hardness of the pond water. These results indicate that stock ponds located adjacent to active mining operations are not expected to have major impact with respect to livestock use.

Table 4.2-2. Surface Water Quality at Stevenson's Ponds

Analysis Parameter	Sample Date			
		7/21/08		8/12/08
Alkalinity as CaCO3 (mg/L)		312		-
Aluminum, D (mg/L)	<	0.10		
Aluminum, T (mg/L)		-		1.83
Arsenic, D (mg/L)	<	0.005		
Arsenic, T (mg/L)			<	0.0025
Barium, D (mg/L)		0.208		-
Barium, T (mg/L)		-		0.1550
Bicarbonate as CaCO3 (mg/L)		312		-
Boron, D (mg/L)		0.2		0.1
Cadmium, D (mg/L)		0.0083		0.01397
Calcium, D (mg/L)		44.6		-
Carbonate as CaCO3 (mg/L)	<	10		
Chloride (mg/L)		19		-
Chromium, D (mg/L)	<	0.01	<	0.01
Cobalt, D (mg/L)		-		0.00030
Electrical conductivity (EC) (µs/cm)		608		-
Copper, D (mg/L)		0.014		0.0068
Fluoride (mg/L)		1.2		-
Hydroxide as CaCO3 (mg/L)	<	10		
Iron, D (mg/L)		0.05		-
Iron, T (mg/L)		383		-
Lead, D (mg/L)	<	0.001	<	0.0016
Magnesium, D (mg/L)	<	0.5		
Manganese, D (mg/L)		0.357		-
Manganese, T (mg/L)		9.26		-
Mercury, T (mg/L)		0.0008	<	0.0002
Nitrate/Nitrite as N (mg/L)		0.03		
pH (su)		7.80		-
Phosphorous, T (mg/L)	<	0.05		
Potassium, D (mg/L)		7.5		-
Sodium adsorption ratio (SAR)		0.7		-
Selenium, D (mg/L)	<	0.010		
Selenium, T (mg/L)				0.002
Settleable solids (mL/L)		37.9		
Silver, D (mg/L)	<	0.0005		
Sodium, D (mg/L)		86.4		-
Sulfate (mg/L)		39		
Total dissolved solids (mg/L)		380		-
Total suspended solids (mg/L)		9200		-
Vanadium, D (mg/L)		-		0.0064
Zinc, D (mg/L)		0.02		0.006

Surface Water Use

No change to surface water use is expected. Due to generally poor water quality, water uses in the Project Area are limited to stock watering. BNCC has provided water to local permittees in tanks for livestock use in areas around the coal mine. Within Area III, the upland highwall pond—Lowe Impoundment #1—would be retained as a permanent impoundment to provide a stock watering water supply. BNCC is continuing discussions with the local community to address the concern raised in scoping regarding coal dust in stock ponds located near disturbance areas and stockpiles. Water quality data are not available for this impoundment although the water is expected to be suitable for livestock use given the samples from the Stevenson Pond and from sediment ponds as discussed above. No changes in surface water uses are expected from mining in Area IV North.

Waters of the U.S.

Proposed mining in Area III would impact about 1.0 acres of ephemeral channels; about 0.7 acre in Area IV North; and 0.1 acre along Burnham Road. No special aquatic sites are located here or would be impacted by the Proposed Action. BNCC proposes to avoid and minimize impacts to WUS by employing BMPs to control runoff, erosion, and sedimentation; by providing stream buffers during mining; by reclaiming mined areas and restoring long-term hydrologic balance; and by compensating for temporal loss of aquatic functions by creation and enhancement of riparian and wetland habitats. Additional details are provided in the 404(b)(1) Analysis in Appendix A.

Burnham Road Realignment

The proposed Burnham Road realignment would include seven crossings of WUS including two crossings of Cottonwood Arroyo (refer to Appendix A). Each of the crossings would be constructed with culverts to ensure safe travel during precipitation events. Appendix A includes detailed descriptions of each crossing including the width and depth of the channels, the acres of impacts, and the anticipated amount of fill within the streambed. The Burnham Road crossings were designed and constructed to minimize their effect on a channel's flow hydraulics and sediment transport ability. Appendix A includes engineered drawings of each WUS crossing. Water would continue to flow past each culvert road crossing with only minimal and localized hydraulic affect. Water and sediment control for the Burnham Road realignment construction would be performed in accordance with the project SWPPP. BMPs would be implemented under this plan to control water and sediment.

4.2.2.2 Proposed Action with Conditions

Under this Alternative, impacts would be the same as those described for the Proposed Action; however, additional surface water monitoring information would help ensure the accurate characterization of stream flow variability in the area that would be used for the North Fork permanent channel design.

This additional condition is authorized under OSM Performance Standard 816.41(a) – Hydrologic-balance protection. This regulatory authority enables OSM to require additional preventative, remedial, or monitoring measures to assure that material damage to the hydrologic balance outside the permit area is prevented. As such, this alternative is expected to reduce impacts to water resources relative to those impacts described under the Proposed Action.

4.2.2.3 No Action Alternative

Under the No Action Alternative, the mine permit revisions would not be approved and no further mining activities would occur in Area IV North and the area would be reclaimed per BNCC's SMCRA permit. Burnham Road would not be realigned. Mining activities would continue as permitted in Area III. Impacts from mining activities in Area III have been assessed previously and are not expected to differ appreciably in nature from what is described above, however; the intensity of mining activities would be expected to decrease over time as mineable coal is depleted

4.3 Noise and Vibration

4.3.1 Impact Assessment Methodology

4.3.1.1 Noise

Although there are no regulatory limits for noise impacts from the project, the EPA guidelines established under the Noise Control Act of 1972 can be used to assess the acceptability of project-related noise. The EPA guideline uses the 24-hour noise metric and sets a noise level of 55 dBA L_{dn} as the acceptable limit for outdoor use areas (EPA 1974). Because there are no other enforceable noise standards that apply to the project, the EPA acceptable noise level will be used as the criteria for evaluating noise impacts from the project.

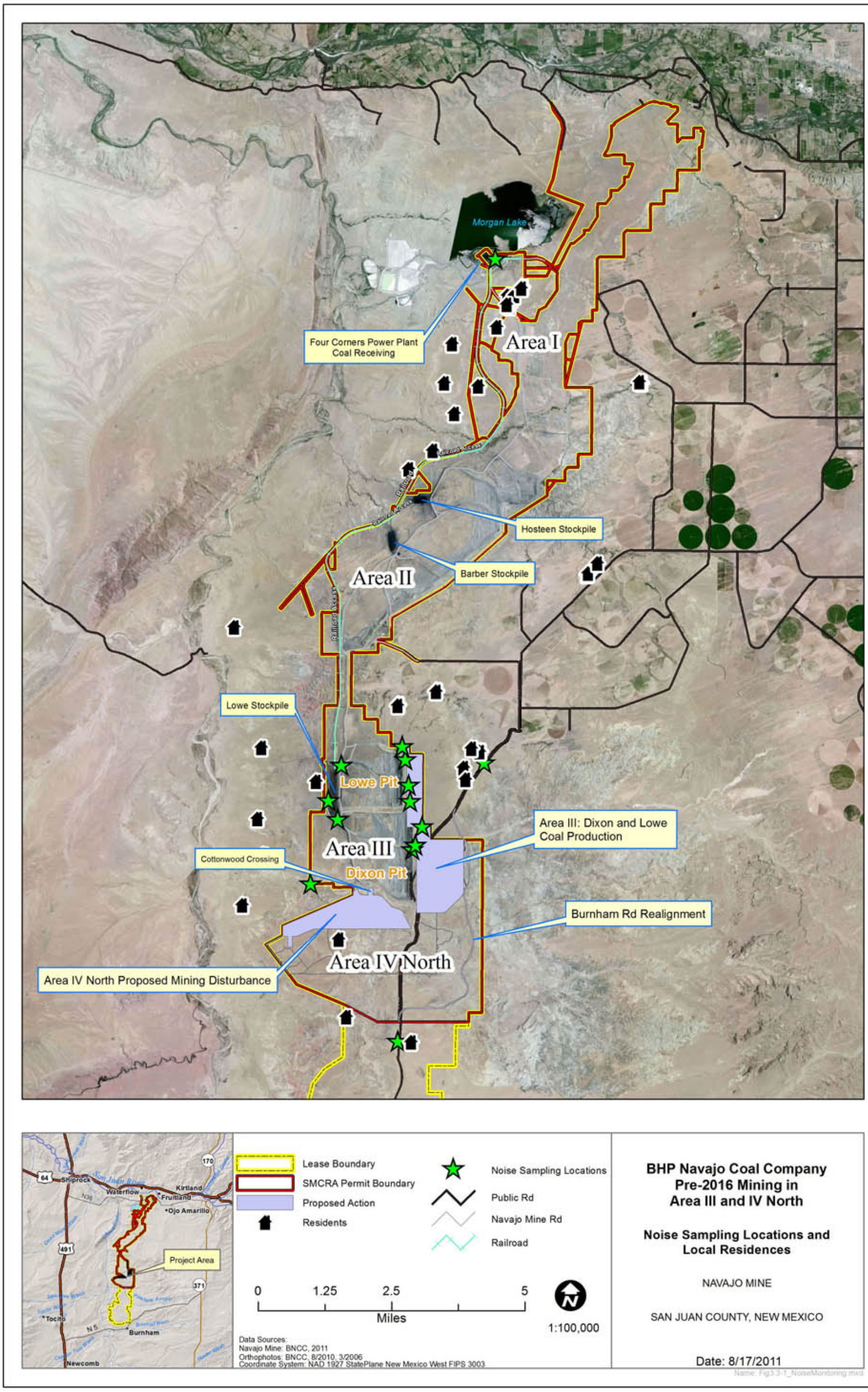
The methodology for evaluating potential noise impacts from mining activities from the Proposed Action is based on the procedures of ISO 9613-2:1996, *Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation*. This international standard procedure is widely used for propagation and evaluation of environmental noise over distances and is the basis for calculation protocols in numerous computer models, including CadnaA and SoundPlan. Such computer models require complex information on scheduling and daily duration of each noise-producing activity to be able to calculate and propagate noise levels. Since detailed information was not available, the methodology involved simple spreadsheet calculations based on the ISO 9613-2:1996 standard. The procedure essentially involved determining the maximum noise levels during the various stages of mining activities, based on noise data from equipment manufacturers, the Federal Highway Administration's database of construction equipment noise levels (FHWA 2006), and field measurements around the existing mining areas, and then propagating those maximum noise levels from Area IV North and Area III to the nearest residential dwellings.

4.3.1.2 Vibration

Vibration impacts for this analysis are described based on the OSM Blasting Performance Standards contained in 30 CFR 816.67. A chart of the Blasting Criteria Level from the regulations is contained in Figure 3.3-2 of this document. To ensure that no adverse impacts occur from blasting operations, BNCC typically uses the scaled-distance equation contained in the regulations to determine the allowable charge weight of explosives. The scaled-distance equation includes a factor of safety to ensure that the maximum PPV is not exceeded. Seismic monitoring would be needed if the scaled-distance equation shows that the maximum PPV may be exceeded for a certain blast.

The methodology for evaluating potential vibration impacts relies on existing seismic monitoring provided by BNCC, along with standard vibration propagation rates to calculate potential vibration levels at the nearest residential dwellings to the planned blasting areas.

Figure 4.3-1. Noise Sampling Locations and Area Residences



4.3.2 Impacts

4.3.2.1 Proposed Action

Noise levels and noise impacts from the Proposed Action are directly related to the number and types of heavy equipment being used for the specific activity. The most comprehensive database of construction and heavy equipment source noise is maintained by the Federal Highway Administration (FHWA) (2006). The database was created in conjunction with the EPA and is widely used for highway and non-highway projects.

Table 4.3-1 lists equipment noise source data and the quantity of equipment to be used in the permit area at Navajo Mine and likely for the Proposed Action. The acoustical usage factor is the percentage of time that the equipment is typically in use over a given period of time. Noise levels are determined based on the average noise level or L_{eq}, which is calculated from the peak noise level (L_{max}) and the acoustical usage factor using the following equation (FTA 2006):

$L_{eq} = L_{max} + 10 \log(\text{usage factor})$

These data were compared with, and are consistent with, field measurements throughout the Navajo Mine. Though not all equipment used in the existing SMCRA permit area would be used for the Proposed Action, these sources represent the maximum number that would be expected.

Table 4.3-1. Equipment Source Noise and Quantity in Permit Area

Equipment	Peak Noise Level at 50 feet (dBA L_{max})	Acoustical Usage Factor (%)	Quantity
Draglines	87	40	3
Overburden drills	81	20	3
Coal drills	81	20	1
Dozers	82	40	12
Rubber tire dozers	82	40	1
Front-end loaders, large	79	40	7
Front-end loaders, small	79	40	3
Graders	85	40	4
Scrapers	84	40	3
Coal haul trucks	76	40	5
End dump haul trucks	76	40	8
Mix trucks	79	40	2
Water trucks	76	40	3
Cable reels	75	20	2
Locomotives (electric)	78	50	2
Rail cars	65	50	40

Equipment	Peak Noise Level at 50 feet (dBA L_{max})	Acoustical Usage Factor (%)	Quantity
Stemming trucks	75	40	1

Source: FHWA 2006

The closest receiver is approximately 4,000 feet from the mining operations. Vibration levels from surface mining operations are typically less than 0.10 to 0.20 inches per second (in/sec) at 10 feet from the source. Ground-borne vibration dissipates very rapidly with distance, reducing the typical mining-related vibrations to an imperceptible level at about 200 feet from the source—well before reaching the nearest residence at 4,000 feet. Consequently, mining-related vibrations are generally not an issue for receivers at that distance, except for blasting activities. Therefore, impacts from ground-borne vibration were evaluated only for blasting activities.

Finally, because noise levels diminish with increasing distance from the noise-generating activity, noise levels are directly related to the distance to the nearest noise-sensitive receiver or residential home. As mentioned in Section 3.3.2.1, the nearest residence is approximately 4,000 feet from the edge of the proposed mining disturbance area and approximately 4,500 feet from the nearest proposed dragline. All residences within approximately one mile of the mining disturbance area for Area IV North and Area III were evaluated for noise and vibration impacts.

Mining Activities

The vast majority of activities under the Proposed Action fall under the general category of mining activities, which consists of a progression of activities listed and described in Chapter 2 of this document. These activities would use most of the equipment listed in Table 4.3-1. The noise evaluation is based on the data in the table along with the actual ambient noise measurements conducted around the active portions of the Navajo Mine, which were presented in Table 3.3-4.

The highest noise levels from mining activity would be associated with coal removal, producing an estimated noise level of 83 dBA L_{eq} at 50 feet from operating equipment. Vegetation and topdressing removal activities throughout the disturbance area would produce an estimated noise level of 81 dBA L_{eq} at 50 feet from the operating equipment. Overburden and interburden removal near the coal seams would produce an estimated noise level of nearly 78 dBA L_{eq} at 50 feet from the operating equipment.

Impacts for noise are based on the 24-hour L_{dn} noise metric, rather than a one-hour L_{eq} noise metric. As defined in Section 3.3.1.1, the 24-hour L_{dn} noise metric is an overall noise level incorporating noise over an entire 24-hour period and includes a 10-dBA nighttime penalty for noise occurring between 10 p.m. and 7 a.m. Conversely, the one-hour L_{eq} noise metric is an average over a shorter time period and does not include any penalties for nighttime noise. The noise evaluation, therefore, propagated the estimated short-term noise levels to the nearby residences, and then calculated the 24-hour L_{dn} noise level. The evaluation assumed that the estimated noise levels from activities along the coal seams were constant around the clock, but that estimated noise levels from other activities within the disturbance area, such as the vegetation and topdressing removal, were constant for only 12-hours of the day, from 7:00 a.m. to 7:00 p.m. The evaluation also assumed an average nighttime noise level of 35 dBA L_{eq}, consistent with the lowest measured ambient noise levels at nearby residences.

Although blasting activities cause high instantaneous noise levels measured at 94 dBA L_{max} at 300 feet or nearly 110 dBA L_{max} at 50 feet from the blast, the duration of the noise is very brief, lasting only a few seconds. Blasting is typically only conducted during the daytime, therefore nighttime noise standards would not apply to blasting. Nighttime blasting would only occur during emergencies, where there are safety or equipment hazards that would require detonation outside of daytime hours. When averaged over time for either the 1-hour L_{eq} or the 24-hour L_{dn} noise metrics, the influence of blasting activities to the overall noise environment is small.

Table 4.3-2 shows the calculated noise levels at each of the surrounding receivers, which are all residences, including the peak hourly daytime L_{eq} noise level, the 24-hour L_{dn} noise level, and whether the noise level constitutes a noise impact based on the EPA guideline, 24-hour noise levels of 55 dBA L_{dn} or greater are considered to be impacted.

Table 4.3-2. Calculated Noise Levels and Impact Determination at surrounding residences for Mining Activities

Receiver ID	Distance and Direction from Area IV North or Area III Activity Area	Hourly Noise Level (dBA L_{eq})	24-hour Noise Level (dBA L_{dn})	Impact
Removal of vegetation and topdressing – daytime only activity				
A4N-3	4,500 feet west	41.9	43.0	None
A3-1	3,880 feet north	43.2	43.6	None
A3-2	3,990 feet north	43.0	43.5	None
A3-3	4,325 feet east	42.3	43.2	None
A3-4	4,500 feet east	41.9	43.0	None
Blasting of overburden, interburden, and coal* – daytime only activity				
A4N-3	4,850 feet west	41.9	43.0	None
A3-1	4,180 feet north	43.2	43.6	None
A3-2	4,290 feet north	42.9	43.4	None
A3-3	4,625 feet east	42.3	43.2	None
A3-4	4,800 feet east	42.0	43.0	None
Drilling and removal of overburden and interburden – daytime and nighttime activity				
A4N-3	4,850 feet west	38.3	44.7	None
A3-1	4,180 feet north	39.6	46.0	None
A3-2	4,290 feet north	39.3	45.7	None
A3-3	4,625 feet east	38.7	45.1	None
A3-4	4,800 feet east	38.4	44.8	None
Removal of coal – daytime and nighttime activity				
A4N-3	4,850 feet west	43.3	49.7	None
A3-1	4,180 feet north	44.6	51.0	None

Receiver ID	Distance and Direction from Area IV North or Area III Activity Area	Hourly Noise Level (dBA L_{eq})	24-hour Noise Level (dBA L_{dn})	Impact
A3-2	4,290 feet north	44.3	50.7	None
A3-3	4,625 feet east	43.7	50.1	None
A3-4	4,800 feet east	43.4	49.8	None

* As noted in the text, instantaneous noise from blasts were measured at 94 dBA L_{max} at 300 feet from the blast. This calculates to peak instantaneous noise levels of 70 to 80 dBA L_{max} at the seven residences; however, this noise level would last only a few seconds and quickly dissipate.

Noise level results from mining activities shown in Table 4.3-2, range from 43.0 dBA L_{dn} to 51.0 dBA L_{dn}, which are all below the impact threshold of 55 dBA L_{dn}. The analysis revealed no noise impacts from coal removal activities.

Because ground-borne vibration dissipates rapidly with distance from the source, typically reaching an imperceptible level at 200 feet from the source, and because the nearest residence is more than approximately 4,000 feet from the edge of the mining disturbance area, there would be no perceptible impact from ground-borne vibrations from most of the mining activities in Area IV North. The possible exception would be ground-borne vibrations from blasting activities. However, as described in Section 4.3.1.2, BNCC typically uses the scaled-distance equation contained in the OSM regulations establishing blasting performance standards to determine the allowable charge weight of explosives to ensure that no adverse vibration impacts occur from blasting operations. The scaled-distance equation includes a factor of safety to ensure that the maximum PPV is not exceeded. Seismic monitoring would be needed if the scaled-distance equation shows that the maximum PPV may be exceeded for a certain blast. Because of these controls on blasting operations and because blasting does not occur at night, substantial impacts are not expected from noise or ground-borne vibrations from blasting operations.

Transportation of Coal

The network and infrastructure for transporting coal is already in place and operating from the FCPP down to the existing active mining areas in Area III. The Proposed Action would involve using off-highway haul trucks to transport the coal from Area III and IV North along existing haul roads to the coal stockpile located in Area III. From the Area III stockpile, the coal would be loaded into the rail cars and transported to the coal sizing and blending facility next to FCPP. The noise evaluations for this component of the project include both the continued use of the existing rail line and haul roads. As shown in Table 4.3-3, noise levels from coal transportation were calculated to range from 41.4 dBA L_{dn} to 43.0 dBA L_{dn}, which are all below the impact threshold of 55 dBA L_{dn}. Therefore, the analysis revealed no noise impacts from coal transportation.

Table 4.3-3. Calculated Noise Levels and Impact Determination at Surrounding Residences for Coal Transportation

Receiver ID	Distance and Direction from Area IV North Activity Area	Hourly Noise Level (dBA L_{eq})	24-hour Noise Level (dBA L_{dn})	Impact
Construction of haul road and rail line extensions – daytime only activity				
A4N-3	4,500 feet west	41.9	43.0	None
Operation of haul road and rail line extensions – daytime and nighttime activity				
A4N-3	4,500 feet west	32.9	41.4	None
A3-1	3,880 feet north	34.2	41.4	None
A3-2	3,990 feet north	34.0	41.4	None
A3-3	4,325 feet east	33.3	41.4	None
A3-4	4,500 feet east	32.9	41.4	None

As described above, because ground-borne vibration dissipates rapidly with distance from the source, and because the nearest residence is approximately 4,000 feet from the edge of the coal transportation area, there would be no impact from ground-borne vibrations from the coal transportation activities.

Burnham Road

As part of the Proposed Action, Burnham Road would be realigned further to the east to accommodate the active and proposed mining areas. The noise evaluation of this component of the project includes the construction of the realigned Burnham Road.

Only one residence, Receiver A4N-4, is located within one mile of the Burnham Road realignment. Noise level calculations were conducted for this receiver only. As shown in Table 4.3-4, the noise level from the Burnham Road realignment was calculated to be 46.2 dBA L_{dn}, which is below the impact threshold of 55 dBA L_{dn}. Therefore, the analysis revealed no noise impact from the realignment of Burnham Road.

Table 4.3-4. Calculated Noise Levels and Impact Determination at Surrounding Residences for Burnham Road Realignment

Receiver ID	Distance and Direction from Area IV North Activity Area	Hourly Noise Level (dBA L_{eq})	24-hour Noise Level (dBA L_{dn})	Impact
Construction of Burnham Road Realignment – daytime only activity				
A4N-4	2,310 feet south	47.7	46.2	None

Because ground-borne vibration dissipates rapidly with distance from the source, typically reaching an imperceptible level at 200 feet from the source, and because the nearest residence is more than 2,300 feet from the Burnham Road realignment area, there would be no or minimal impact from noise or ground-borne vibrations from the construction of the Burnham Road realignment.

Reclamation

The reclamation activities would involve many of the same equipment used during active mining operations described above. Therefore, the noise evaluation for the reclamation component of the project was similar to that for the mining activities component. Reclamation consists of backfilling and grading, replacement of topdressing, revegetation, and reclamation monitoring. As shown in Table 4.3-5, noise levels from reclamation activities were calculated to range from 43.0 dBA L_{dn} to 43.6 dBA L_{dn}, which are all below the impact threshold of 55 dBA L_{dn}. Therefore, the analysis revealed no noise impacts from reclamation activities.

Table 4.3-5. Calculated Noise Levels and Impact Determination at Surrounding Residences for Reclamation Activities

Receiver ID	Distance and Direction from Area IV North Activity Area	Hourly Noise Level (dBA L_{eq})	24-hour Noise Level (dBA L_{dn})	Impact
All reclamation activities – daytime only activity				
A4N-3	4,500 feet west	41.9	43.0	None
A3-1	3,880 feet north	43.2	43.6	None
A3-2	3,990 feet north	43.0	43.5	None
A3-3	4,325 feet east	42.3	43.2	None
A3-4	4,500 feet east	41.9	43.0	None

Because ground-borne vibration dissipates rapidly with distance from the source, typically reaching an imperceptible level at 200 feet from the source, and because the nearest residence is approximately 4,000 feet from the edge of the reclamation area, there would be no impact from ground-borne vibrations from the reclamation activities for the Proposed Action.

4.3.2.2 Proposed Action with Conditions

Under this Alternative, impacts would be the same as those described for the Proposed Action.

4.3.2.3 No Action Alternative

Under the No Action Alternative, the mine permit revisions would not be approved. No mining activities would occur in Area IV North and the area that had been previously prepared for mining would be reclaimed per BNCC's SMCRA permit. Burnham Road would not be realigned. Mining activities would continue as permitted in Area III. There would be no change to current noise or vibration levels at residential dwellings around Area IV North. Impacts from mining activities in Area III have been assessed previously and are not expected to differ appreciably in nature from what is described above, however, the intensity of mining activities would be expected to decrease over time as mineable coal is depleted in Area III.

4.4 Visual Resources

4.4.1 Impact Assessment Methodology

Potential effects to visual resources were determined by using BLM's visual resource methodology, which compares landscape sensitivity with the degree and type of visual change that is proposed. Adverse effects to visual resources can occur when: (1) an action perceptibly changes features of the physical environment so that they no longer appear to be characteristic of existing conditions in the subject locality or region, (2) an action introduces new features, colors or textures to the physical environment that are perceptibly uncharacteristic of the region and/or locale, or (3) aesthetic features of the landscape become less visible or are removed (BLM Handbook H-8410-1).

Potential effects to visual resources were determined using a Visual Sensitivity – Visual Change method of impact analysis (see Section 3.4) supplemented with additional BLM visual resource analysis documentation. This method analyzes the contrasts between existing conditions at KOPs (see Figure 3.4-1) and expected views following project implementation to evaluate the degree of change that may occur because of the action. Viewshed analysis mapping was used to identify areas that the project may be visible from and to help establish KOPs. Eight KOPs were identified (see Table 3.4-1). During analysis it was determined that future public access to KOP sites 2 and 3 would be restricted as a result of currently permitted mining activities. Accordingly, these KOPs were eliminated from further analysis and the remaining sites (1, 4, 5, 6, 7, and 8) were utilized in the visual resource evaluation.

Some factors used in determining potential impacts on visual resources at the KOP locations included: (1) the existing visual quality associated with the site and vicinity, (2) the level of public interest in the existing landscape characteristics and concern over potential changes, (3) visibility, frequency, and duration that the landscape is viewed, (4) viewing distance and degree to which project components would dominate the view of the observer, (5) resulting contrast of the proposed facilities or activities with existing landscape characteristics, and (6) the extent to which project features or activities would block views of higher value landscape features. All of these factors were evaluated at each of the six KOP locations considered.

Table 4.4-1. Visual Quality Rating Guide

Visual Quality Rating	Visual Quality Criteria
High	Landscape elements (landforms, vegetative patterns, water characteristics and cultural features) have high visual appeal
	Landscape has high degrees of variety, vividness, intactness, harmony, and uniqueness (attributes)
	Distinctive landscape that attracts people to view
Moderate-to-High	Landscape elements have moderate-to-high visual appeal
	Landscape attributes have a mix of moderate and high values
	Landscape may contain built features that neither complement nor detract from overall visual quality

Visual Quality Rating	Visual Quality Criteria
Moderate	Landscape elements are moderately appealing
	Landscape attributes have common or ordinary values
	Landscape may contain discordant built features but they are subordinate
Low-to-Moderate	Landscape elements have low-to-moderate appeal
	Landscape has weak or missing attributes
	Landscape may have prominent though not dominant discordant built features
Low	Landscape elements have low-to-no appeal
	Landscape is missing some attributes
	Landscape is dominated by discordant built features

Under the Visual Sensitivity–Visual Change methodology, the degree of impact is a function of overall visual sensitivity and visual change. Actual parameter determinations (e.g., visual contrast, project dominance, and view blockage) are based on analyst experience and site-specific circumstances. Table 4.4-2. Visual Resource Impact Potential illustrates the interrelationship between overall visual sensitivity and visual change; this relationship was used in defining the potential impacts associated with the Proposed Action as discussed below.

Table 4.4-2. Visual Resource Impact Potential

OVERALL VISUAL SENSITIVITY	OVERALL VISUAL CHANGE			
	Low	Low to Moderate	Moderate	Moderate to High
Low	Not Substantial[1]	Not Substantial	Adverse but Less Than Substantial	Adverse but Less Than Substantial
Low to Moderate	Not Substantial	Adverse but Less Than Substantial	Adverse but Less Than Substantial	Adverse but Less Than Substantial
Moderate	Adverse but Less Than Substantial[2]	Adverse but Less Than Substantial	Adverse but Less Than Substantial	Adverse and Potentially Substantial
Moderate to High	Adverse but Less Than Substantial	Adverse but Less Than Substantial	Adverse and Potentially Substantial	Adverse and Potentially Substantial
High	Adverse but Less Than Substantial	Adverse and Potentially Substantial[3]	Adverse and Potentially Substantial	Substantial[4]

[1] Not Substantial impacts may or may not be perceptible but are considered minor in the context of existing landscape characteristics and view opportunities.

[2] Adverse but Less Than Substantial impacts are perceived as negative but do not exceed environmental thresholds that define parameters in Table 4.4-1.

[3] Adverse and Potentially Substantial impacts are perceived as negative and may exceed environmental thresholds depending on project and site-specific circumstances.

[4] Substantial impacts with feasible mitigation may be reduced to levels that are less than significant or avoided all together. Without mitigation, substantial impacts would exceed environmental thresholds.

4.4.2 Impacts

Table 4.4-3 summarizes the visual impacts from the KOPs. Appendix D summarizes the factors used to analyze potential project effects for both the No Action Alternative and the Proposed Action, including how the information and conclusions were derived.

Table 4.4-3. Summary of Visual Impacts

Location	No Action			Proposed Action		
	Description of Visual Changes	Overall Visual Change	Potential Impact	Description of Visual Changes	Overall Visual Change	Potential Impact
KOP 1	Permitted mining activities in Area III would be visible to the east	Low to Moderate	Not Significant	Mining in Area IV North would be visible to the south; the proposed Burnham Road realignment will be visible; mine activities, dust and nightlighting would occur over a longer duration.	Moderate	Adverse but Less Than Significant
KOP 4	Permitted mining activities in Area III would be visible on the horizon to north/northwest.	Low to Moderate	Not Significant	Mining in Area IV North would be visible to the north; the proposed Burnham Road realignment will be visible to north within a 0.25 mile; mine activities, dust and nightlighting would occur over a longer duration.	Moderate	Adverse but Less Than Significant
KOP 5	Some slight increase in visibility of night lighting and dust.	Low	Not Significant	Same as No Action.	Low	Not Significant
KOP 6	Permitted mining	Low to Moderate	Not Significant	Mining in Area IV North would extend	Moderate	Adverse but Less Than

Location	No Action			Proposed Action		
	Description of Visual Changes	Overall Visual Change	Potential Impact	Description of Visual Changes	Overall Visual Change	Potential Impact
	activities would be extend to the east.			south and become more visible; mine activities, dust and nightlighting would be visible for longer duration.		Significant
KOP 7	Permitted mining activities would be visible to the east of existing disturbance.	Low	Not Significant	Mining in Area IV North would be visible to the south of existing mining; mine activities, dust and night lighting would be visible for longer duration.	Low	Not Significant
KOP 8	No change	Low	Not Significant	Nightlighting would be visible for longer duration.	Low	Not Significant

4.4.2.1 Proposed Action

Activities that would result in direct impacts to visual resources would include the continuation of permitted mining activities in Area III, the proposed expansion of mining activities into Area IV North and the realignment of Burnham Road to the east and south of existing mining activities. Indirect effects, such as construction dust, haze, and night lighting would continue through the life of the proposed mining and were accounted for in the visual impacts analysis. Implementation of dust suppression measures would reduce, but not completely eliminate, potential short-term effects to visual resources in the Project Area.

Only KOP locations 1, 4, and 6 would experience visual changes that are adverse, but not significant, largely due to the more dominant views of proposed mining, new views of the Burnham Road realignment, and the longer-term duration of visible fugitive dust and night lighting. Changes in views at KOP locations 5, 7, and 8, under the Proposed Action, would experience low degrees of visual change that are not significant, due primarily to their distance from the Project Area (middleground to seldom seen). In general, areas located within one mile of the Proposed Action activities would experience moderate visual changes that are not considered significant. More distant views would experience a lower degree of visual change.

Visual change associated with mining would be short term. Once mining operations are completed in Area III and Area IV North, reclamation in these areas would be implemented and the landscape would return to visual conditions similar to pre-mined lands. The visual change associated with the realignment of Burnham Road would be long term.

4.4.2.2 Proposed Action with Conditions

Under this Alternative, impacts are the same as the Proposed Action.

4.4.2.3 No Action Alternative

Direct effects to visual resources would result from currently permitted mining activities in Area III. Indirect effects, such as generation of fugitive dust and night lighting, would continue through the duration of mining and reclamation activities in Area III. These were considered in the analysis of visual effects. Dust suppression measures would reduce these short-term effects. Since coal mining is currently occurring in the area, the contrast with overall existing conditions and future permitted activities would be minimal.

Only KOPs 1 and 6 would continue to experience visual changes that are low to moderate but not significant. Changes in views at other KOPs would be low and not significant. In general, areas located within one mile of the activities would continue to experience low to moderate but not significant visual changes. Areas in more distant zones would experience low degrees of visual change. As with the Proposed Action, visual change associated with mining would be short term. Reclamation would restore the landscape to visual conditions similar to pre-mined lands.

4.5 Air Quality

4.5.1 Impact Assessment Methodology

Under the CAA, a proposed change at a new or modified major source of air pollutants generally is first examined in terms of the emissions increase resulting from that change. Quantitative “Significance” levels are defined by rule for such increases to identify projects that may have a discernable effect on air quality. If a project may have increased emissions above the Significance levels, then the proposed change is subsequently evaluated in more detail to assess its potential impact on air quality in accordance with EPA’s methodology for new or modified sources.

Key CAA criteria provide useful metrics that define whether project emissions or ambient air quality impacts that warrant description in an environmental assessment with respect to air quality resources. In particular, the CAA regulations establish “Significant Impact Levels” (SIL) that are quantitative, ambient air concentrations for each criteria pollutant below which it is presumed a project will not have a discernable effect on air quality. The SILs are lower than the comparable health-based NAAQS, and offer a suitable screening tool for air quality affects. Predicted ground level concentrations from refined air dispersion modeling of project emissions can be compared to applicable SILs to assess whether that project may have discernable affects on local air quality.

The AQRA for this environmental assessment first considered project emission changes relative to CAA Significance criteria. The methodology for quantifying emission levels for the various mining and support activities associated with active mining at Navajo Mine, including the Proposed Action, was described in Section 3.5.2.1. EPA and other regulatory bodies have published emission factors or emission equations for particulate matter emissions from numerous fugitive dust sources at western surface coal mines (e.g., EPA Document AP-42, § 11.9). Particulate-emitting activities addressed in AP-42 include topsoil

removal by scraper, drilling of overburden or coal, blasting of overburden or coal, dragline for overburden, truck loading by power shovel, bulldozing overburden or coal, grading, haul truck, bottom dump truck unloading, end dump truck unloading, train loading, overburden replacement, active coal storage piles, and wind erosion of exposed areas. In those instances where AP-42 does not provide an emission factor or equation for a particular surface mining activity, an AP-42 emission factor or equation for the same general type of activity in a related minerals product industry has been applied. In addition, this analysis also includes estimates of gaseous tailpipe emissions from mining vehicles and equipment, and assessment of greenhouse gas (GHG) emissions from the Proposed Action.

Estimates of particulate matter emissions from mining and reclamation activities in existing Area III, and Area IV North under the Proposed Action, have been based generally on applicable AP-42 emission factors for western surface coal mining. This methodology (EPA 1995) has been used to calculate estimated PM_{10} and $PM_{2.5}$ emissions from each of the individual pollutant-emitting activities associated with the existing mine baseline (No Action) and for the Proposed Action. Table 3.5-3 presents the published emission factors and correlations used to quantify particulate emissions from Navajo Mine operations.

Dispersion modeling tools offer an accepted method to assess project impacts on ambient PM_{10} and $PM_{2.5}$ concentrations within the AQRA. After establishing emission levels for PM_{10} and $PM_{2.5}$, as described in Section 3.5.2.3, EPA's AERMOD model was applied in a non-regulatory, screening manner in concert with two pre-processor codes: AERMET to process the meteorological data for input and AERMAP to process terrain elevation data and generate receptor information for input. This modeling was completed to estimate the distance from the mine boundary for potential impacts associated with the generation of fugitive dust and deposition associated with particulates. For this comparison, the regulatory SILs were used as the criteria to identify the extent of discernable effects, even though the predicted ground level concentrations were well below the health-based NAAQS thresholds (See Table 3.5-1).

4.5.2 Impacts

4.5.2.1 Proposed Action

Under the Proposed Action, Navajo Mine's annual coal production rate will remain essentially the same as the mine's baseline coal production rate of 8.5 million tpy. Further, implementation of the Proposed Action means that mining will commence for the first time in Area IV North. From 2012 through 2016, a targeted amount of annual coal production will come from new mining activities in Area IV North, and the remainder of the mine's total production of 8.5 million tpy will come from existing, continued mining operations that remain in Area III.

4.5.2.1.1 Assessment of Emissions under the Proposed Action

Navajo Mine's estimated air pollutant emissions with the Proposed Action can be compared to current estimates of those emissions from the mine. This analysis serves to demonstrate that mine emissions, including those of PM_{10} and $PM_{2.5}$, will remain essentially at current levels with emissions from some sources slightly decreasing while from others increasing. In total, it can be shown that the balance of these changes does not cause increases that approach the regulatory significance quantities for each criteria pollutant.

Sources of emissions from Areas III and IV North have been sub-divided into the following categories, as listed in Table 4.5-1 to quantify the mine's total emissions for the existing baseline condition and with the Proposed Action.

Table 4.5-1. Roster of Emission Source Categories at Area III and Area IV North

Area III Emission Source	Area IV North Emission Sources
Overburden Drilling and Blasting	Overburden Drilling and Blasting
Coal Seam Drilling and Blasting	Coal Seam Drilling and Blasting
Overburden Dragline Stripping	Overburden Dragline Stripping
Mine Extraction Operations and Loading	Mine Extraction Operations and Loading
Coal Haul Truck to Stockpiles	Coal Haul Truck to Stockpiles
Unloading at Stockpile & Railcar Loading	Unloading at Stockpile and Railcar Loading
Plant Vehicle Travel	Plan Vehicle Travel
Wind Erosion – Soil/Overburden Spoil Pile	Wind Erosion – Soil/Overburden Spoil Pile
Wind Erosion – Coal Stockpile	Wind Erosion – Coal Stockpile
Reclamation – Mine Pit Backfilling, Grading, and Topdressing	Reclamation – Mine Pit Backfilling, Grading, and Topdressing
Preparation Plant	Wind Erosion – Un-reclaimed Open Area

The same types of mining activities, vehicle travel, reclamation activities, and wind erosion will occur in both Navajo Mine Areas. The Area III baseline case also includes emissions from the existing coal preparation plant, encompassing coal transfer from railcar unloading to the conveyance to the FCPP. Under the Proposed Action, all emissions from the existing coal preparation plant continue to be designated as occurring in Area III, even though some coal going to the preparation plant will be mined from Area IV North.

Particulate emissions from Navajo Mine under the Proposed Action were estimated by applying the same methodology used for estimating Navajo Mine's baseline emissions, as explained in Section 3.5. Particulate emission rates for individual operations were estimated using accepted emission factor correlations for western surface coal mining in EPA Document AP-42, primarily from Sections 11.9, and 13.2 (EPA 1995). For each pollutant-generating activity at the mine, the estimated emissions were calculated based on:

- An applicable emission factor or emissions equation for that activity

- An operating "rate" of that particular activity such as tons processed, or vehicle miles traveled (these parameters were based on an underlying annual combined coal production of 8.5 million tpy from Areas III and IV North)
- A "control efficiency", if applicable, for the equipment, device, work practice, or combination thereof used for suppressing generation of emissions and/or for removing emitted particulate matter from the subject activity (based on representative efficiencies for the particular equipment, device, etc. reported primarily in AP-42)

Annual emissions for other criteria pollutants, primarily gaseous pollutants from blasting and vehicle exhaust, were quantified using agency-approved emissions factors (See details in Appendix F). Operation of diesel-fueled non-road mining vehicles and equipment generates emissions of NO_X, CO, PM_{10}/$PM_{2.5}$, and VOC. The South Coast Air Quality Management District (SCAQMD) has compiled a set of emissions factors for diesel-engine powered construction equipment and off-road vehicles published as part of the SCAQMD Emissions Handbook (SCAQMD 1993). The SCAQMD emissions factors are used in this analysis because they are considered the most complete set of emissions factors for construction-equipment sources and are used in air quality impact evaluations throughout the US. These SCAQMD factors account for the adoption of increasingly stringent diesel engine performance standards (e.g., USEPA Tier II and Tier III diesel engine standards), and incorporate the benefit of reduced emissions as new construction vehicles and equipment enter into use. Values of the SCAQMD emissions factors and emission calculations are provided in tables provided in Appendix F.

Table 4.5-2 provides estimates of annual emissions of criteria pollutants from Area III's different mining and reclamation activities, its processing facilities, and wind erosion under the Proposed Action. Table 4.5-2 includes annual estimates of gaseous pollutant emissions from blasting, mine vehicles, and from the mine's various non-road engines.

Table 4.5-2. Estimated Emissions from Area III under the Proposed Action

Emission Source Category [1]	Area III Emissions (tons/yr)				
	PM_{10}	$PM_{2.5}$	NO_X	CO	VOC
Overburden Drilling and Blasting	1.72	0.50	2.50	9.84	--
Coal Seam Drilling and Blasting	2.47	0.72	30.70	121.0	--
Overburden Dragline Stripping	32.20	2.85	--	--	--
Mine Extraction Operations and Loading	105.9	11.60	68.06	31.13	7.40
Coal Haul Truck to Stockpiles	138.8	13.88	62.96	34.19	7.11
Plant Vehicle Travel	130.9	13.09	17.25	5.07	1.72
Unloading at Stockpile and Railcar Loading	0.36	0.11	--	--	--
Reclamation	65.73	13.15	--	--	--
Preparation Plant (ex. storage piles)	13.89	4.05	--	--	--
Wind Erosion (coal and spoils piles)	30.15	10.78	--	--	--

Emission Source Category [1]	Area III Emissions (tons/yr)				
TOTAL - Area III Emissions with Proposed Action	522.3	70.7	181.5	201.2	16.2

[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 average baseline level of 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.

Table 4.5-3 provides comparable estimates of annual emissions of each criteria pollutant from Area IV North under the Proposed Action. This tabulation is based on the operating assumption that Area III and Area IV North combined production will closely match the representative annual Proposed Action production level of 8.5 million tons per year. Detailed calculations for this inventory are provided in Appendix F.

Table 4.5-3. Estimated Emissions from Area IV North under the Proposed Action

Emission Source Category 1	Area IV Emissions (tons/yr)				
	PM_{10}	$PM_{2.5}$	NO_X	CO	VOC
Overburden Drilling and Blasting	1.64	0.47	2.50	9.84	--
Coal Seam Drilling and Blasting	2.36	0.68	30.70	121.0	--
Overburden Dragline Stripping	30.76	2.72	--	--	--
Mine Extraction Operations and Loading	77.63	8.98	73.68	34.44	8.04
Coal Haul Truck to Stockpiles	137.6	13.76	62.42	33.89	7.05
Plant Vehicle Travel	49.8	4.98	16.48	4.84	1.64
Unloading at Stockpile and Railcar Loading	0.35	0.11	--	--	--
Reclamation	58.78	11.76	--	--	--
Wind Erosion (coal and spoils piles)	28.67	10.25	--	--	--
TOTAL - Area IV North Emissions with Proposed Action	387.6	53.7	185.8	204.0	16.7

[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 average baseline level of 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.

Navajo Mine's total emissions after implementation of the Proposed Action would be represented by the aggregate annual emissions from Areas III and IV North, as shown below in Table 4.5-4.

Table 4.5-4. Estimated Total Emissions from Navajo Mine with Proposed Action

Emission Source Category 1	All Emissions (tons/yr)				
	PM_{10}	$PM_{2.5}$	NO_X	CO	VOC
Overburden Drilling and Blasting	3.36	0.97	5.00	19.68	--
Coal Seam Drilling and Blasting	4.83	1.40	61.4	242.0	--

Emission Source Category 1	All Emissions (tons/yr)				
Overburden Dragline Stripping	62.96	5.57	--	--	--
Mine Extraction Operations and Loading	183.59	20.58	141.74	65.57	15.44
Coal Haul Truck to Stockpiles	276.4	27.64	124.4	68.08	14.16
Plant Vehicle Travel	180.7	18.07	33.73	9.91	3.36
Unloading at Stockpile and Railcar Loading	0.71	0.22	--	--	--
Reclamation	124.72	24.91	--	--	--
Preparation Plant (ex. storage piles)	13.89	4.05	--	--	--
Wind Erosion (coal and spoils piles)	58.82	21.03	--	--	--
TOTAL - Areas III & IV North Emissions with Proposed Action	909.86	124.43	367.3	405.2	32.9

[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 average baseline level of 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.

The emissions changes due to the Proposed Action compared to the Area III baseline case can be compared to the regulatory Significance levels provided under CAA regulations. Table 4.5-5 compares the total emissions from the mine under the Proposed Action (Table 4.5-4) to the mine's total baseline emissions before the Proposed Action (Table 3.5-4).

Table 4.5-5. Emission Increase (Decrease) from Proposed Action

Selected Action Scenario	All Emissions (tons/yr)				
	PM_{10}	$PM_{2.5}$	NO_X	CO	VOC
Area III & Area IV North Emissions Under the Proposed Action	909.9	124.4	367.3	405.2	32.9
Area III Baseline Emissions (Table 3.5-4)	906.3	128.3	362.5	408.0	32.2
Emissions Increase (Decrease) Due to Proposed Action	3.6	(3.9)	4.8	(2.8)	0.7
CAA Emissions Increase Significance Levels	15	15	40	100	40

Table 4.5-5 confirms the Proposed Action is projected to result in small relative increases in annual emissions of PM_{10} (3.6 tpy), NO_X (4.8 tpy), and VOC (0.7 tpy). These are well below the CAA Significance levels of 15 tpy for direct PM_{10} and 40 tpy each for NO_x and VOC. In sum, the Proposed Action will not cause a "significant" air emission increase, as defined by the CAA, for any pollutant from the Navajo Mine. Consequently, for purposes of regulatory analysis and permitting the Proposed Action does not result in emissions changes that would warrant in-depth analysis. While it can be assumed that the location of the mining emissions sources would be in different locations under the Proposed Action than under current operations, the modeling analysis discussed in the next section illustrates that the extent of particulate concentrations beyond the mine's boundary would not be substantially affected.

4.5.2.1.2 Modeling Analysis of Particulate Impacts

Although changes in emissions due to the Proposed Action do not exceed regulatory Significance criteria, refined dispersion modeling of particulate emissions was completed in order to quantify the extent to which these emissions from the Navajo Mine tend to disperse. The object of the modeling exercise was to identify the distances from the mine boundary to which ground-level concentrations may reach the SIL levels described in Section 4.5.1. These regulatory SIL concentrations are well below the health-based NAAQS for particulates, and are generally accepted as indicators of minimal air quality effects resulting from a project.

EPA's AERMOD model (40 CFR Part 51, Appendix W) was applied in a non-regulatory, screening manner in concert with two pre-processor codes: AERMET to process the meteorological data for input and AERMAP to process terrain elevation data and generate receptor information. One year of on-site meteorological data collected at Navajo Mine from April 2009 through March 2010 was used to operate the model, as representative of current and future year meteorological conditions.

Design of the dispersion model followed accepted regulatory assessment practices. Specific areas within the mine that are projected for overburden removal, coal extraction and reclamation over the course of a year during the Proposed Action were represented in the model as a set of large, rectangular area sources. Haul roads were included in the model as a sequence of volume sources positioned along the paths of those roads. A radial receptor grid was constructed with the centroid at the center of the boundary separating Area III from Area IV, a set of radii were laid out at 10-degree intervals, and receptors for AERMOD concentration calculations were spaced 5 km apart along each radius.

For the Proposed Action case, AERMOD predicted the highest 24-hour PM_{10} concentration that would occur at each receptor location. These concentration values, in units of microgram per cubic meter ($\mu g/m^3$) appear on the topographic plots provided in this section. The receptor point was identified along each radial grid line where the highest predicted 24-hour PM_{10} concentration was equal to the 24-hour PM_{10} SIL of 5.0 $\mu g/m^3$. These receptors having 5.0 $\mu g/m^3$ concentrations were connected to form an isopleth representing the extent of SIL concentrations for 24-hour PM_{10}. The 5.0 $\mu g/m^3$ isopleth shown in Figure 4.5-1 indicates that the farthest predicted extent of Navajo Mine's PM_{10} impact above the regulatory SIL on a 24-hour basis is located due north of the mine at a distance of about 12.5 km from the origin of the receptor grid, or roughly 6 to 6.5 km beyond the boundary of the mine. The remaining concentration values on the figure show how the concentrations decay with distance outward from the mine.

This modeled result can be compared to typical monitored 24-hour PM_{10} concentration within the AQRA of 140 $\mu g/m^3$ near the mine boundary. This suggests that airborne PM_{10} levels near the mine may be reduced by dispersion as much as 95 percent (i.e., to 5 $\mu g/m^3$ or less) at a distance no greater than 6 to 6.5 km from the mine's boundary. This rapid decay in airborne concentrations is reasonable, because mining emissions are released near ground level with relatively low potential for long-range transport. In addition, it should be recognized that because the mine total particulate emission rates are virtually unchanged under the Proposed Action, the extent of particulate concentration affects modeled here would be similar to those that occur currently.

AERMOD was also used to predict the maximum extent of average annual PM_{10} concentrations. In a similar manner, the model identified the location on each radial grid line where the PM_{10} annual concentration was 1.0 $\mu g/m^3$ (i.e., the SIL level for annual concentrations of PM_{10}). The annual 1.0 $\mu g/m^3$ isopleth shown in Figure 4.5-2 was constructed following the technique described for the 24-hour average modeling. In this case, the farthest extent to which the airborne PM_{10} emissions attributable to mine sources caused ground level concentrations above the SIL on an annual basis was located about 5 km and due north from the mine's boundary. This indicates that longer-term ambient air affects due to mine emissions are less than short-term predicted concentrations.

The same modeling process with AERMOD was repeated using estimated $PM_{2.5}$ emissions from Navajo Mine under the Proposed Action. As shown in Figure 4.5-3, the isopleth corresponding to the extent of predicted $PM_{2.5}$ concentrations that are equal to or above the 24-hour SIL of 1.2 $\mu g/m^3$ for extends to a distance of about 10 km from the mine's boundary in three different directions (i.e., north-northeast, southeast and southwest). Similarly, AERMOD predicted annual $PM_{2.5}$ concentrations and extent of concentrations at or above the annual SIL of 0.3 $\mu g/m^3$ for $PM_{2.5}$ due to the mine's emissions. Figure 4.5-4 shows the resulting isopleth line that defines annual $PM_{2.5}$ affects, which extend to a distance of about 5 km from the mine boundary.

The ambient air impacts due to $PM_{2.5}$ emissions under the Proposed Action are also predicted to be abated by normal dispersion. Unlike $PM_{10,}$ ambient $PM_{2.5}$ concentrations are not monitored inside the AQRA. As noted previously for emissions estimates, the ratio of $PM_{2.5}$ emissions to PM_{10} emissions at a typical western surface coal mine is typically about 0.10 (EPA 1995; Pace 2005). Therefore, based on monitored levels of PM_{10} at the mine, high levels of $PM_{2.5}$ emissions near the mine boundary are estimated to be on the order of 14 $\mu g/m^3$ (i.e., 10 percent of the typical 140 $\mu g/m^3$ PM_{10} monitored level by Navajo Mine within the AQRA). Based on the modeled extent of the SIL concentration due to the mine's $PM_{2.5}$ emissions, this suggests that $PM_{2.5}$ levels at the mine may be reduced by natural dispersion by as much as 90 percent at a distance of 10 km from the mine boundary. In the case of $PM_{2.5}$, it was also found that mine total particulate emission rates are virtually unchanged under the Proposed Action, so that the extent of particulate concentration affects modeled here would be similar to those that occur currently.

Dispersion modeling of air quality impacts from Navajo Mine's particulate emissions also allows for estimation of the dry deposition rate of those particles. As shown at the top, or northern-most edge of Figure 3.5-2, the average annual ambient PM_{10} concentration near the San Juan River due to mine sources alone is predicted to be on the order of 0.1 $\mu g/m^3$. A representative value for the dry deposition velocity of large (>2 μm) particles on exterior surfaces is 1.0 cm/sec (EPA 2001). Multiplying the above PM_{10} concentration times that deposition velocity results in an annual average particle dry deposition rate of 3.6 $\mu gPM_{10}/hr\text{-}m^2$ for mine-related emissions in the area of the San Juan River closest to the mine.

Based on the concentrations of specific elements typically contained within the mined material, it is possible to estimate deposition rates of those individual elements from the mine. Total mercury (Hg) concentrations in overburden materials at Navajo Mine range from <0.1 to 0.8 mg/kg with a median of 0.2 mg/kg. The inventory of air emissions in Table 4.5-4 show that 60 percent of PM_{10} emissions are from coal-based activities (e.g., blasting, extraction, and transportation) while the remaining 40 percent of the emissions are from non-coal sources (e.g., overburden). Multiplying the weighted median Hg concentration in overburden and coal (0.104 mg Hg/kg PM_{10}) times the previously calculated annual

average PM_{10} dry deposition rate results in an estimated annual average dry deposition rate of mercury equal to 3.2 nanogram Hg/yr-m^2. This amount equates to three-billionth of a gram deposited over an entire year, a vanishingly small quantity in the natural environment. It can be concluded that the estimated rate of annual dry deposition of mercury in the area of the San Juan River due to Navajo Mine's emissions is extremely low, and not likely to create additional environmental effects.

Similar analysis for selenium deposition is based on measured concentrations of selenium (Se) in coal at Navajo Mine that range from <0.3 to 1.2 mg/kg with a median of 0.35 mg/kg. Likewise, total Se concentrations in overburden materials at Navajo Mine range from <1 to < 2 mg/kg with a median of 1.5 mg/kg. With the previously noted 60:40 ratio of coal-based activities to overburden operations, the weighted mean Se relatively concentration in particles emitted from Navajo Mine is estimated to be 0.81 mg Se/kgPM_{10}. Multiplying that concentration of selenium in the particulate matter, times the previously calculated annual average PM_{10} dry deposition rate results in an estimated annual average dry deposition rate of selenium equal to 24.9 nanogram Se/yr-m^2.

Figure 4.5-1. 24-hour PM_{10} SIL Isopleth and Surrounding Concentrations

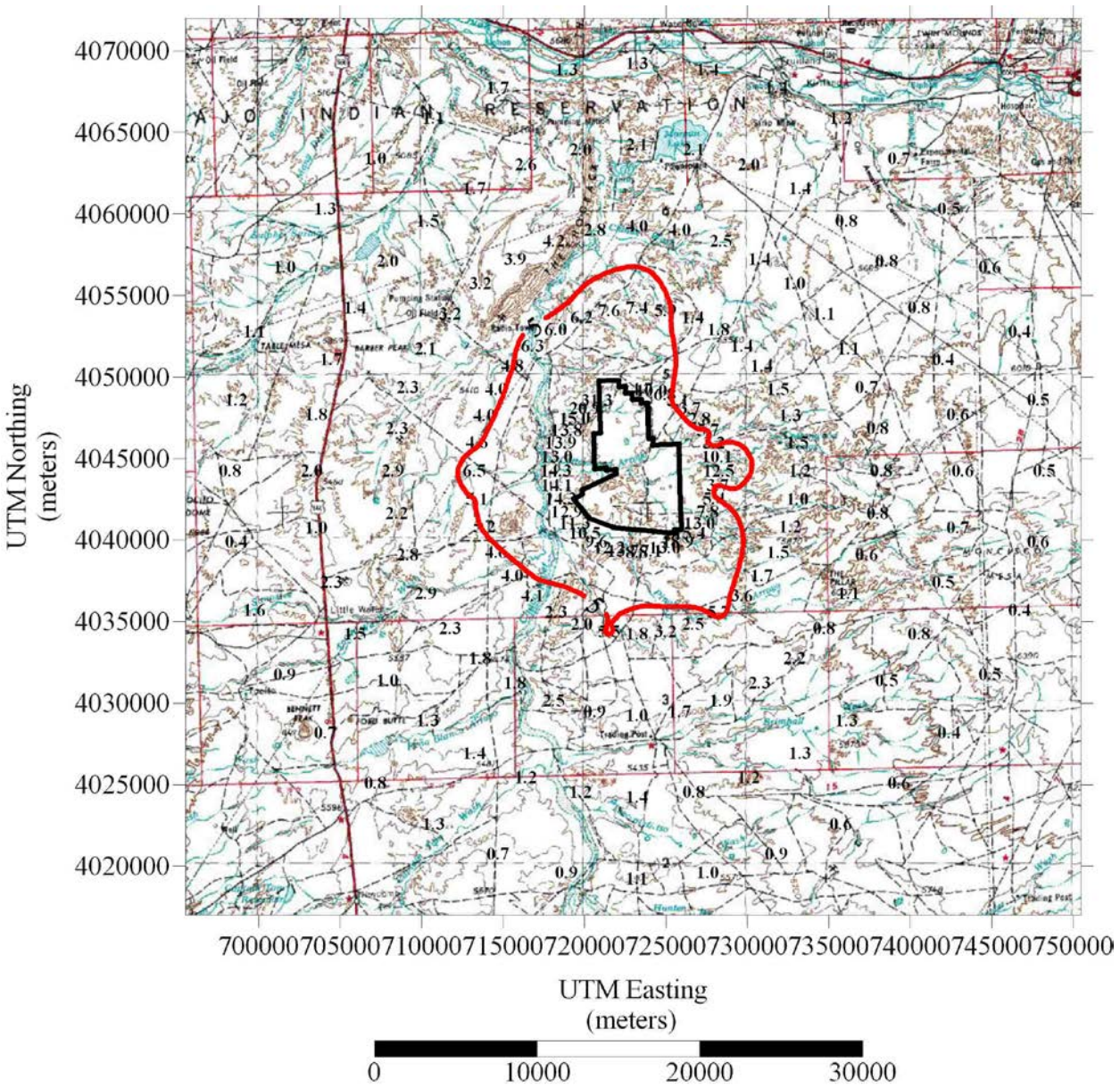


Figure 4.5-2. Annual PM_{10} SIL Isopleth and Surrounding Concentrations

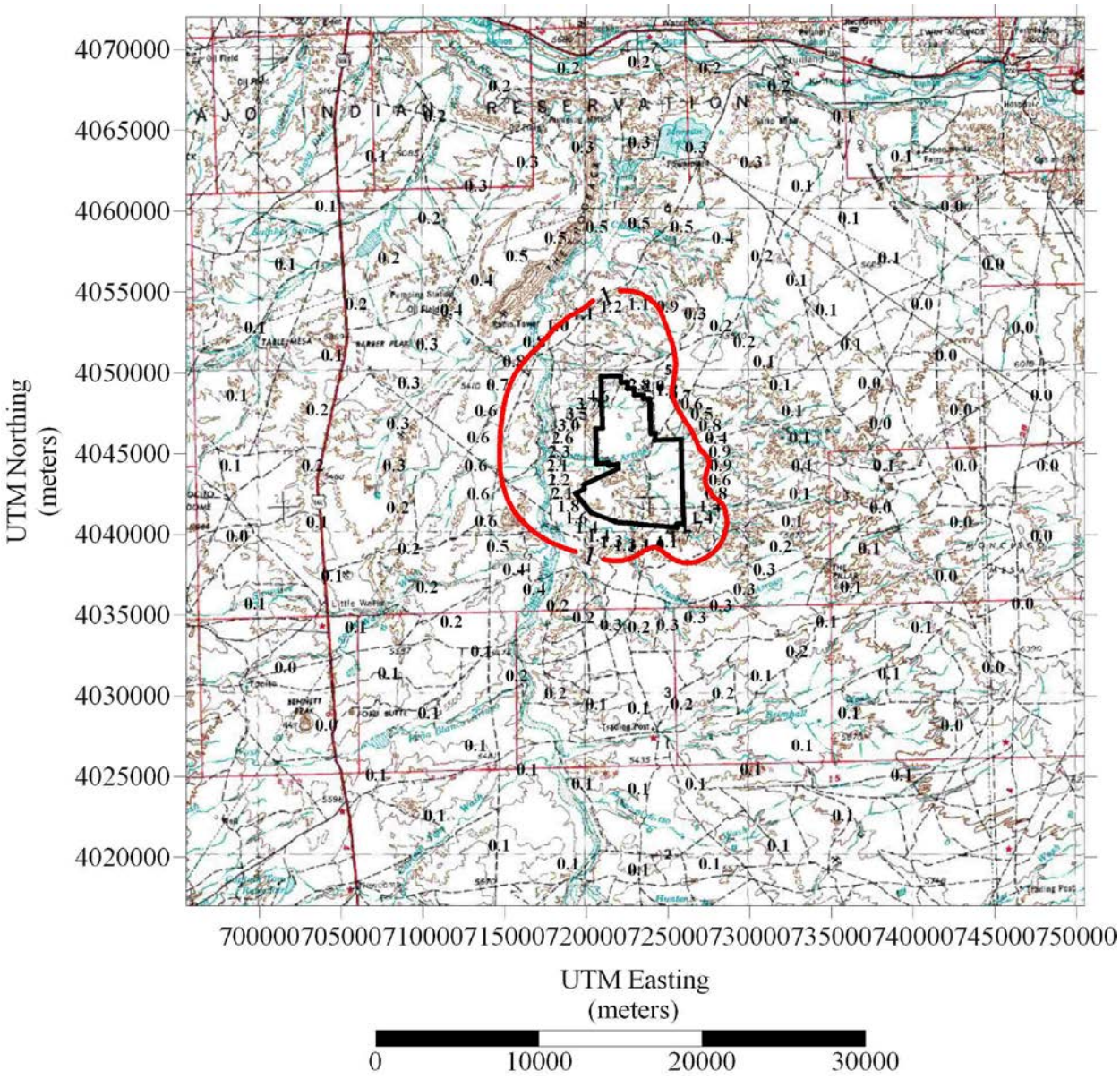


Figure 4.5-3. 24-Hour $PM_{2.5}$ SIL Isopleth and Surrounding Concentrations

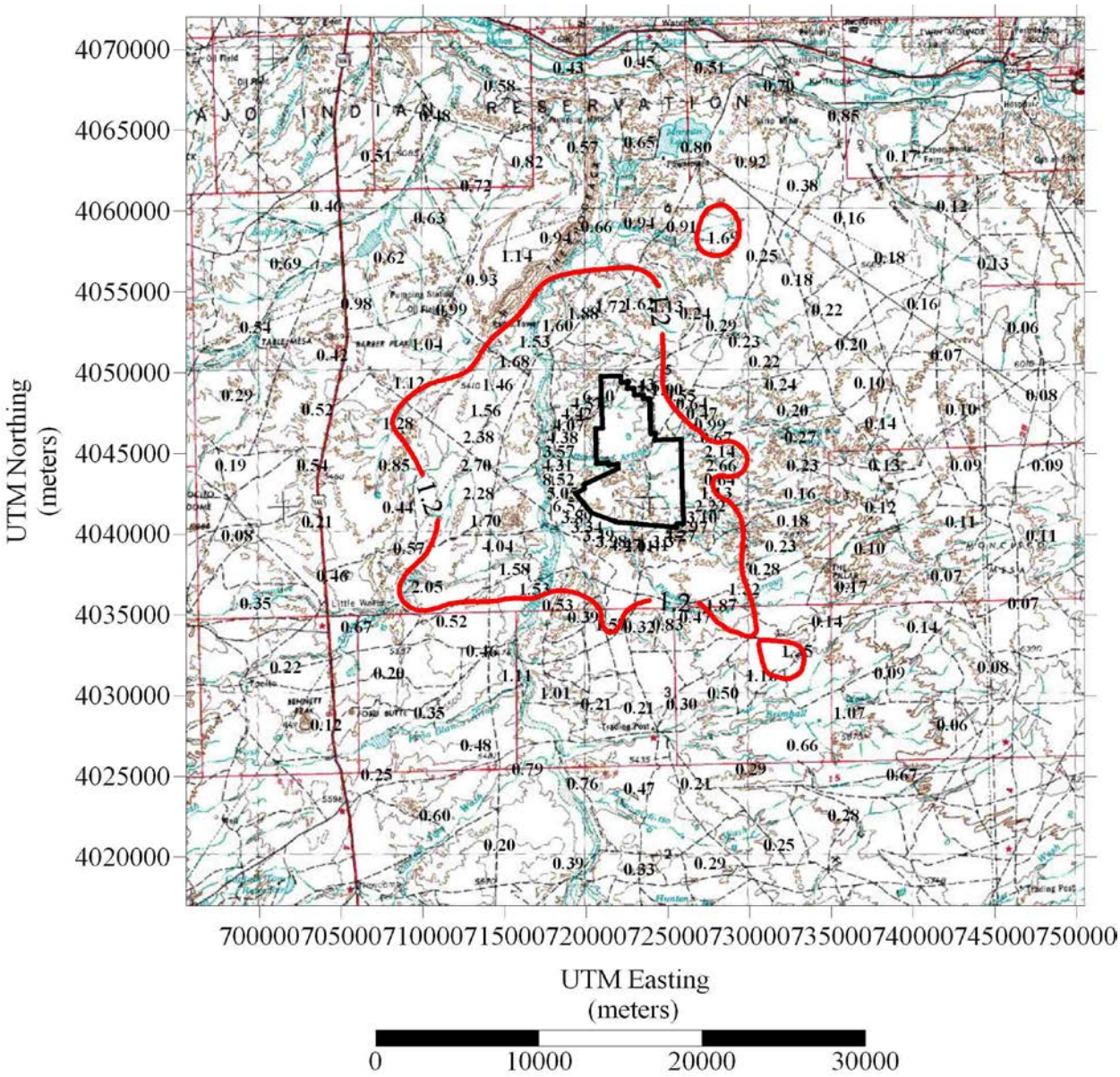
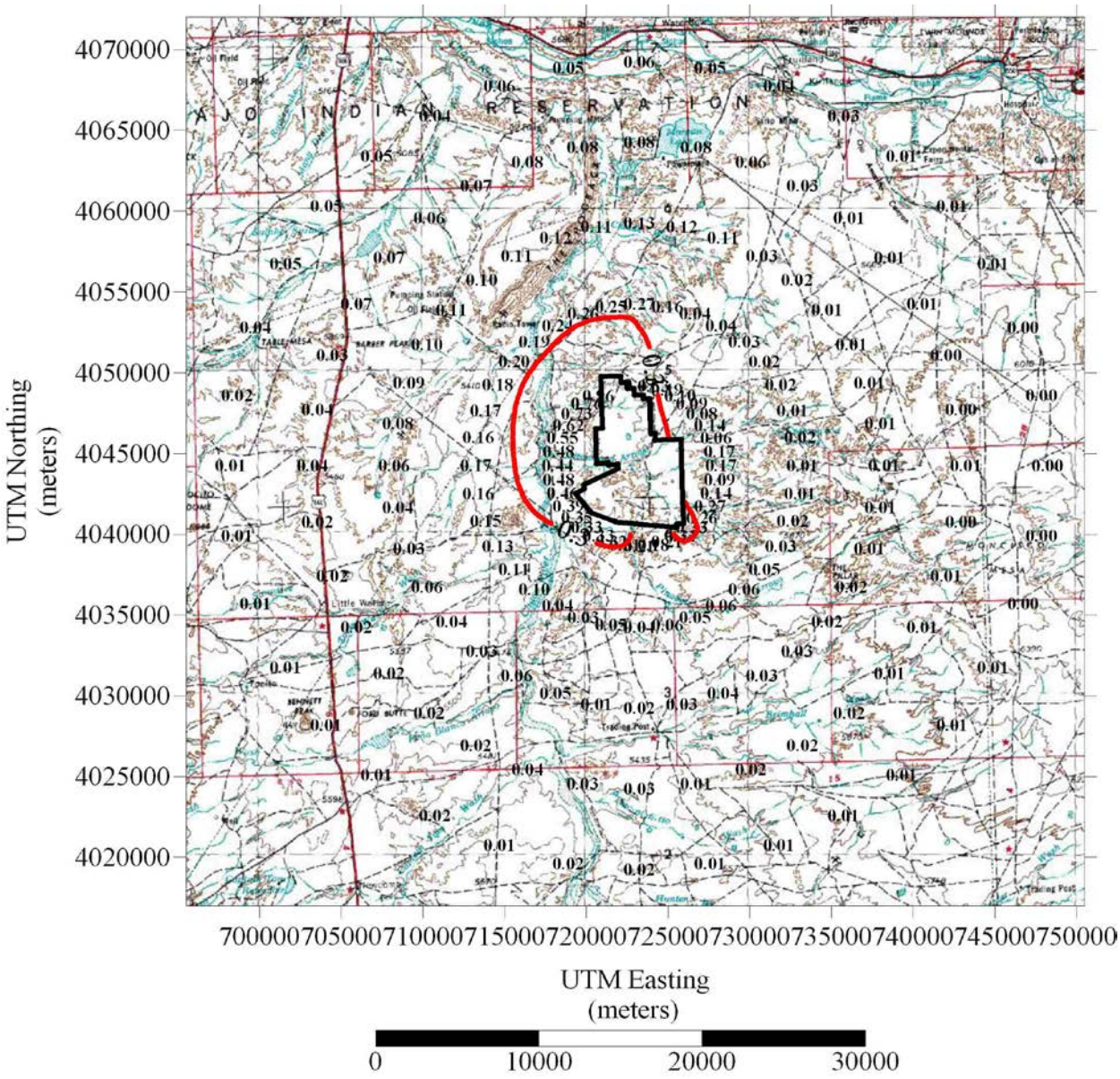


Figure 4.5-4. Annual $PM_{2.5}$ SIL Isopleth and Surrounding Concentrations



From both NEPA and CAA perspectives, this assessment of predicted increases in ambient levels of PM_{10} and $PM_{2.5}$ indicate that total emissions from the Proposed Action standing alone will not cause discernable alteration of currently acceptable ambient levels of PM_{10} and $PM_{2.5}$ in the AQRA. Moreover, the finding that criteria pollutant emissions increases due to the Proposed Action are well below regulatory significance levels implies that the project will not affect current ambient conditions in the AQRA.

4.5.2.1.3 Emissions from Burnham Road Relocation

Relocation of Burnham Road—a component of the Proposed Action—is estimated to result in a maximum land disturbance of approximately 75 acres. That conventional surface road-building project will result in temporary emissions of fugitive dust and engine exhausts that normally accompany such construction. As addressed in prior environmental assessments, particulate matter is the primary pollutant emitted by a road project of this nature. A typical emissions assessment using applicable emission factors and equipment activity rates can provide a conservative estimate of this project's temporary emissions. Measures such as watering and restrictions on vehicle speeds in active work areas can reduce the amounts of particulate matter emitted during road construction. As explained in Section 1.2, OSM had previously approved this proposed road realignment after a 2008 environmental assessment of the project.

The realigned road will be properly graded, compacted, and maintained to avoid the accumulation of fine particles on the road surface, which can easily become entrained in the air by passing vehicles. Because of minimizing particle accumulation on the new road, the level of particulate matter emitted per vehicle mile traveled on the new road is expected to be less than the particulate emission rate from the current roadway. However, at this time there is no reliable means for quantifying that anticipated reduction in traffic-generated particulate emissions once the relocation of Burnham Road has been completed.

4.5.2.1.4 Regional Haze

In preparing its regional haze, the SIP and the NMED examined regional emissions of the following pollutants believed to either cause or contribute to visibility impairment in mandatory federal Class I areas:

- Fine particulate matter (Soil-$PM_{2.5}$)
- Coarse particulate matter ($PM_{2.5-10}$)
- Elemental carbon (EC)
- Primary organic aerosol (POA)
- Oxides of nitrogen (NO_x)
- Sulfur dioxide (SO_2)
- Volatile organic compounds (VOC) and ammonia (NH_3) (New Mexico Section 309(g) SIP at 48)

From that group of pollutants, Navajo Mine emits, in total, major source amounts of fine particulate matter (Soil-$PM_{2.5}$), coarse particulate matter ($PM_{2.5-10}$) and oxides of nitrogen (NO_x).

The Proposed Action will result in slight increases in PM_{10} and NO_X, and a decrease in $PM_{2.5}$ emissions, as shown in Table 4.5-4. Regional haze is affected by large emissions sources, typically from elevated stacks with the potential to be transported substantial distances and participate in atmospheric reactions that create haze particles. In light of the small emissions changes and the near ground-level emission characteristics of the Navajo Mine sources, it is reasonable to conclude that the Proposed Action will not result in increased long-range pollutant transport or visibility impairment in any mandatory federal Class I area.

4.5.2.1.5 GHG Emissions and Climate Change

Because the Proposed Action does not involve a change in the annual coal production from Navajo Mine, there will be no appreciable change in the operating rates of the mining activities or in the various mobile sources (non-road engines and motor vehicles) that support those mining activities. Navajo Mine's annual GHG emissions with the Proposed Action are summarized in Table 4.5-6. The mine's total GHG emissions with the Proposed Action are estimated to be 70,252 Mtpy CO_2e. This represents a 1,890 Mtpy CO_2e reduction in GHG emissions below current GHG emission baseline (reported as 72,142 Mtpy CO_2e). The decrease is mainly due to reduction in coal haul truck travel distances under the Proposed Action, and because end-dump truck operation for overburden stripping will not be necessary as Area IV North is developed. The largest single category of GHG emissions, surface coal mine methane, will be largely unchanged under the Proposed Action, since total coal production is not projected to increase substantially.

Table 4.5-6. Estimated Annual GHG Emissions with Proposed Action, Mtpy CO_{2e}

Emission Source Category	CO_2	CH_4	N_2O
Nonroad Mine Vehicles	7,557	108.8	720.2
Coal Haul Trucks	2,010	2.41	15.96
Plant Vehicles	2,134	2.21	13.79
Surface Coal Mine and Post-mining	--	57,688	--
TOTAL - GHG Emissions with Proposed Action	**11,701**	**57,801**	**750**

A quantitative or qualitative assessment of project GHG emissions is warranted if a proposed action would be reasonably anticipated to cause direct GHG emissions increases of 25,000 metric tons or more per year CO_2e. In that event, the Tailoring Rule would require BNCC/Navajo Mine to obtain an air permit revision for the proposed project to account for the new GHG emissions. However, the Proposed Action will not cause Navajo Mine's GHG emissions to increase, and will more likely result in a longer-term decrease in direct GHG emissions. Therefore, further analysis of direct GHG emissions beyond the above quantification is not applicable.

4.5.2.2 Proposed Action with Conditions

Under this Alternative, impacts would be the same as those described for the Proposed Action.

4.5.2.3 No Action Alternative

The No Action Alternative is often an appropriate baseline against which to compare predictions of air quality effects due to a proposed action and from past, present, and reasonably foreseeable actions. In this instance, the No Action Alternative does not constitute an appropriate baseline because under this alternative it is expected that historic annual coal production of typically 8.5 million tons per year would begin to decline. Baseline conditions for the study of air quality resource affects under Proposed Action are those associated with the mine's recent historical operations (e.g., a nominal coal production rate of 8.5 million tons per year from all areas, including Area III). The corresponding annual production in Area

III alone under the No Action Alternative is expected to range from 4.9 million to 7.4 million tons of coal per year.

4.5.2.3.1 Operational and Emissions Changes

The No-Action Alternative for this study means that no coal would be mined from Area IV North. Coal production from Area III during the period from 2012 to 2016 would nevertheless need to remain at the production rates anticipated for the Area III under the Proposed Action (i.e., 4.9 – 7.4 Mtpy, or roughly from 58 percent to 83 percent of the mine's baseline operating rate). Consequently, overall air emissions under the No Action Alternative are expected to gradually decline in proportion to the reduction in production rates below the baseline case of 8.5 Mtpy.

Navajo Mine's PM_{10} and $PM_{2.5}$ emissions from Area III alone as part of the mine's baseline coal production rate of 8.5 Mtpy are presented in Section 3.5.2.1. Because the rate of surface coal mine particulate matter emissions is roughly proportional to its production rate, Navajo Mine's annual emissions of PM_{10} and $PM_{2.5}$, under the No Action Plan, would likely vary over a range of roughly 60-80 percent of the mine's baseline emission levels shown in Table 3.5-4.

4.5.2.3.2 Air Quality Impacts under the No Action Alternative

Compared to the modeled levels for the Proposed Action, ambient concentrations of PM_{10} and $PM_{2.5}$ in the AQRA under the No Action Alternative would not change appreciably, or may decline from current conditions. Because annual emissions of PM_{10} and $PM_{2.5}$ under the No Action Alternative would likely be reduced compared to Navajo Mine's recent baseline emissions, the mine's PM_{10} and $PM_{2.5}$ annual impacts will not extend as far from the mine boundary as predicted in Section 4.5.2.1 for the Proposed Action. However, as explained below, the extent of the mine's short-term PM_{10} or $PM_{2.5}$ impacts on a 24-hour basis with the No Action Alternative are not expected to decrease from their counterparts with the Proposed Action.

The distance to which particulate emissions from the mine will have a discernible ambient impact on a short-term (24-hr) basis, is a function of the emission rate and dispersion characteristics on a daily basis. As described in Section 3.5, elevated short-term monitored concentrations of PM_{10} and $PM_{2.5}$ inside the Mine's boundary during baseline operations, have typically been 140 $\mu g/m^3$ and 14 $\mu g/m^3$, respectively. While the No Action Alternative will have less annual emissions than the mine's annual baseline emissions, the No Action Alternative will still have localized mining events that may cause elevated levels of fugitive dust near the mine's boundary. Those elevated concentrations of PM_{10} and $PM_{2.5}$ emissions inside the mine's boundary during the No Action Alternative could still cause significant 24-hour impacts of PM_{10} and $PM_{2.5}$. Based on AERMOD modeling of the Area III sources, concentrations above the SILs of PM_{10} and $PM_{2.5}$ may occur at distances as far as 6.5 km and 10 km from the mine's boundary, respectively.

With the No Action Alternative from 2012 to 2016, the annual amount of Navajo Mine's emissions of gaseous pollutants (SO_2, NO_x, CO, and VOCs) from its numerous non-road engines and motor vehicles would be reduced in a given year roughly in proportion to the 20 – 40 percent reduction in mine production relative to the annual baseline rate. However, annual gaseous pollutant emissions from the mine's baseline operation, as shown in Table 3.5-4, are very small relative to the aggregate amounts of each pollutant emitted within San Juan County. Consequently, any reduction in gaseous emissions from

the mine's non-road engines and motor vehicles under the No Action Alternative is not expected to have a discernible effect on the ambient air concentrations of those pollutants within the AQRA.

Concentrations of some of those gaseous pollutants recently measured at New Mexico's SLAMS monitoring site in at the San Juan Substation, near Shiprock are shown in Table 3.5-10. Any reduction in gaseous emissions from the mine's non-road engines and motor vehicles during the No Action Alternative should not cause a perceptible change in those measured levels at Shiprock or elsewhere.

4.6 Vegetation

4.6.1 Impact Assessment Methodology

Impact analyses and conclusions are based on the best available scientific literature, a thorough analysis of the potential effects of the project, and the professional judgment of the biologists and ecologists who completed the evaluation. Impacts are quantified where possible. In the absence of quantitative data, best professional judgment was used. For vegetation resources, an impact would be considered significant if it resulted in a substantial loss of habitat function or the disruption of life history requirements of a species, or plant population, which would make them eligible for listing under the Federal ESA, or would limit the recovery of a listed species.

This analysis was developed using existing reports and GIS data, collected from past field surveys and inventories. Acres of surface disturbance for each plant community were calculated by overlaying the Project Area boundaries on the vegetation maps. The affected area includes all portions of the Project Area that would be directly disturbed by mining activities and indirectly impacted by fugitive dust.

4.6.2 Impacts

The types of impacts to vegetation would be common to both alternatives. The differences between the alternatives would be the amount and type of vegetation impacted. Table 4.6-1 shows impacts to vegetation by community for the No Action and Proposed Action. Surface disturbance in mining areas, or areas disturbed for transportation, would physically remove native vegetation resulting in direct impacts. Vegetation removal would result in short- or long-term impacts depending on the plant community, the extent of the impact, and the success of revegetation.

Reclamation would restore vegetation to the disturbed areas of the Project Area using an approved native seed mix. Revegetation would replace existing plant communities with native grass, forb, and shrub species to establish a post-mining land use of grazing and wildlife habitat. As a result, not only would species composition change, but also post reclamation vegetation cover would increase in most areas reclaimed, especially where badlands communities are replaced with plant communities suitable for the post-mining land uses.

Vegetation adjacent to surface disturbance may be affected by windborne dust, off-road travel, and weed invasion (Elliott et al. 2009). Fugitive dust that settles on plants can block photosynthesis, respiration, and transpiration and can cause physical injuries to plants (Trombulak and Frissell 2000). Airborne dust concentrations decrease with increasing distance from the source, with the majority that can impact plant photosynthesis settling within 100 meters in arid conditions (Ellis et al. 2006). With surface disturbance, the potential for the spread or introduction of noxious weeds increases. Vehicles, people, wind, or water

may transport seeds and deposit them in disturbed soils, or existing seeds may be encouraged to germinate in disturbed soils. Noxious weeds that spread can degrade habitat quality and decrease productivity of native forage. As with fugitive dust, the effects of noxious weeds can extend beyond the immediate area of disturbance. BNCC's Noxious Weed Management Plan employs multiple measures to minimize the introduction and spread of noxious weeds within Navajo Mine. These measures include the purchase of certified native seed and grass-hay mulch from credible sources.

Table 4.6-1. Impacts to Vegetation Communities

Vegetation Community	No Action (Acres)	Proposed Action (Acres)
Alkali Wash	100	238
Arroyo Shrub	28	32
Badlands	479	689
Dunes	0	10
Sands	89	206
Thinbreaks	5	89
Disturbed*	626	626
Total**	1,327	1,890

*This classification accounts for areas previously cleared in preparation for mining in Area IV North, as well as those affected by the construction of power lines and ancillary roads. A description of these areas is provided in Section 3.6.
**Acreage totals approximate those presented in Chapter 2 due to rounding per component and vegetation community type.

4.6.2.1 Proposed Action

Mining Activities

Under the Proposed Action, direct impacts would include removal of vegetation in the footprint of the proposed disturbance areas. Table 4.6-2 lists the acres of each plant community that would be removed by mining operations. Impacts to vegetation associated with the realignment of Burnham Road are discussed below. Badlands, Alkali Wash, and Sands vegetation community types comprise the majority of vegetation within the area. Vegetation removal would result in short-term high intensity impacts, which would last the duration of mining operations. All areas proposed to be mined would be reclaimed which would reduce impacts to vegetation in the long-term, increasing cover. Fugitive dust from mining activities could impact vegetation, particularly in areas downwind. Potential impacts from fugitive dust would be localized and decreased through the implementation of fugitive dust control measures. Surface disturbance from mining could introduce or spread existing noxious or invasive weeds resulting in long-term impacts.

Table 4.6-2. Acres of vegetation community types and percent of total affected by mining activities under the Proposed Action (not including the Burnham Road Realignment).

Vegetation Community Type	Total (Acres)	Percent of Total
Alkali Wash	213	12
Arroyo Shrub	29	2
Badlands	657	37
Sands	192	11
Thinbreaks	88	5
Dunes	10	1
Disturbed	571	32
Total Mining *	1760	

* The total acreage of disturbance is for proposed mining activities only and does not account for existing disturbance associated with power lines and ancillary roads or the proposed realignment of Burnham Road, which is assessed below.

Transportation of Coal

No new direct impacts to vegetation would occur because use is not expected to increase above baseline conditions. Traffic along existing roads and rail may result in minor quantities of dust settling on adjacent vegetation. This indirect impact would be long term and could be mitigated by use of fugitive dust control measures. Use of roads could also potentially introduce or spread noxious or invasive weeds.

Burnham Road

Construction of the Burnham Road realignment would remove a maximum of 75 acres of vegetation. Approximately 23 acres of vegetation associated with the driving surface and drainage structures would be permanently removed, resulting in long-term impacts. Short-term impacts would occur on the remaining acres, which would be reclaimed following construction. As shown in Table 4.6-3, Badlands comprise nearly half the total of vegetation community types within the proposed alignment.

Table 4.6-3. Acres of vegetation community types and percent of total affected by the Burnham Road realignment under the Proposed Action.

Vegetation Community Type	Total (Acres)	Percent of Total
Alkali Wash	25	33%
Arroyo Shrub	3	3%
Badlands	32	43%
Dunes	0	0%
Sands	14	19%

Vegetation Community Type	Total (Acres)	Percent of Total
Thinbreaks	1	1%
Total	75	100%

Burnham Road realignment use would result in long-term impacts from fugitive dust settling on adjacent vegetation and the potential for introduction and spread of noxious or invasive species, which is currently occurring with the road in its present location. The only difference is the impact location would move with the proposed realignment.

4.6.2.2 Proposed Action with Conditions

Under this Alternative, impacts are the same as the Proposed Action.

4.6.2.3 No Action Alternative

Under this alternative, Area III mining would continue as permitted and would have the same impacts for mining activities described in the Proposed Action. Approximately 701 acres within Area III would be mined under this alternative. The approximately 268 acres (mine development, power lines, and ancillary roads) impacted in Area IV North following the 2005 mine plan revision approval, would be reclaimed in accordance with the existing SMCRA mine plan.

4.7 Wildlife

The Analysis Area for assessing potential impacts to wildlife is the same as is considered for federal and Navajo Nation listed species (refer to Section 3.8). The Action Area was determined based on maximum distance that a particular impact from mining could reasonably be expected to affect species. Based on the results of the noise, water, and air impact pathway analyses completed in this EA, a one-mile radius around the Project Area is a conservatively large Action Area to assess potential impacts to wildlife from the Proposed Action.

Impacts to wildlife may include direct impacts from habitat loss, alteration, and fragmentation, as well as incidental mortality from animal-vehicle collisions, vegetation clearing with heavy equipment, or construction activities. Impacts may also include indirect impacts from noise and human presence.

4.7.1 Impact Assessment Methodology

Mining, reclamation, transportation of coal, and the realignment of Burnham Road have potential to impact wildlife in the Action Area. Potential impacts are analyzed based on the best available data for the species that are known or are likely to occur in the Action Area. For purposes of the wildlife impacts analysis, the severity of impacts is defined as the following:

- Low – Impacts that are detectable, but slight; that is, habitat loss in relatively small proportion (e.g., in the presence of available similar habitat)
- Moderate – Impacts that could affect individuals either through mortality, habitat loss, or stress

- High – Impacts that could affect a species at the population level

4.7.2 Impacts

4.7.2.1 Proposed Action

Mining Activities

Loss and fragmentation of wildlife habitats are inevitable consequences of surface disturbance when vegetation is removed (Crooks 2002). Therefore, direct impacts to wildlife primarily include the loss and fragmentation of Badlands, Alkali Wash, Sands, Thinbreaks, Dune, and Arroyo Shrub habitats (see Table 4.6-1). More than one-third of the vegetation removed would be Badland habitat, which has the lowest species abundance and diversity of the habitat types represented in the Project Area. Sands and Alkali Wash would be secondarily impacted by mining activities. These habitat types are relatively abundant in large areas adjacent to the mine and the western portion of the San Juan Basin. Generalist species such as coyote, black-tailed jackrabbit, desert cottontail, lizards, and small mammals utilize these habitats and are commonly documented in the reclaimed areas north of the Project Area (Areas I and II) (Ecosphere 2008a, 2008b, 2009b; Hawks Aloft 2000-2007). Small mammal densities are historically low in the Project Area (BNCC 2009a) and concentrated in Arroyo Shrub habitat (Ecosphere 2004b, 2008a) due to greater availability of food and shelter relative to other area habitats.

Direct impacts from habitat loss and fragmentation would be confined to the proposed Project Area. These impacts would have low to moderate effects on wildlife in the short term, limited in severity due in part to the availability of thousands of acres of similar habitats adjacent to the Project Area. Impacts would be reduced to low in the long term after reclamation of the mined area is complete. Further, impacts would likely be limited to specialist species, such as burrowing owl and kit fox, which are less able to adapt to changes in their environment. Other direct impacts could include incidental mortality to wildlife from heavy equipment used for mining. Small, burrowing, or less mobile animals may be especially susceptible to mortality. Impacts to migratory birds, including ground and shrub-nesting species that may be present in the Project Area are discussed in Section 4.8. These direct impacts would be short term, limited to the mined area during mining activities.

Noise and human presence during mining activities would also cause direct impacts to wildlife. Wildlife species tend to avoid humans and associated disturbances. Impacts to wildlife from noise is confounded by multiple variables such as the magnitude and duration of the noise generated, proximity to the noise source, life history of the species affected, time of year (e.g., breeding vs. non-breeding season), time of day, and the influence of other environmental stressors such as heat. Wildlife that moves away from noise generally displays their response as either mild annoyance or panic behavior (Fletcher 1980). Such displacement would be localized to areas where the noise generated may cause a flee, annoyance or panic response. Based on the noise analysis described in Section 4.3, potential impacts would largely be confined to within one-mile of the Project Area. Beyond this distance, noise attenuates to approximately ambient background noise levels. Ultimately, potential impacts depend upon the sensitivity of the species or individual subjected to the noise. Instantaneous noise such as that generated from a blasting event is more acute (louder) but of very short duration, lasting several seconds. Instantaneous noise may cause these same impact responses in wildlife at a further distance than one-mile depending upon the sensitivity of species in the area or individual to the noise. It is important to note that both constant and

instantaneous noise events are part of the environmental baseline in the Action Area from ongoing mining at Navajo Mine. As the Proposed Action essentially maintains current coal production levels to 2016, there would be no quantifiable increase in Action Area noise relative to current conditions. There would be a spatial shift in where the noise is generated to Area IV North with a commensurate reduction in noise in areas currently being mined such as Hosteen/Yazzie pits in Area II and Lowe Pit in Area III.

Displacement could push individuals from preferred habitat into less suitable habitat. These impacts can also predispose an individual to predation or increase the potential for animal-vehicle collisions. Stress can also reduce fitness and reproductive success. Indirect impacts dependent on the aforementioned variables, would initially be low to moderate over the short term until the area is reclaimed, decreasing in severity to low over the long term. Conversely, some predator species may benefit from stressed or less-fit prey that is easier to catch. Raptor species may avoid such areas and potentially alter nesting and roosting sites to avoid disturbances (Larkin 1996). Noise and human presence may also disrupt breeding, cause nest abandonment, or loss of young if disturbances occur during the breeding season of raptors and other migratory birds. Although direct impacts from noise and human presence are expected to be low to moderate over the short term, some wildlife may permanently leave the area or, especially in the case of raptors, choose to nest elsewhere. With that said, raptors have been monitored at Navajo Mine since 1993 and although such impacts may be detrimental to an individual, raptor populations in the Action Area have remained stable.

Fugitive dust generated by mining activities would also directly impact individual wildlife in the vicinity of mining activities by impairing visibility and possibly respiration. Fugitive dust emissions would likely be greatest near mining activities, especially during high winds. Impacts to individuals near mining activities would likely be low to moderate and occur over the short term depending on the proximity, intensity, and duration of exposure, as well as the species, time of year, and other environmental conditions.

Coal Transportation

Transportation of coal from Area IV North and Area III to the FCPP would involve use of existing roads and rail system at Navajo Mine. Mine activities for the Proposed Action would not create an increase above the current condition in the number and type of vehicles using the roads or train trips to transport coal. Infrequent animal vehicle collisions with truck and train travel would be expected to occur at levels commensurate with current truck and rail activity. These low, short-term impacts would persist until coal-hauling activities begin to decline around 2016.

Burnham Road

Realigning Burnham Road would result in a maximum of 75 acres of new surface disturbance. The primary habitat affected by the Burnham Road realignment would again be Badlands and Alkali Wash (Table 4.6-3). Vegetation removal would result in direct habitat loss for wildlife as previously described. Wildlife habitat would be fragmented because of the Burnham Road realignment. Alkali Wash habitat is typically associated with minor waterways and therefore may serve as discrete travel corridors for predators needing to travel large distances with some relative cover. Other vegetation communities that would be lost include Sands, Thinbreaks, and Arroyo Shrub. Those individuals in the path of the realignment would be permanently impacted by habitat loss, alteration, and fragmentation, but the number of acres lost is relatively small and considering the surrounding available habitat impacts would be low.

Small mammals have been documented utilizing Alkali Wash habitats, as well as Sands and Arroyo Shrub habitats, albeit in low abundance. Herptiles are also common in these habitats. Carnivore and raptor species dependent on small mammal species and herptiles for prey could also be indirectly impacted, both beneficially (carrion availability along the roadway) and adversely (indirect impacts associated with human activity). Habitat loss and fragmentation would be permanent. Therefore, direct impacts from habitat loss would be low to moderate and long term. Direct and indirect impacts are similar in type as those previously described under mining activities and would be low and long term.

Reclamation

All areas proposed to be mined under the Proposed Action would be reclaimed. BNCC performs reclamation at Navajo Mine pursuant to its SMCRA permit (BNCC 2009a) commencing once an area is mined out, and as soon as practical considering that some infrastructure may impede immediate reclamation. Reclamation would result in the restoration of vegetative cover, though the species composition and density would be different from that which was disturbed. Wildlife could return to mined areas following reclamation, although the species that use the areas may be different.

4.7.2.2 Proposed Action with Conditions

Under this Alternative, impacts would be the same as those described for the Proposed Action.

4.7.2.3 No Action Alternative

Under the No Action Alternative, none of the described mine activities would take place in Area IV North and Burnham Road would not be realigned. Mining would continue as permitted in Area III. Impacts to wildlife from mining in Area III would be similar to that described above for the Proposed Action, except that there would be fewer acres of surface impacts (see Table 4.6-1). The approximately 268 acres (mine development, power lines, and ancillary roads) impacted in Area IV North following the 2005 mine plan revision approval would be reclaimed in accordance with the existing SMCRA mine plan.

4.8 Threatened and Endangered and Sensitive Species

4.8.1 Impact Assessment Methodology

Impacts to threatened and endangered species would be considered significant if the action were to result in serious, long-term affects to the species or their habitat. Impacts would be considered significant if for example it resulted in: (1) habitat loss or fragmentation to the extent that wildlife could not maintain viable populations on the Navajo reservation, (2) disturbance to or removal of potential habitat for current federally listed or candidate species to the extent that such populations could not exist or become established in the Action Area, or (3) loss of any federally listed species, or loss of critical habitat of such species, that would be considered a take under the ESA.

The methodology for determining impacts to threatened and endangered species was based upon evaluations of existing data, consideration of the environmental baseline, habitat associations, discussions with the NNDFW and the USFWS, and field investigations and analyses. A BE that addresses potential impacts to federal and tribally listed species, was prepared for this project and is included in Appendix E. Detailed descriptions of impacts and the Action Area for which potential impacts were described are also

included in the BE. This section summarizes the impacts and effect determinations made in the BE for federally listed and Navajo Nation species of concern.

4.8.2 Impacts

A detailed assessment of impacts and assessment methodologies can be found in the BE prepared for this project (Appendix E). Impacts are summarized below.

4.8.2.1 Proposed Action

Federally Listed Species

Effects to federally listed species resulting from the Proposed Action are summarized in Table 4.8-1. No adverse impacts, as described above, have the potential to occur to any federally listed species. The proposed project "may affect but is unlikely to adversely affect" the Southwestern willow flycatcher, primarily through disturbance from human presence and noise from mining activities. Impacts are considered improbable as they relate to infrequent occurrences of this species in adjacent poor quality habitats coinciding with instantaneous noise events (e.g., blasting event) and possibly from blowing fugitive dust. There would be no adverse impacts to this species post mining and reclamation and possibly beneficial impacts associated with CWA mitigation requirements dealing with riparian habitat enhancement and creation along the San Juan River (refer to the BE in Appendix E).

Table 4.8-1. Determination of effects to federally listed species

Species	Preliminary Determination of Effect
Black-footed ferret	No Effect
Canada lynx	No Effect
Mexican spotted owl	No Effect
Southwestern willow flycatcher	May affect, not likely to adversely affect
Yellow-billed cuckoo	No Effect
Colorado pikeminnow	No Effect
Razorback sucker	No Effect
Roundtail chub	No Effect
Knowlton's cactus	No Effect
Mancos milkvetch	No Effect
Mesa Verde cactus	No Effect

Navajo Nation Listed Species

Potential impacts to Navajo Nation listed species resulting from the Proposed Action are summarized in Table 4.8-2 below. Those species dually listed under the federal ESA are addressed above in Table 4.8-1. Impacts to kit fox, golden eagle, ferruginous hawk, western burrowing owl, and San Juan milkweed result primarily from habitat loss and modification and secondarily from disturbance from mine-related noise

and human presence in the area. Impacts to the listed animal species are expected to be short term, as reclamation would create suitable habitat for these species. The loss of 10 acres of dune habitat suitable for San Juan milkweed is expected to have minor but long-term effects since that habitat would not be restored post reclamation. Given the abundance of suitable habitat within this species distribution, habitat loss under the Proposed Action would result in impacts to individuals, but would not be expected to result in population level impacts. Impacts are not likely to result in a loss of species viability range-wide.

Table 4.8-2. Impacts to Navajo Nation Listed Species

Species	Preliminary Determination of Effect
Black-footed ferret	No Impacts
Kit fox	May Impact Individuals
Ferruginous hawk	May Impact Individuals
Golden eagle	May Impact Individuals
American peregrine falcon	No Impacts
Mountain plover	No Impacts
Western burrowing owl	May Impact Individuals
San Juan milkweed	May Impact Individuals

Migratory Birds

Direct effects associated with mining and the construction of Burnham Road would include the temporary loss of potential nesting and foraging habitat for ground and shrub-nesting birds. Mined areas would eventually be reclaimed—creating new habitat for migratory birds. As discussed above for federally and tribally protected species, there may be disturbance to individuals from noise and increased human presence during mining, transportation of coal, and road construction and use. Direct effects to migratory birds would be greater should ground clearing occur during the breeding season of April 15 through July 15 when nests and nestlings could be lost. Indirect effects could include nest abandonment during mining or construction in adjacent areas, degradation of habitat from invasive species introduction, mortalities associated with use of area haul and public roads, and decreased mammal prey base for raptors due to loss of habitat. Short-term effects would include avoidance of the area during mining and mining-related activities and road construction, and displacement of individuals to adjacent habitats. Once the area is reclaimed, migratory birds would be expected to return to the area for nesting and foraging.

Although some individuals would be displaced to suitable adjacent habitats for the duration of mining activities, there is the potential for nest destruction or abandonment—the amount of habitat affected for the short term would impact only a few individual territories. Therefore, no population level impacts are expected to occur under the Proposed Action.

4.8.2.2 Proposed Action with Conditions

Under this Alternative, impacts would be the same as those described for the Proposed Action.

4.8.2.3 No Action Alternative

Impacts resulting from the No Action Alternative to federally and tribally listed species and migratory birds would be similar in nature to those that would result from implementing the Proposed Action. Habitat loss, modification, and the presence of humans and mine-associated noise would be limited to the additional 701 acres of Area III where future disturbance is currently permitted by OSM. The 268 acres of existing disturbance in Area IV North would be reclaimed.

4.9 Socioeconomics

4.9.1 Impact Assessment Methodology

The potential social and economic impacts of the alternatives are analyzed for the affected area defined as the eight counties surrounding Navajo Mine and the Navajo Nation (see Section 3.9). Economic impacts are measured in terms of changes to population, employment, income, and government revenue. Social impacts are expressed as changes to community infrastructure—such as access to social services and quality health care services related to the rate of change in demand for these social services or in the ability of local governments to provide these services. Section 4.11 of this document evaluates the environmental justice impacts related to such changes.

The impact assessment criteria for economic impacts are based on changes to employment, wages, and tax payments at BNCC Navajo Mine associated with each alternative. The criteria for social impacts include the previous indicators as well as the rate and scale of change of employment, income, and tax revenues, as sudden shifts in these measures tend to reduce the ability of local governments to respond to changes in demand for social services because of the lag time between employment changes and receipt of tax or royalty revenues.

4.9.2 Impacts

4.9.2.1 Proposed Action

Employment, wages, and tax revenues generated by mining activities would not change measurably from the baseline under the Proposed Action because the volume of coal mined at Navajo Mine would not differ appreciably from current levels. The realignment of Burnham Road would not have any measurable changes to baseline socioeconomic conditions.

4.9.2.2 Proposed Action with Conditions

Under this Alternative, impacts would be the same as those described for the Proposed Action.

4.9.2.3 No Action Alternative

Under the No Action Alternative, approximately 30 percent less coal would be mined at Navajo Mine relative to the Proposed Action. Table 2.1-2 shows the scheduled annual coal volumes for each alternative. Therefore, it is assumed that employment, taxes, and royalty payments for BNCC would be reduced by as much as one-third from baseline conditions. Using this assumption, the direct economic impacts of the No Action Alternative would be a reduction in employment at BNCC and a reduction in

annual federal, state, and Navajo Nation tax and royalty payments. A reduction in annual coal production at the mine would likely have similar effects on employment, taxes, and royalties at the FCPP.

Many commenters noted concerns about loss of jobs, income, and related negative effects of not proceeding with pre-2016 mining, including ability to educate children, provide housing, and a stable life.

The indirect impacts of the No Action Alternative estimated with the IMPLAN model using 2009 data for San Juan County would be an additional loss of jobs in the local economy. Compared to the size of the local economy, these job losses may not be substantial. However, because more than four-fifths of the BNCC workforce is Native American, the Navajo population would experience a larger impact compared to the non-Navajo workforce and available employment in San Juan County, NM (see Section 3.9.2.3 for details). The No Action Alternative would increase Navajo unemployment by as much as one percent. However, because mining jobs pay wages more than twice the San Juan County average, the impacts to individuals and families would be larger.

Similarly, the reductions in tax payments to the state and in royalty and tax payments to the Navajo Nation would be small compared to total state and tribal government revenues. A reduction in tax and royalty payments of $9 million per year would reduce total gross general fund revenue to the Navajo Nation by as much as three percent.

The social impacts of the No Action Alternative are not quantifiable because the change in taxes and royalty payments, although measurable, do not directly translate into changes in the amount or availability of social services. It is not possible to predict which programs or services local governments would decide to cut in association with reductions in government revenues. Another consideration is that relative size and timing of these revenue reductions. The potential increase in demand for social services associated with the employment and income reductions would be small compared to total demand for these services in the affected area. In addition, these revenue reductions would likely be experienced over a five-year period giving local governments' sufficient time to adjust to the revenue changes. Therefore, there would be no substantial changes to ability of local governments to fund social services.

4.10 Land Use

4.10.1 Impact Assessment Methodology

The land use resource assessment area considers land use within the proposed mining areas and related features and one-mile area surrounding proposed mining and Burnham Road realignment. Assessment of potential effects on land use resources, including effects on CUA and grazing uses, surface access, and water sources, is based on criteria defined by SMCRA's land use provisions (30 CFR 761.11(a)) and from issues identified during the public workshops and the informal conference. Land use related comments raised during the public workshops and the informal conference include concerns about reclamation of mined lands, timing of release of reclaimed lands, and the effect that the Proposed Action may have upon tribal member rights and customary use areas. Associated concerns include how fugitive dust may affect land use management and livestock water sources.

Under SMCRA regulations, BNCC is required to develop adequate resource protection measures to eliminate, minimize, and/or mitigate land use effects. The Proposed Action wholly incorporates these

SMCRA-based requirements. Likewise, the success, timing and release of mine-land reclamation areas are administered by OSM in facilitation of and compliance with federal SMCRA requirements (30 CFR 800.40), and are also coordinated with the Navajo Nation and BIA prior to release of lands.

For analysis within this EA, it is assumed that during construction, operation, and reclamation of the mine, current grazing use within the land use resource area would be restricted and/or modified during mining and reclamation, but would be reinstated following reclamation and release of lands. Issues developed include the impact upon CUAs, the impact on surface access, and the impact on important water sources. To analyze these issues within the land use resource area, criteria includes potential for change or disruption in current land use, access, and dwellings; potential for change or modification to current surface use; potential for changes in grazing capacity; and displacement of livestock from water sources. Potential impacts include relocation of grazing uses, changes in grazing capacity and access to grazing areas, and displacement of livestock from water sources from the Project Area. Water sources and related assessment criteria are discussed in depth in Section 4.2 – Water Resources.

4.10.2 Impacts

4.10.2.1 Proposed Action

No residences or dwellings would be affected or relocated due to mining. Relocation of the Burnham Road would not limit access to nearby dwellings. Water sources and related assessment criteria are discussed in depth in Section 4.2 – Water Resources. Transportation issues are discussed in Section 4.13.

In the short term, the Proposed Action would directly reduce the livestock grazing area for local permittees, reduce wildlife habitat, and restrict public access on two-track roads in the land uses resource assessment area. The Proposed Action would restrict or modify access to approximately 183 acres from current grazing use in CUA Area .0396, approximately 100 Acres in CUA Area .0049, approximately 801 acres in CUA Area .0362, and approximately 804 acres in CUA Area .0394. The existing network of unimproved two-track roads would be restricted and or eliminated in area of active mining for the life of the operation. Realignment of the Burnham Road is not anticipated to result in loss of grazing rights in any CUAs. Impacts to wildlife habitat resulting from the Proposed Action are discussed in Section 4.7.

BNCC has entered into agreements with holders of impacted grazing permits and CUAs within the land use resource assessment area to compensate them for the value of disrupted grazing production and relocation or replacement of improvements to their grazing area. These agreements comply with 13 Navajo Tribal Code Section 1401-1403, which requires compensation for all surface use. Agreements have been reviewed by the Navajo Land Administration and BIA to ensure fair and equitable compensation. To minimize impacts to grazing permittees, as a result of modification of surface use due to mining, BNCC would continue to provide water (in tanks) for livestock use in areas around the Navajo Mine. Permanent impacts to grazing permittees and allotment use would be minimized by retaining the existing Lowe Impoundment #1 for stock watering in Area III.

The indirect impacts that could affect land uses include increased dust, noise, and blasting vibrations from mining activities and traffic along haul roads. These would have minor to moderate short term and life of operation effects on management and quality of surface land use due to the distance of mining from dwellings and surrounding CUAs. BNCC would coordinate with local users regarding stock pond

locations and conditions. Impact assessment associated with fugitive dust, noise and blasting vibrations is included in Section 4.5.1, and Section 4.3.2 respectively. In addition to the resource protection measures to minimize the impacts to these related resources included in as part of the Proposed Action, plans for minimizing adverse impacts from noise and vibration (based on 30 CFR 816.67) and fugitive dust would be required within the associated SMCRA permit for the life of the operation.

In the long term, the surface and vegetation affected by the Proposed Action would be reclaimed and returned to a condition similar to or better than its original status. Post-mine land use would be designated for livestock grazing and wildlife habitat, and would again be open to grazing and other tribal surface uses. The construction of impoundments incorporated into the post-mining landscape would support livestock grazing and wildlife habitat.

4.10.2.2 Proposed Action with Conditions

Under this Alternative, impacts would be the same as those described for the Proposed Action.

4.10.2.3 No Action Alternative

Under the No Action Alternative, existing land status, access, and prior rights within the land use resource assessment area would remain unchanged. Mining and reclamation in Area III would proceed according to the existing approved Mine Plan and reclamation requirements, but mining in Area IV North would not occur. Lands already disturbed within Area IV North would be reclaimed to grazing and wildlife habitat. Impacts would continue to be minor (slight but detectable) to moderate (readily apparent, measurable long-term change) and short term to long term within the existing Navajo Mine.

4.11 Environmental Justice

4.11.1 Impact Assessment Methodology

Executive Order 12898 requires that the federal government identify and estimate disproportionate impacts to low-income or minority populations of proposed federal actions. There are both low-income and minority populations that would be affected by the Proposed Action and alternatives that are identified in Section 3.11.

To determine whether human health effects are disproportionately high and adverse on such populations, three factors are to be considered to the extent practicable: (1) whether the risks and rates of health effects are significant (as employed by NEPA), or above generally accepted norms, (2) whether the risk or rate of exposure to an environmental hazard is significant (as employed by NEPA) and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group, and (3) whether the health effects occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards (CEQ Environmental Justice Guidance, p. 26).

To determine whether environmental effects are disproportionately high and adverse, three factors are to be considered to the extent practicable: (1) whether there is or will be an impact on the natural or physical environment that significantly (as employed by NEPA) and adversely affects a minority or low income population or Indian tribe, (2) whether environmental effects are significant (as employed by NEPA) and

are or may be having an adverse impact on a minority or low income population or Indian tribe that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group, and (3) whether the environmental effects occur or would occur in a minority or low income population or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards (CEQ, Environmental Justice Guidance, p. 26).

4.11.2 Impacts

4.11.2.1 Proposed Action

In general, the Proposed Action would result in limited environmental and health effects, not above generally accepted norms or appreciable exceeding those experienced by other populations, on the local community due to the limited magnitude and geographic range of expected impacts and extensive mitigation and protective measures incorporated in project operations. See Section 4.5 on dust dispersion; Section 4.14.2.1 on public health issues; Sections 4.2.2 and 4.8.1 on limited extent of groundwater surface water impacts and effects on biological resources; Section 4.12.2.1 on limited cultural resource impacts; and Section 4.10.2.1 on limited effects on grazing rights.

There is no opportunity for traditional and ceremonial resource use in the Project Area because the Navajo Mine lease area, including the Project Area, is excluded from public access and use because it is an active surface mine. Therefore, there would be no disproportionate impacts associated with ceremonial or traditional resource use for this alternative. In considering "special exposures related to cultural or traditional use of resources near the Project Area," it is important to understand the Navajo relationship with the land based on the principle of Diné Natural Law that "The rights to use the land, natural resources, sacred sites, and other living beings must be accomplished through the protocol of offering and these practices must be protected." (Navajo Nation Code Sections 201-206). In applying this principal to extraction of coal resource at Navajo Mine, it would be appropriate for Navajos to make offerings to support the rights to use this natural resource. BNCC has built and maintains a ceremonial Hogan on Navajo Mine property. This Hogan was built so that BNCC employees and their families could conduct traditional ceremonies. Information about this ceremonial Hogan and how Diné Natural Law informs environmental justice analysis was presented to the public at the OSM workshops held in Nenahnezad and Burnham Chapter houses (see Section 1.5).

The realignment of Burnham Road would not have any disproportionate adverse human health or environmental effects to minority or low-income populations in the affected area. There would be a small benefit to these populations with the Burnham Road realignment because travel on the Burnham Road would be safer after the realignment.

4.11.2.2 Proposed Action with Conditions

Under this Alternative, impacts would be the same as those described for the Proposed Action.

4.11.2.3 No Action Alternative

The No Action Alternative would not result in any change in baseline environmental or health factors for local residents, Navajo Nation tribal members and other community members in the short term. However,

once mining is complete in Area III, mining impacts would cease and would not extend into Area IV North as proposed in the Proposed Action.

As mining operations are reduced with the completion of mining in Area III, there would be a disproportionate reduction in employment and income to vulnerable populations because more than four-fifths of the workforce at BNCC is Native American. As noted in Section 4.9 on socioeconomic impacts, the extent of these employment reductions are not known, but it is expected that they would be small compared to the employment and revenue opportunities for the Navajo Nation as a whole or employment and income for Navajo workers in San Juan County, NM. However, the unemployment rate on the Navajo Nation is estimated to be 4 to 5 times higher than the rate for San Juan County, NM so these job losses would add to this elevated rate (see Tables 3.9-4 and 3.9-5).

In addition, the estimated $9 million reduction in annual tax and royalty revenues to the Navajo Nation associated with the lower coal production for the No Action Alternative would reduce the ability of the tribal government to provide support services to its members at time when revenues from other energy and extractive industry resources are also being reduced.

In 2006, revenues from Navajo coal resources amounted to about $81 million and comprised 35 percent of total gross revenue to the Navajo Nation General Fund (NNCEDS 2010). Since then, coal revenues have declined because mining operations ceased at the Peabody Black Mesa Mine in 2006 and Chevron McKinley Mine in 2009. In 2010, revenues from the remaining coal operations at BNCC Navajo Mine and Peabody Kayenta mines were estimated to be about $50 million or about 25 percent of total gross revenue to the General Fund (NNCEDS 2010). Other foreseeable employment and revenue reductions for the Navajo Nation would include shutdown of three units at the FCPP. Since this power plant is located on Navajo Nation land and has a Native American hiring preference, the shutdown of units at FCPP would result in employment and revenue losses to the Navajo Nation. Under a new lease agreement, even if FCPP shuts down three units, revenues to the Navajo Nation would decrease from $65 million to $60 million annually and no jobs would be cut (Navajo Times 2010).

However, these revenue reductions could be offset by revenue diversification strategies that are being implemented by the Navajo Nation, such as casino gaming. The Navajo Nation recently invested more than $200 million in casino and resort properties located on Navajo Nation lands in the Four Corners region. This is more than the amount planned for all other economic development investments by the Navajo Nation (NNCEDS 2010). The Nation is expecting to earn $150 million a year from these investments. (Navajo Nation, Navajo President Joe Shirley Jr. BIA Director Omar Bradley sign land into Trust for Twin Arrows Casino Near Flagstaff (December 23, 2010)). Twin Arrows Casino Flagstaff http://www.south-of-flagstaff-arizona.com/twin-arrows-casino-flagstaff.html). In 2010, it was estimated that the Fire Rock Casino near Gallup, New Mexico employed more than 350 workers and realized $40 million in net win (a measure of casino income)(Landry 2010).

There is no regular opportunity for traditional and ceremonial resource use in the Project Area because the Navajo Mine lease area including the Project Area is excluded from public access. Traditional ceremonies and collection activities may be allowed upon request once safety issues are considered. There would be no change to the current public use policy with this alternative. Therefore, there would be no disproportionate impacts associated with ceremonial or traditional resource use for this alternative.

4.12 Cultural Resources

4.12.1 Impact Assessment Methodology

Assessment of the potential effects on the cultural environment was based in part on criteria defined by regulations for *Protection of Historic Properties* (36 CFR 800), which implement the NHPA. Those regulations define an effect as a direct or indirect alteration to the characteristics of a historic property that qualify it for inclusion in the NRHP. Effects are adverse when the alterations would diminish the integrity of a property's location, setting, design, materials, workmanship, feeling, or association. Examples of adverse effects include the following:

- Physical destruction, damage, or alteration of all or part of a property
- Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provisions of handicapped access, that is not consistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties (36 CFR Part 68) and applicable guidelines
- Removal of a property from its physical location
- Change of the character of the property's use or of physical features in the property's setting that contribute to its historic significance
- Introduction of visual, atmospheric, or audible elements that diminish the integrity of the properties significant historic features
- Neglect of a property, which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization
- Transfer, lease, or sale of the property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance [36 CFR Part 800.5(a)(2)]

The region of influence, or area of potential effects, varies for each type of potential impact on the cultural environment. Direct impacts on cultural resources would result from the long-term mining of coal. The area of potential direct effects on cultural resources is the geographic extent of the Project Area.

There is a limited potential for indirect effects on traditional cultural properties from visual intrusion, vibrations, and increased noise. To consider these potential effects a one-mile buffer around the proposed Project Area is considered reasonable. For this analysis, the criterion for a substantial impact on cultural resources was defined as an adverse effect that cannot be avoided or satisfactorily mitigated through consultation with parties participating in the review of the project in compliance with Section 106 of the NHPA. Also for NEPA analysis, impacts on cultural resources need to be analyzed under regulations other than NHPA such as NAGPRA and NNCPRA.

4.12.2 Impacts

In accordance with Section 106 of the NHPA, federal agencies must take into account the effects of proposed actions on NRHP-eligible sites. This consideration may include the potential for additional mitigation. Consequently, this section may be revised between the initial draft and the final version of this EA as details of a PA or an Amended PA between responsible federal and tribal agencies and other parties (or other documentation reflecting compliance with cultural resources statutes) are finalized.

4.12.2.1 Proposed Action

Archaeological and Historical Resources

Under Proposed Action, thirteen archaeological and historical resource sites would be directly impacted, twelve by mining activities, and one by the Burnham Road realignment (Table 4.12-1). Four of these properties were determined eligible for nomination to the National Register; three of which have been mitigated through ethnographic research, and the remaining property was mitigated through excavation (Kelly et al. 2007; Johnson et al. 2007), including the one impacted by Burnham Road. Seven of the remaining properties were determined not eligible and two have been recommended as not eligible after testing. No further work has occurred on these ineligible sites. None of these nine sites contains deposits or attributes that are afforded protection under NAGPRA or NNCRPA.

Table 4.12-1. Directly Impacted Archaeological and Historical Resources

Site Number	Site Type	National Register Status	Mitigation
29-31	Unknown isolated feature	Not eligible	None
29-33	Navajo limited activity - Rock shelter	Not eligible[1]	Tested[1]
29-81	Navajo temp camp	Not eligible[1]	Tested[1]
29-82	Navajo historic isolated cairn	Not eligible	None
29-84	Navajo historic isolated cairn	Not eligible	None
29-89	Navajo historic mine test pit	Eligible	Mitigation/Ethnography[3]
29-91	Navajo historic wagon road wall	Eligible	Mitigation/Ethnography[3]
29-93	Navajo historic mine shaft/test pit	Eligible	Mitigation/Ethnography[3]
29-94	Navajo historic check dam	Not eligible	None
29-95	Navajo historic earthen dam	Not eligible	None
29-112	Navajo historic water control feature	Not eligible	None
29-113	Unknown isolated features	Not eligible	None
28-177	Navajo Multi-habitation	Eligible[1]	Mitigation/Excavated[2]

[1] (Johnson et al. 2007); [2] (Fetterman 2011); and [3] (Kelly et al. 2007)

Traditional Cultural Properties

While no TCPs have been identified in the Project Area, eight TCPs are located in the one-mile buffer around Area IV North. There are no TCPs associated with Area III (Table 4.12-2). Seven of these

properties are considered not eligible to the NRHP and one is considered as "More Data Needed" to make a determination. Six of the eight sites are eligible as Navajo Nation TCPs. In addition, the Hogback and the San Juan River have been identified in comments and other communications as culturally important. Since those comments were received, communications between OSM and NNHPD confirm that there will be no impact—direct or indirect—on those features. Finally, comments have suggested that certain clay gathering sites in nearby washes should be considered. The locations of these sites were not identified, and impacts on them cannot be evaluated based on current information. However, two mineral gathering sites are identified as TCP 3 and TCP 4. There would be no direct or indirect impacts to any of these properties due to noise, vibration, and visual changes would be extremely low to nonexistent and would not diminish the integrity of the properties.

Table 4.12-2. Traditional Cultural Properties within One Mile of Project Area

TCP Identification	Description	NRHP Eligible
TCP1[1]	Ntl'iz (offering place) of stones to Mother earth, rain prayer, used since 1930s	No
Kelly TCP 2[1]	Onion gathering area, (Ch'il/azee') used "for generations", plant medicine gathered by one individual for Windway ceremonies; Interviewees voiced no concerns about project impacts	No
Deenasts'aa' Bito (Wildram Spring) [1]	Location where wild sheep drank	No
Deenasts'aa' Dah Njah (Wildram Bedground) [1]	Location where wild sheep bedded	No
Teel (Chaco Wash) [1]	Plant gathering area tied to Teehooltsodii (Holy Being Who Controls the Waters) story	More Data Needed
Chavez TCP 2[2]	Lightning struck corral, ntl'iz (offering place) used from 1930s to present	No
TCP 3[2]	Mineral gathering area used from 1930s to present	No
TCP 4[2]	Mineral gathering place used from 1930s to present	No

[1](Kelly et al. 2007); [2] (Chavez 2006)

4.12.2.2 Proposed Action with Conditions

Under this Alternative, impacts would be the same as those described under the Proposed Action. However, the consolidated cultural resource protection measures covered in the Cultural Resource PA will provide greater assurance that all cultural resources will be thoroughly and expeditiously considered for future actions. The PA also refines procedures for data recovery and mitigation as well as handling cases of unanticipated finds. The PA ensures that future impacts would be considered and mitigated as necessary.

4.12.2.3 No Action Alternative

Under the No Action Alternative, none of the described mine activities would take place in Area IV North but would continue as permitted in Area III. No change would occur to archaeological and historical

resources or TCPs in Area IV North other than the investigative activities that were completed on sites in the area. Within Area III, previous mitigation work was conducted and no unmitigated archaeological or historical sites will be impacted by continued mining in this area. A historic burial was described in this area during ethnographic studies. However, a detailed examination of the location failed to produce physical evidence of this burial. There are no TCPs associated with Area III. Mining in this area would be closely monitored and if human remains are encountered, mining would be suspended in the area and Navajo Nation Jishchaa' and NAGPRA procedures implemented.

4.13 Traffic and Transportation

4.13.1 Impact Assessment Methodology

The traffic and transportation resource assessment area considers use of the existing transportation infrastructure within the proposed mining area and Burnham Road realignment and one-mile area surrounding the Proposed Action. The use of the regional transportation infrastructure and associated traffic related to it would not be modified by activities associated with the Proposed Action and/or the continued operation of the Navajo Mine. It is anticipated that mine-related traffic would remain level with new mining development as part of the Proposed Action. As no increase in employee use or material transport use is anticipated on the regional highway road system during the life of the operation, this area and related traffic use is not considered as part of the resource assessment area.

Under SMCRA regulations (30 CFR 761.14), BNCC is required to develop adequate resource protection measures to eliminate, minimize, and/or mitigate any effect to public roads. BNCC would also coordinate with the Navajo Nation and their chapter houses affected by the Proposed Action. The Proposed Action wholly incorporates both of these administrative requirements.

Comments from community members indicated concern regarding access to CUAs used for grazing, and concerns for road improvements. Therefore, this analysis considers the potential for change to CUA access and management and the potential for modification of use due to proposed mining activities and Burnham Road realignment. Further discussion of direct and indirect impacts to related land use management is included in Section 4.10 – Land Use.

4.13.2 Impacts

4.13.2.1 Proposed Action

Direct impacts associated with mining operations in Area III and Area IV North would require removing, restricting, and/or relocating unimproved two-track roads used for CUA access and livestock grazing. No existing unimproved two-track roads are anticipated to be affected in Area III, though approximately 5 miles of unimproved two-track roads are anticipated to be affected by proposed mining in a portion of Area IV North. Restriction or modification of existing access routes specifically used for CUA management would result in minor to moderate short-term impacts for the life of the operation. Temporary use restrictions of up to 30 minutes would occur on public roads and unimproved access routes to ensure public safety during blasting, resulting in a minor short-term impact. Adequate signage and surface oversight would be provided to communicate timing of such activities to the public and minimize the short-term impact of this necessary protection measure.

Direct short-term to long-term beneficial impacts for realignment of the Burnham Road would modify the existing transportation infrastructure. The proposed realignment would improve road surface conditions and safety from the existing condition. The realignment would eliminate a "hairpin" corner, thus increasing transportation network safety. In addition, there would be no need to stop traffic during blasting operations at Navajo Mine after the realignment, which will improve both transportation network safety and traffic flow. Realignment of the Burnham Road would have minor to moderate beneficial effects upon traffic volumes associated with use of this road.

No indirect impacts that could affect the transportation infrastructure are anticipated.

In the long term, the transportation network would provide access for post-mine land use for livestock grazing and wildlife habitat.

4.13.2.2 Proposed Action with Conditions

Under this Alternative, impacts would be the same as those described for the Proposed Action.

4.13.2.3 No Action Alternative

Under the No Action Alternative, the transportation infrastructure would continue to be affected by mining actions in Area III. Access routes and the Burnham Road would continue to experience short-term impacts associated with restricted use for the life of Area III operations. The Burnham Road would not be relocated and public benefits to transportation and safety would not be realized. No impacts to access in Area IV North would be anticipated. Traffic volume assumptions for the regional road system used by the Navajo Mine would remain as described, with anticipated mine-related traffic decreasing as early as 2016. Impacts would continue to be minor to moderate and short term to long term within the existing Navajo Mine.

4.14 Health and Safety

4.14.1 Impact Assessment Methodology

The consequences of the alternatives on health and safety focus on public exposure to air emissions from Navajo Mine operations. Other potential health and safety risks to workers are not expected to be substantial as extensive health and safety programs designed to minimize worker risk are implemented and enforced at Navajo Mine. A recent health survey in San Juan County, NM found that residents have a higher incidence of CLRD, including asthma, than the remainder of New Mexico and the United States (SJC 2010). Increased medical visits for asthma symptoms have been attributed to elevated levels of ozone in the area (NMHD 2007). However, there is no direct link between increased ambient PM levels and increased reports of asthma symptoms or asthma incidence. The impact assessment criteria for public health are based on whether the levels of PM and ozone precursor emissions from Navajo Mine would cause exceedances of NAAQS in San Juan County, NM because the NAAQS are set by EPA to ambient concentration levels that are to be protective to human health. The analysis also considers localized effects.

4.14.2 Impacts

4.14.2.1 Proposed Action

The Proposed Action would result in the same levels of ozone precursor emissions. Ambient air modeling found that these emissions would not cause a measurable change in ambient PM_{10} or $PM_{2.5}$ concentrations in San Juan County, NM. San Juan County is currently in "attainment" status and ambient air quality does not regularly exceed the NAAQS. Therefore, there would be no substantial adverse public health consequences for this alternative.

4.14.2.2 Proposed Action with Conditions

Under this Alternative, impacts would be the same as those described for the Proposed Action.

4.14.2.3 No Action Alternative

The estimated air emissions from Navajo Mine for the No Action Alternative would be lower than baseline levels because coal production will be as much as 30 percent below current levels. San Juan County is currently in "attainment" status and ambient air quality does not regularly exceed the NAAQS. Therefore, there would be no substantial adverse public health consequences for this alternative because there would not be an increase in PM or ozone precursor emissions levels from Navajo Mine.